Technical Session Overview

PNCWA 2021 Annual Conference

Session Overview

Date: Monday, 13/Sept/2021	
10:30am - 12:00pm	Session 01A: Planning & Regulatory - Livestream

10:30am - 11:15am

ID: 289 / Session 01A: 1

Main Technical Program

Topics: Collection and Conveyance, Utility & Assessment Management

Keywords: Rehabilitation, Asset Management, Collection Systems, Strategic Planning, Capital Investment

One Doesn't Just Walk into a Proactive Rehabilitation Program: SPU's Strategic Quest.

Caroline Barlow[1], Julie Crittenden[1], David Gordon[2]

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Seattle Public Utilities (SPU) entered into a Consent Decree in 2013 to reduce combined sewer overflows and work towards eliminating sanitary sewer overflows. A major cause of sewer overflows in Seattle is structural failure. It is also a growing concern given that the City's 1,420 miles of sewer pipes have an average age over 80 years and pipe rehabilitation has been historically underfunded. SPU increased pipe inspection and rehabilitation funding upon signing the Consent Decree, but recognized that there would need to be a holistic look at pipe rehabilitation to ensure long-term system reliability.

This presentation walks through SPU's work to develop and secure funding of a long-term rehabilitation plan for its aging sewer system. This planning effort was not a single event, but a concerted effort through a series of strategic projects over four years; with each strategy building on one another. Participants will learn about SPU's strategies for pipe inspection, condition evaluation, risk assessment, capital investment, and implementation planning. Particular focus will be spent on key aspects of the process such as incorporating service equity, increasing efficiencies, securing staffing for implementation, and preparing for adaptive management. This presentation will leave participants with a roadmap for how to move from a reactive to proactive rehabilitation program. It was not a simple and quick solution, but has set SPU up for reliable and sustainable long-term sewer service.

Brief Biography and/or Qualifications

Caroline Barlow, PE; Seattle Public Utilities (SPU): With 19 years of experience in the municipal utility industry, Caroline currently serves as the Rehabilitation Program Manager for SPU's Drainage and Wastewater Line of Business, overseeing $30M in annual investments to rehab drainage and wastewater pipes. Caroline uses her utility engineering and project management experience to work closely with a team to define long term performance goals and identify resource needs to deliver a programmatic capital improvements portfolio. Caroline received her BS degree in Civil Engineering from Gonzaga University and is a registered Professional Civil Engineer in Washington State.

Julie Crittenden, Seattle Public Utilities (SPU): Julie is a program manager and strategic advisor with SPU and leads Seattle's Capacity, Management, Operations and Maintenance Program. Julie has over 20 years of water resource management experience focused on drainage and wastewater planning, asset management, regulatory compliance, environmental assessment and permitting, and shoreline and stream restoration. She received her M.S. degree from the University of Washington, and her B.S. degree from the University of California, Davis.

11:15am - 12:00pm

ID: 223 / Session 01A: 2

Main Technical Program

Topics: Wastewater Treatment Process, Regulatory Challenges, Recycled Water & Resource Recovery

Keywords: reuse, recycle, beneficial, Klamath, NPDE

Klamath Falls Evaluates What to Do With Its Final Effluent

Randy Zollinger, Nigel Beaton, Eva Steinle-Darling

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In response to lower nutrient and temperature limits for continued river discharge, the City of Klamath Falls evaluated 100% reuse against continue river discharge. The City is looking for economical, long-

term strategies that beneficially uses City's final effluent, offers some regulatory certainty and promotes partnerships in addressing Upper Klamath River water supply and water quality concerns. This presentation will discuss reuse to augment agricultural irrigation needs involving the US Bureau of Reclamation, the Klamath Drainage District and the Lower Klamath National Wildlife Refuge. Under this reuse alternative, the City would divert its final effluent over the entire year to the Klamath Drainage District who in turn would beneficially use and manage the final effluent to meet irrigation demands of local growers and to help the Lower Klamath National Wildlife Refuge maintain habitat for migrating waterfowl. Reuse water management plans, permitting strategies and needed improvements to the City's existing Spring Street Wastewater Treatment Plant to support a 100% reuse option will be reviewed and compared to a continued river discharge alternative. Critical factors in alternative selection will be discussed so other Cities facing similar water quality challenges may benefit from City of Klamath Fall's experience.

Brief Biography and/or Qualifications

Randy is a project manager with 24 years of experience in providing planning, final design and construction management services for water and wastewater infrastructure improvement projects. He served as the assistant project manager in helping the City of Klamath Falls evaluate the reuse alternative. He collaborated with reuse partners, the Klamath Drainage District and the Lower Klamath National Wildife Refuge, and helped develop wastewater treatment, conveyance and water management strategies.

Nigel Beaton has 6 years of experience in water and wastewater treatment planning and design experience. He helped evaluate City of Klamath Falls Spring St. STP for both water recycling and continued river discharge options. Nigel helped evaluate secondary and tertiary treatment options and flow management options, including flow equalization.

Eva Steinle-Darling has 15 years of experience primarily focused on water reuse research and feasibility analysis, planning and design of reuse projects. She is Carollo Engineers' Reuse Innovation Lead. Eva helped review Oregon and California water recycling rules and requirements.

10:30am - 12:00pm

Session 02A: Social Equity - Livestream

10:30am - 11:15am

ID: 179 / Session 02A: 1

Main Technical Program

Topics: Leadership, Social Equity, Workforce Development

Keywords: STEM/STEAM, Outreach, Equity, Diversity, Community

How Do We Make Outreach More Equitable? A Case Study at Murraysmith + Quincy

Maricris "Mari" Orama, Sage Ebel

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It is no secret that STEAM fields lack the diversity and inclusion of the communities they serve. Many individuals and organizations are working hard to develop plans for increasing racial and gender equity within their fields. STEAM Outreach plays a significant role in supporting long-term societal goals of increasing STEAM literacy and diversity within our STEM workforce.

STEAM Outreach has been found to provide communities—particularly students, parents, and teachers—with opportunities to engage in ways that are relevant, educational, and inspirational. COVID-19 stay-at-home orders and remote schooling have posed both challenges and advantages for STEAM Outreach. Ultimately, without an intentional focus on equitable structure and practice within an outreach program, students in underserved communities will continue to have limited access and exposure to knowledge of STEM fields, technology, resources, and a comprehensive STEM educational experience (Avendano et al, 2018; Boyce, 2017).

What can we as professionals in the engineering industry do to build and foster more equitable STEAM communities? How do we structure our Outreach Programs to focus on equity?

This presentation explores the steps taken at Murraysmith + Quincy to improve its STEAM Outreach program. We will discuss: 1) the significance of STEAM versus STEM; 2) the challenges and advantages posed by remote learning and STEAM outreach; 3) the restructuring of our program; 4) lessons learned and next steps; and 5) pertinent conclusions and recommendations for other companies looking to initiate more equitable outreach programs.

Brief Biography and/or Qualifications

Maricris “Mari” Orama – Maricris Eleno-Orama, EdD, P.E., has 10 years of experience in water, stormwater, and wastewater design and planning projects throughout Washington State. She has seven years of experience as a chemistry/engineering professor in Higher Education, including supporting the Washington Mathematics Engineering Science Achievement (WA MESA) Program at Tacoma Community College as the Faculty Sponsor. She has been with Murraysmith since 2019 as a Professional Engineer and is on Murraysmith’s Corporate Social Responsibility Leadership Team. She supports Sage Ebel in initiating an Outreach Program focused on equity for local underserved communities. She is also a co-founder of S.C.O.P.E., or Supportive Community of Professional Engineers, an outreach project focused on connecting students to local engineers and computer scientists within Pierce County, Washington.

Sage Ebel has been with Murraysmith for three years as an Engineering Designer. She has experience working on water, wastewater, and stormwater projects in various capacities ranging from planning, modeling, and design to inspection and construction support. She has taken the lead in restructuring the Murraysmith + Quincy outreach program and supports the company’s outreach team’s regional representatives in their efforts to incorporate equitable outreach into the fibers of daily life.

11:15am - 12:00pm

ID: 304 / Session 02A: 2

Main Technical Program

Topics: Leadership, Social Equity, Workforce Development

Keywords: equity, infrastructure, community engagement

Walking a Mile in Our Communities' Shoes

Nicki Pozos, Jessie Maran

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Wastewater professionals often struggle to translate equity principles into their everyday work. At the heart of this struggle is a lack of understanding—how does our work interact with the life conditions of the communities we serve? This interactive session will explore three scenarios relevant to utilities: basement flooding, trust in drinking water, and construction impacts. Attendees will explore how socio-economic resilience, disenfranchisement, and transportation access affect our lived experience.

Brief Biography and/or Qualifications

Dr. Nicki Pozos, Principal with The Formation Lab, brings 19 years of experience in engineering, planning and communications for major infrastructure projects. Nicki is a recognized leader in promoting equity within the water industry. She has presented on bias and equity to thousands of technical professionals, is a co-founder of Leading Water Forward, and serves as a minority evaluator for the City of Portland. Nicki's experience includes developing a unique approach to managing and supporting DMWESB firms, coordinating engagement with tribal nations on a major capital program, and integrating input from underrepresented populations into Oregon's recycling program.

Jessie Maran, Principal with The Formation Lab, brings over 25 years of experience in urban design, graphic communications, operations, and project management. Jessie is a systematic and compassionate leader focused on creating equitable cities. Jessie manages DMWESB development programs on major capital projects, develops equity strategies for private firms, and works with utilities to integrate equity into the planning, design and operation of public infrastructure.

10:30am - 12:00pm	**Session 03A: Wastewater Process: Planning & Compliance - Livestream**

10:30am - 11:15am

ID: 178 / Session 03A: 1

Main Technical Program

Topics: Wastewater Treatment Process, Resiliency, Planning, Climate Science

Keywords: Treatment, Capacity, Planning

What? When? How Sensitive? Evaluating Capacity At King County's Three Regional Plants

Patricia Tam[1], Henryk Melcer[1], John Conway[2], Tiffany Knapp[2]

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To protect public health and deliver reliable clean water services while accounting for changes in the service area, King County Wastewater Treatment Division (WTD) updates its projections of wastewater flows and loads every 10 years and evaluates their impact on overall treatment plant capacity. In 2014, WTD noted that influent loads were increasing more quickly than flows. Recent water conservation efforts have reduced the amount of potable water used on a per-capita basis. These reductions in water use directly impact wastewater flows, but not loads. As a result, influent concentrations are higher than the design values. Comparing the flow and load projections with the current rated capacities for each of the County's three regional plants (South, West Point and Brightwater) shows that the rated flow capacities will be reached after 2035 whereas the rated loading capacities will be exceeded within the next 10 years.

To identify potential capacity limitations and their timing by process within the three plants, WTD undertook an in-depth capacity evaluation for all major processes. The evaluation accounts for plant-specific wastewater characteristics, existing regulatory requirements, operating configurations, and process performance. Sensitivity analyses were conducted for each plant to assess the influence of various critical parameters on unit process capacities. Some unit process capacities were found to be highly sensitive to changes in certain parameters. For example, at West Point, capacity of the aerators in the high-purity oxygen aeration basins could change significantly at different target dissolved oxygen concentrations. At both West Point and Brightwater, taking one digester out of service for maintenance was found to have significant impact on the timing of the digester capacity limitation. This analysis provided WTD with an understanding of the timing for when unit process capacity limitations may be experienced to inform system-wide treatment planning.

Brief Biography and/or Qualifications

Patricia Tam is a chemical engineer with 25 years of professional environmental engineering experience. She focuses mainly on process design of biological treatment systems in municipal wastewater treatment plants. Patricia has extensive experiences in plant capacity assessment, facility planning and aeration system design. She also has experiences in disinfection and tertiary system design, odor control, and hydraulic modeling.

11:15am - 12:00pm

ID: 190 / Session 03A: 2

Main Technical Program

Topics: Wastewater Treatment Process

Keywords: Treatment/conveyance structures, Environmental Protection Agency

Dairy Cows Speak a Different Language: Jerome's Journey to Wastewater Compliance

Jason King[1], Eric Roundy[1], Dade Pettinger[2]

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Jerome's wastewater treatment plant is unique in that several dairy products processing facilities deliver most of the loading to the treatment plant. This dairy processing brought significant revenue to the City, at the cost of large fluctuations and high loading at the treatment plant. Seeking resolution to repeated discharge permit violations caused by the high loadings, the City and the Environmental Protection Agency entered a consent decree. The City of Jerome and Keller Associates worked quickly to assess

the treatment system and evaluate compliance options for the best treatment of the high-strength wastewater. A phased approach to improvements allowed the City to promptly reduce additional non-compliance risks while further upgrades were designed and constructed.

Phased upgrades at the treatment plant were completed approximately a year ago. These upgrades incorporated approximately five years of construction and a total cost of about $35 million – the largest project in the City's history. This wastewater treatment project successfully reused/rehabilitated a significant portion of the existing plant and included the construction of 24 new treatment/conveyance structures. Plant compliance during construction was challenging as all unit processes were disrupted. This presentation will focus on the approach and results – during design, construction, and post-construction – that addressed Jerome's high-strength dairy wastewater and prepared them for sustained compliance.

Brief Biography and/or Qualifications

Jason King, P.E., Project Manager for Keller Associates, Inc.

Jason is a licensed professional engineer in several states, including Idaho, Oregon, and Washington. He graduated from the University of Idaho with a bachelor's degree in civil engineering with an emphasis on wastewater treatment design. Jason has extensive experience in wastewater collection, conveyance, and treatment system design and construction. In the past five years, he has led the design and construction of over $50 million in water and wastewater infrastructure projects.

Eric Roundy, P.E., BCEE, Senior Process Engineer for Keller Associates, Inc.

Eric has nearly 20 years of experience in the design and evaluation of wastewater treatment systems. He has a master's degree in environmental engineering from the University of Illinois at Urbana-Champaign, a bachelor's degree in civil engineering from the University of Nebraska – Lincoln, and a master's degree in business administration from Mississippi State University. He is a licensed professional engineer in five states, including Idaho, Washington, and Oregon.

Dade Pettinger, Associate Engineer for the City of Vancouver, Washington

Dade, often referred to as Dave or Dale, prefers restaurants where orders are called out by number. Currently, he provides support to Vancouver's wastewater treatment facilities capital and regulatory programs. He is a licensed Washington Class III Wastewater Treatment Operator and Engineering Intern. Dade's experience includes work for the City of Jerome, Idaho, assisting in the operation, maintenance, and planning of Jerome's wastewater treatment facility.

10:30am - 12:00pm	**Session 04A: Energy Recovery**

10:30am - 11:15am

ID: 235 / Session 04A: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Recycled Water & Resource Recovery, Resiliency, Planning, Climate Science

Keywords: Biogas, co-digestion, combined heat and power (CHP), energy neutrality, liquid organic waste

Beyond Net Zero – Reaching the Next Level of Renewable Energy through Beneficial Use of Food Waste

Kristen Jackson[1], Alan Johnston[2], Matt Noesen[1], Jodie Binger[1], Dave Parry[1]

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The City of Gresham (City) Wastewater Treatment Plant (WWTP) is a 15 MGD facility located east of Portland, Oregon. The plant accepts and co-digests fats, oil, and grease and beneficially uses their biogas to fuel a combined heat and power system to achieve energy neutral status and they are evaluating how to go beyond net zero. The existing two mesophilic anaerobic digesters at the facility are currently at capacity and in need of an expansion to accommodate projected future loadings for city growth as well as to provide redundancy.

A recently adopted policy by Metro (regional entity) requires mandatory segregation, collection, and alternate processing (not landfilling) of food waste that is generated by businesses within the Portland metropolitan area. The City conducted a study to explore the financial payback options for a digestion expansion project that could fulfill the City's capacity needs, accept food slurry from Metro's food waste program (or other liquid organic waste sources), and beneficial use of the additional biogas produced.

The study assessed potential cost and non-cost benefits and impacts associated with additional liquid organic waste loading on the WWTP, digestion alternatives, sidestream recycle loading to the liquids treatment, solids dewaterability, biogas production, and biosolids end use. The study included a business case evaluation considering economic, environmental, social, and operational impacts to assess the favorability of pursuing the selected alternative. Finally, the study included a conceptual design for the selected alternative.

The study has shown that the City could spend 16 million dollars and construct a third mesophilic digester for capacity needs and not accept additional feedstocks nor receive a payback on the investment. Alternatively, the City could spend approximately 30 million dollars to convert two existing digesters to thermophilic technology, construct a third thermophilic digester, expand feedstock receiving, expand cogeneration, and obtain a payback on investment under 10 years by utilizing State incentive programs. The City is planning to conduct a predesign to further refine liquid organic waste availability, revenues and costs, and funding sources for the project.

Brief Biography and/or Qualifications

Kristen Jackson is a Wastewater Treatment Engineer and Project Manager with over 10 years of professional experience and 5 years of expertise in treatment plant process mechanical design, hydraulics, alternative delivery, startup and commissioning, and construction inspection services. She is personally passionate about energy conservation and protecting the environment as she spent three years in the Peace Corps solving rural water and sanitation problems.

Alan Johnston is Senior Engineer and has worked for over 30 years for the City of Gresham. He manages the Wastewater Treatment Plant program. This includes planning, design and construction of capital projects, managing plant operations and maintenance contracts, implementing ongoing asset management strategies, preparing annual operations and capital budget, etc.

Jodie Binger has 10 years of experience focused on renewable natural gas, beneficial use of biogas, and wastewater projects based on a lifelong love of water and outdoor recreation. She thrives on managing project production and coordinating team members to innovatively create solutions to inevitable societal issues in a way that is sustainable and economically viable.

11:15am - 12:00pm

ID: 211 / Session 04A: 2

Main Technical Program

Topics: Wastewater Treatment Process, Recycled Water & Resource Recovery

Keywords: Anaerobic Digestion, FOG, Co-Digestion, Microbial Community

Linking Anaerobic Digester Microbiomes With Resistance To Organic Overloads

Ashley Berninghaus, Tyler Radniecki

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Anaerobic co-digestion has become a popular option to increase biogas production, thus increasing recapture potential, with grease trap waste, or FOG (fats, oils, and greases), showing the highest methane production potential. In order to ensure reactor stability and optimal performance, the correct microbiome composition is essential. However, it is currently unknown what microbiome compositions are optimal for co-digestion nor what operational parameters are most effective at creating these optimal structures. This work monitored nineteen full-scale anaerobic digesters, at six separate facilities, monthly for one year to link operational characteristics with microbiome composition. Of the nineteen digesters studied, three perform FOG co-digestion, four perform co-digestion with biodiesel wash water, one is fed only TWAS (thickened waste activated sludge), and the remaining eleven are fed primary sludge and TWAS. Microbiome composition was analyzed using 16S rRNA amplicon sequencing. Operational data from each of the full-scale facilities (including pH, alkalinity, volatile fatty acids, detention time, temperature, total and volatile solids, free ammonia, organic N, dissolved P, organic P, chemical oxygen demand, and gas production) was examined to determine their influence on microbiome compositions.

Batch resistance assays were created to link microbiome compositions with digester functionality in response to organic over loadings. For each full-scale anaerobic digester tested, twenty-five 100 mL batch anaerobic digesters were used for batch resistance assays. Five batch anaerobic digesters were ran as digestate-only controls, and the remaining twenty were fed 1 mL, 5 mL, 10 mL, and 20 mL of canola oil (in quintuplet). The rates of methane production and methane content of the biogas were used to calculate the functional resistance of each full-scale anaerobic digester. The batch resistance assays were performed in winter and summer to account for seasonal variations in full-scale plant operation and microbiome compositions.

Brief Biography and/or Qualifications

Ashley Berninghaus is a 5th year Ph.D. candidate in the School of Chemical, Biological, and Environmental Engineering at Oregon State University where her work is centered on biologically based renewable energy and water treatment systems. She earned a B.S. in both Chemical and Biological Engineering at Montana State University in 2015 and plans to finish her Ph.D. in Environmental Engineering in the spring of 2022.

10:30am - 12:00pm	**Session 05A: Stormwater**

10:30am - 11:15am

ID: 163 / Session 05A: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Stormwater, Regulatory Challenges

Keywords: MRF, waste, compliance, treatment, treatability

Advanced Stormwater Treatment Innovation for Materials Recovery Facilities

Jennifer Schmitz

Clear Water Services, United States of America; jen.schmitz@clearwaterservices.com

This presentation will highlight a case study on a waste and recycling facility located on the Lower Duwamish Waterway in Seattle, Washington. The case study will assess the stormwater challenges the Facility dealt with (run-on, runoff, discharge location variation, remaining in compliance with strict permit regulations) and discuss what steps the Facility did ahead of time in order to evaluate and select the appropriate long term stormwater treatment system.

The Lower Duwamish Waterway is known for legacy contamination due to decades of industrial activity and runoff from residential areas. The Waterway is an approximately 5-mile stretch of the Lower Duwamish River which flows into Elliott Bay and ultimately, the Puget Sound. In 2001, the US Environmental Protection Agency (EPA) added the Lower Duwamish Waterway site to the Superfund National Priorities List. Since then, The Department of Ecology (Washington State Permit Regulator) has led efforts to control sources of sediment pollution in the Waterway with cooperation from the City of Seattle, King County, and EPA.

In the Duwamish cleanup effort, total suspended solids (TSS) contamination was mandated by legislature as an effluent numeric limit. Recology CleanScapes, a recycling waste processing facility (Facility) and direct discharger to the Duwamish Waterway was having a difficult time remaining in compliance with TSS permit effluent limits while also struggling with total metals (zinc and copper) and other pollutants. Clear Water Services (Clear Water) was asked to assist in a design-build treatment selection process and develop a tiered approach for the Facility.

Clear Water was able to prove the efficiency of multiple treatment media and chemistries through bench scale testing and treatability. Using the results, Clear Water and Recology were able to select the best-fit treatment option for the Facility that was most practical for site constraints while also remaining cost effective and within their budget. Clear Water also provided the design and oversight of much needed infrastructure improvements in support of the treatment system selection: combining all site drainage to one discharge location, minimizing runoff from loading and unloading areas and run-on from neighboring properties.

Brief Biography and/or Qualifications

Ms. Schmitz is a Municipal Services manager and project manager for Clear Water, bringing over 15 years of water resources experience encompassing a wide array of technical and project management expertise in private consulting, state government, and regional government. She develops effective, collaborative approaches to water resources management projects for local governments, state and federal agencies, and nongovernmental organizations, while fostering long-term trust and relationships with clients and partners. She has exceptional time, budget, organization, and multi-disciplinary management skills with impeccable attention to quality and detail.

11:15am - 12:00pm

ID: 250 / Session 05A: 2

Main Technical Program

Topics: Stormwater

Keywords: Green Stormwater Infrastructure, Cold Climate, BMPs, GSI, LID

Cold Climate Impacts on Green Stormwater Infrastructure

Kari Nichols

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Green Stormwater Infrastructure (GSI) is widely used throughout the largely temperate climate of the Pacific Northwest. However, not all areas of the region are as temperate, and as we are seeing more

extreme weather events, we need to consider how GSI may react to more sustained exposure to cold, ice and snow, as well as heat and drought.

Studies around the world have been performed on the performance of GSI facilities in cold climates. Winter runoff conditions, including frozen ground, snow cover, and ice/snow melt events have the potential to adversely impact the performance of GSI, compounded by the addition of sand and chemical deicers to runoff pollutants of concern. In short, a colder climate can impact GSI in a variety of ways.

For instance, a cold climate may result in educed infiltration capacity for GSI. Although frost penetration does not necessarily equate to no permeability, ice lenses may still form, restricting infiltration. Additionally, rain and snowmelt events may reduce or eliminate frost depth in filter media present before and after events; however, larger snow melt events on frozen ground can result in increased runoff.

A colder climate can also reduce the effectiveness of treatment from vegetated systems as the biological function tends to “turn off” in the winter when the vegetation goes dormant. Cold climate regions may also have a shorter growing season, so plant establishment may be more challenging. The effectiveness of other treatments may be similarly reduced—for instance, there may be less sediment removal due to reduced settling velocities in colder water. All of these impacts must be considered in the design and selection of infiltrating best management practices.

Designers may need to include some additional considerations when selecting specific GSI solutions, such as potentially providing larger facilities in cold climates for snow storage and meltwater infiltration as long as road salt and deicing chemical usage is limited. However, the use of GSI still yields the most cost-effective benefits to stormwater runoff management, even in cold climates.

Brief Biography and/or Qualifications

Kari Nichols, PE, Mead & Hunt. Kari is a water resources engineer with Mead & Hunt. Her background is in stormwater, water and wastewater design and construction management. Kari's experience spans hydrology and hydraulics; stormwater management; low impact development and sustainable stormwater design; flood risk reduction; natural channel design; and sanitary sewerage and water distribution systems. She is familiar with state and federal codes and regulations pertaining to water resources protection.

10:30am - 12:00pm

Session 06A: Facility Operations

10:30am - 11:30am

ID: 305 / Session 06A: 1

Main Technical Program

Topics: Wastewater Treatment Process

Keywords: Solids, Start up

"Plan the Work, Work the Plan" Start up of the Tri-City Solids Handling Improvement Project

Jeff Stallard

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In 2015, Clackamas Water Environment Services (WES) kicked off a project to completely overhaul and expand the solids facilities at the Tri-City Water Resources Recovery Facility (TCWRRF). The project constructed a new 1.3 million gallon digester, dewatering facilities and a combined heat and power system. Two existing digesters are also being upgraded. During the project development, WES operations staff was integral in developing the construction constraints included in the construction bid package. To accommodate the constraints identified, the start-up of the project was separated into two phases. Phase 1 of start-up, was completed in December of 2020, included the new digester, centrifuges, polymer systems, boilers, and dewatering feed tank. Phase 2 of the project, scheduled to begin in April 2021, will include making the upgrades to the two existing digesters, addition of a digester feed tank and replacement of the co-generation system.

Because digestion facilities must remain online and reliable during construction, significant coordination effort between engineering, operations and construction team members has been required throughout the project. This presentation will provide an overview of the project and the challenges there were being experienced prior to this project, it will cover in detail the approach to planning and coordination between the operations staff, contractor, and engineer during design, construction, and execution of both phases of start-up. The presentation will include lessons learned from all three perspectives as well as an update on the operational performance of the new facilities.

Brief Biography and/or Qualifications

Jeff Stallard, Supervising Engineer, Clackamas WES. Jeff is a project manager with 19 years of experience spread across the public and private industry, delivering projects in the Pacific Northwest for the last 12 years.

1:15pm - 2:45pm

Session 01B: Risk Assessment/Stormwater - Livestream

1:15pm - 2:00pm

ID: 266 / Session 01B: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Utility & Assessment Management, Risk Assessments and Emergency Response

Keywords: RT-qPCR, Epidemiology, Laboratory, Early Warning

Boise's SARS-CoV-2 Wastewater Dataset and the Future of PCR Testing at WRFs

Haley Falconer[1], Tyson Schlect[2], Kyle Patterson[1], Dave Clark[2], Michael Kasch[2]

[1]City of Boise; [2]HDR; hfalconer@cityofboise.org, tyson.schlect@hdrinc.com

Viewing wastewater as a resource opened pathways of innovation previously unforeseen. The SARS-CoV-2 pandemic amplified a similar paradigm of innovation in the science of Wastewater-Based Epidemiology (WBE). In May of 2020, the City of Boise began sampling wastewater at both of its Water Renewal Facilities (WRFs) to test for SARS-CoV-2 virus using quantitative polymerase chain reaction (qPCR). On June 17th the City began daily sampling and continued through two infection peaks. The City's dataset is one of the most robust datasets in the country for WBE.

RT-qPCR quantifies copies of virus RNA in the wastewater matrix. The City contracted with the University of Missouri to perform qPCR. Virus quantities in the wastewater ranged from 50,000 to 1,395,000 copies per liter. Puro virus recovery was used as a proxy indicator of the relative amount of virus recovered through the qPCR method and ranged widely from 2 to 82 percent, with an average of 11 percent. Genetic sequencing was also used to perform early screening to detect if SARS-CoV-2 variants were present.

Visualizations of the data show clear correlation with number of confirmed cases in Ada County. Numerical correlations were weak because of daily variability, however the visual correlation revealed that during periods of infection rate increases the wastewater signal provided four to seven days advanced notice prior to case report date. The City coordinated with Centers for Disease Control, Central District Health, and St. Luke's Hospital to maximize the benefit of WBE.

Laboratory layouts and equipment specifications were evaluated for conducting qPCR molecular testing at WRF lab facilities. Experience designing 26 public health labs in the United States was leveraged to customize the "unidirectional flow of sample" design approach within the WRF laboratory context.

Using qPCR at WRFs will continue to expand the paradigm of wastewater as a resource. The current application of qPCR for SARS-CoV-2 testing reveals that indicator virus testing for disinfection (such as adenovirus and norovirus), identification of specific organisms for biological nutrient removal within WRFs, and early detection of future diseases in wastewater are destined to become integral parts of ongoing WRF operations in the modern era.

Brief Biography and/or Qualifications

Haley Falconer is the Environmental Division Senior Manager at the City of Boise. She was early in the game in recognizing the significance of wastewater-based epidemiology. This was in keeping with her constant service to the water industry and her leadership within PNCWA, which is already known to many.

Tyson Schlect is a wastewater process engineer at HDR, and lives in Spokane. He heard the term "micro-sewershed" in the context of virus testing, thought it was interesting, and started asking more questions.

2:00pm - 2:45pm

ID: 135 / Session 01B: 2

Main Technical Program

Topics: Stormwater

Keywords: water quality, beavers, stream temperature, stream complexity, constructed wetlands

Beavers Improve Water Quality in an Urban Watershed

Katie Holzer

City of Gresham, Oregon, United States of America; katie.holzer@greshamoregon.gov

Beaver populations have been returning to urban watersheds in the Pacific Northwest, bringing with them both benefits and challenges. To better understand the effects on local watersheds, we conducted several studies of beaver activities within the city of Gresham, Oregon. We looked at pollutant removal efficiencies in a large stormwater treatment wetland with and without beaver activity, assessed the effect of beaver dams on stream temperatures, and documented the physical and biological changes to stream channels near dams. We found that pollutants of concern were generally removed more efficiently when beaver dams were present in the treatment wetlands. This is likely due to the water being filtered through the dams which are repaired after each storm. The effects of dams on stream temperatures varied depending on site characteristics, but all dams created ponds with temperature heterogeneity and stratification. Dams on higher order streams sometimes reduced overall stream temperature by pulling water from the entire stratified water column and increasing hyporheic flow. Within just a few years of beaver activity, several sites experienced increased stream complexity with new gravel bars, side channels, and braided streams. We also found increased macroinvertebrate diversity in the relatively sediment-free cobbles downstream of dams. These findings demonstrate multiple benefits of beavers in urban watersheds. After communicating these benefits to stakeholders, we have been working with beaver experts to adapt our systems to find ways to protect infrastructure while coexisting with beavers through targeted use of technologies such as pond levelers, culvert fencing, and tree protection.

Brief Biography and/or Qualifications

Katie studies the interactions of humans, wildlife, water quality, and urban ecosystems as a Watershed Scientist. She has a Ph.D. in Ecology from the University of California, Davis.

1:15pm - 2:45pm	**Session 02B: Workforce Development - Livestream**

1:15pm - 2:00pm

ID: 207 / Session 02B: 1

Main Technical Program

Topics: Leadership, Social Equity, Workforce Development

Keywords: Diversity, equity, workforce, leadership, culture

Be the Catalyst: How Individuals Can Shape an Organization and Transform the Water Workforce

Shelby Smith, Vicky Hollingsworth

Brown & Caldwell, United States of America; sbsmith@brwncald.com, vhollingsworth@brwncald.com

The water industry is undergoing a significant cultural transformation in response to social equity challenges and a rapidly evolving workforce. The future workforce has different priorities, backgrounds, and drivers from that of the past and present. Workforce retention challenges emerge due to organizational cultures where employees feel unsupported, disconnected, and inauthentic. Companies that do not evolve to foster inclusive work environments are less competitive and innovative, struggle with recruiting and retaining talent, and ultimately face obsolescence in the water industry. But individual actions at all organizational levels can break down barriers to inclusion and build more desirable work environments.

In 2018, Brown and Caldwell (BC) employees sought to create a more inclusive, open, and diverse work environment that provided them with a space to connect, be authentic, find community, and learn. Out of this movement, employees formed the Women at BC Employee Network Group (ENG), which created an inclusive and safe space for women to share their stories. This first ENG sparked broader conversations around diversity, equity, and inclusion. New ENGs quickly followed – each centered around different BC employee experiences and challenges. BC leadership listened and advocated based on these conversations. The company established the 10 Commitments to Balance and Belonging, which set the long-term plan to transform, operationalize equity into business and hiring practices, and challenged the organization to go beyond current industry limitations.

This presentation will dive into the story behind some of the individuals who became the spark that accelerated a cultural transformation in the workplace. Organizations that create space and establish platforms for employees to be authentic and vulnerable will drive allyship, diversity, and inclusion. These key ingredients create resilient organizations where employees can thrive, innovate, and better serve their communities.

Brief Biography and/or Qualifications

Shelby Smith is a professional engineer with 9 years of experience in program and project management for the municipal wastewater sector. She has supported numerous PNW municipalities with capital investment planning, design, and delivery, stakeholder engagement, alternative delivery methods analysis and procurement, public outreach, and permitting. Shelby has answered a personal call to action to take more responsibility for addressing racial and social inequities. She is a member of Brown and Caldwell's PNW Diversity and Inclusion Team, Vice Chair of the PNCWA Racial and Social Justice Subcommittee, and actively engaged in Brown and Caldwell's Community of Color and Women at BC ENGs.

Vicky Hollingsworth is a professional engineer with over 13 years of experience in the design and construction of wastewater treatment and conveyance. She is one of BC's pumping systems subject matter experts and provides her expertise on projects across the company. Vicky is originally from Nicaragua and moved to the US to pursue an education and a purposeful career. A few years back, Vicky realized that she had a seat at the table and was not using it to make the space more inclusive. Instead, she was too busy trying to fit in. Since then, she has been on a mission to be more authentic and create safe and inclusive environments for those coming after her. In 2020, Vicky co-founded the Community of Color ENG, which focuses on the unique challenges faced by people of color in our industry. She has a sense of urgency and responsibility to make things better for generations to come.

2:00pm - 2:45pm

ID: 308 / Session 02B: 2

Main Technical Program

Topics: Leadership, Social Equity, Workforce Development
Keywords: Diversity, Equity, Racial Justice, Social Justice

Sharing Your Privilege – the Criticality of Advocacy in Diversifying the Pacific Northwest Water Industry

Rob Lee
Leeway Engineering, United States of America; rob.lee@leewayengineeringsolutions.com

The face of the Diversity, Equity, and Inclusion (DEI) movement here in the PNW has largely been women and people of color, and rightfully so in many cases. But this can and has led to cases of fatigue, frustration, and even challenging accusations such as "self-promotion".

As the topic of diversity has become more prominent and as the numbers are starting to be documented about the genuine benefits of diversity, a challenge that has become evident is the critical role that must be played by those who have privilege and the power to enact change.

This session will begin with an introduction of the importance and benefits of diversity and a brief introduction to the ways that PNCWA, as a volunteer organization, is taking steps to advance Racial and Social Justice. The remainder of the time will be given to a panel discussion by advocates in the industry and representatives from several municipalities including the City of Boise, the City of Portland, King County, and Seattle Public Utilities. This panel will provide numerous viewpoints regarding privilege and how anyone, regardless of gender, ethnicity, or orientation, has an important role to play in progressing our industry for positive change.

Brief Biography and/or Qualifications

Rob is a graduate of Cornell University, a licensed Environmental Engineer, the founder of Leeway Engineering, currently President-Elect for PNCWA's Board of Directors, and the inaugural chair of the Racial and Social Justice Committee. Growing up in the Pacific Northwest as an Asian-American, Rob has a unique perspective on the challenges and opportunities facing the water industry, and Rob is passionate about being a change agent to better represent our rapidly changing communities.

1:15pm - 2:45pm	**Session 03B: Wastewater Process: Nutrient Removal - Livestream**

1:15pm - 2:00pm

ID: 267 / Session 03B: 1

Main Technical Program

Topics: Wastewater Treatment Process

Keywords: Chemical Phosphorus Removal

How a Full-Scale Pilot Guided a WRRF Path to Chemical P Removal

Chris Machado[1], Jamie Safulko[2], Greg Farmer[2], Shelley Trujillo[1], Nicole Stephens[1]

[1]Stantec, United States of America; [2]City of Englewood - South Platte Renew;
chris.machado@stantec.com

South Platte Renew (SPR) is the third largest water resource recovery facility (WRRF) in Colorado, with a capacity of 50 million Gallons per day (MGD). SPR's discharge to the South Platte River is regulated by the Colorado Department of Public Health and Environment (CDPHE). CDPHE set a regulatory roadmap for nutrient removal with intermediate steps for compliance including a 10-year Voluntary Incentive Program (VIP). This program allows the SPR to voluntarily treat nitrogen and phosphorus to levels below permit requirements and to earn compliance credits (i.e., years) towards future more stringent regulations.

To take full advantage of the VIP, SPR is implementing a chemical phosphorus removal (Chem-P) process to achieve effluent total phosphorus below 0.7 mg/L. SPR took a comprehensive approach to evaluate design options for Chem-P implementation including full-scale piloting. The pilot used existing ferric sulfate storage/dosing facilities. The ferric sulfate dose was varied in three phases through five months: (I) initial baseline, (II) ramp-up, (III) stabilization at optimum dose. The pilot was conducted by a team of operators and engineers. Close collaboration and monitoring were critical for the successful completion of the pilot. Plant profiles of phosphorus, nitrogen, total suspended solids, alkalinity, and pH were monitored. Spot sludge samples were collected for vivianite analysis through x-ray diffraction.

The full-scale pilot demonstrated that a dose of 40 mg/L is required to reach the desired effluent total phosphorus concentration of 0.7 mg/L as P. It also indicated an increase in solids production of over 10 percent for the current 18 MGD average flow. Furthermore, the results indicated that depending on the overall plant operation, the impact in alkalinity may be significant to meeting effluent pH limits. Nitrification was not significantly affected during the full-scale pilot, however a small reduction in performance during high load hours of the day was observed.

Conversion to full biological phosphorus removal can be a costly option depending on the overall existing facility process design. Chem-P is still a common and cost-effective alternative to many WRRFs. This presentation will describe the approach and lessons learned in the full-scale chemical P removal pilot at the SPR WRRF.

Brief Biography and/or Qualifications

Chris is one of Stantec's Wastewater Practice Leaders with 20 years of experience. His work includes wastewater treatment process design, facility assessment and planning, process optimization, design management, engineering services during construction, research, and development. Chris is specialized in biological nutrient removal (BNR) and has participated in a number of BNR design, planning, and evaluation projects involving both nitrogen and phosphorus removal.

2:00pm - 2:45pm

ID: 238 / Session 03B: 2

Main Technical Program

Topics: Treatment Innovation and the Future, Wastewater Treatment Process

Keywords: Nuvoda, nitrification, denitrification, nutrients

Pilot Testing Nuvoda's Mobile Organic Biofilm at the Edmonds WWTP

Tom Giese[1], Pamela Randolph[2], Li Lei[3], Jason Calhoun[4], Dr. Mari Winkler[5], Bao Nguyen Quoc[5]

[1]BHC Consultants; [2]City of Edmonds, WA; [3]Jacobs; [4]Nuvoda; [5]University of Washington;
tom.giese@bhcconsultants.com, pamela.randolph@edmondswa.gov

Like many other WWTPs in the Puget Sound region, the Edmonds WWTP will be facing nitrogen limits under the Nutrient General Permit from the Washington State Department of Ecology. The City of

Edmonds WWTP is a conventional activated sludge process originally designed for oxidation of BOD with a mean-cell residence time typically between 3 and 5 days. A large amount of additional tankage would be required to upgrade the conventional activated sludge process for nitrification and denitrification at considerable expense and would present major challenges in creating space for such an addition. Rather than wait until forced to face this challenge, the City has decided to proactively explore promising alternatives. One such alternative is Nuvoda's MOB™ (Mobile Organic Biofilm) process. The City of Edmonds, Nuvoda, BHC Consultants, Jacobs, and the University of Washington worked together to first assess the feasibility and potential effectiveness of this technology, followed by conducting a full-scale pilot test. Topics of this presentation will include:

- Overview of the Edmonds WWTP
- Why Nuvoda MOB™?
- Overview of Nuvoda MOB™ technology
- Overview of the full-scale pilot system
- Overview of pilot system performance
- Future application at the Edmonds WWTP

Brief Biography and/or Qualifications

Tom Giese is a registered professional engineer with over 25 years of consulting engineering experience focused primarily on wastewater treatment including facility planning, evaluation and design; process modeling; pilot testing; and construction management. Mr. Giese received both his B.S. and M.S. degrees in Civil Engineering from Oregon State University.

Pamela Randolph is the Manager of the Edmonds WWTP and is a Certified Group 4 Operator with 36 years of experience. Her team has recently been recognized for their work in energy savings and applying innovative solutions to help the City meet its goals. She received her BA in Business, has Certificates in Human Resources and Project Management and completed the UW Management Program. She relies on these in fulfilling her role as Manager of the City of Edmonds WWTP.

1:15pm - 2:45pm	**Session 04B: Resource Recovery**

1:15pm - 2:00pm

ID: 145 / Session 04B: 1

Main Technical Program

Topics: Wastewater 101, Facility Operations & Maintenance

Keywords: energy, efficiency, optimization, operations

The Future of Meeting Permit with Energy Efficient Operations is Here

Wendy Waudby

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While energy hasn't been on everyone's radar in the past, thinking about energy use and ways to operate more efficiently is becoming more common. Many WRRFs have made no and/or low-cost operational changes to save energy without sacrificing water quality. Some have overcome barriers including the "this is the way we've always done it" thinking. Hearing success stories about facilities who have made small changes that led to significant energy savings might just be the help you need for your facility. Even folks who think their facilities are already optimized have found ways to save energy through strategic energy management. This presentation will focus on typical energy saving opportunities at WRRFs. Real world examples of projects implemented in the Pacific Northwest will be shared.

Brief Biography and/or Qualifications

Wendy Waudby is a Senior Water and Wastewater Engineer at Cascade Energy. She helps operators and engineers be more energy efficient without sacrificing water quality. She has 17 years of experience in energy efficiency, wastewater treatment plant design, reuse, and wastewater service charges. She has worked as a consultant and a regulator and worked for a large wastewater agency. She graduated from Cal Poly, San Luis Obispo with a B.S. and M.S. in Civil/Environmental Engineering. She is a registered professional engineer in Idaho and California.

2:00pm - 2:45pm

ID: 192 / Session 04B: 2

Main Technical Program

Topics: Wastewater 101, Wastewater Treatment Process, Regulatory Challenges

Keywords: Ammonia, Compressed Air Mixing, High-Efficiency Aeration

Lewiston, Idaho Revamps their Aeration Basins to Save Energy and Improve Process Control

Curtis Butterfield, Eric Roundy

Keller Associates, Inc., United States of America; cbutterfield@kellerassociates.com, eroundy@kellerassociates.com

Lewiston, Idaho's wastewater treatment plant dates back to the 1950s, and surprisingly several of the original components are still in operation today. Although the equipment had been maintained, several equipment failures, and the associated emergency repairs, opened the City's eyes to the need for additional investment. One of the largest expenses for the facility was the aeration basins. The City utilized coarse bubble diffusers and controlled the aeration using manual operator adjustments. Additionally, the aeration capacity was insufficient, leading to several process upsets.

Over the past few years, the City made several critical decisions to improve its aeration basin system. Their approach eventually led to the construction of a new treatment process configuration within the existing basins. Additionally, the mixing, aeration, and aeration controls were all replaced to reduce energy usage and improve process control. The improvements, including compressed gas mixing and ammonia-based aeration control, have recently started up on the approximately $35 million project. This presentation will discuss the steps the City went through, their decision-making procedure to select the equipment, and the process and energy improvements that have been observed.

Brief Biography and/or Qualifications

Curtis Butterfield, Project Engineer for Keller Associates, Inc.

Curtis was the project engineer for the aeration system in Lewiston, Idaho, providing design and construction support on the project. He has a bachelor's degree in civil engineering from Boise State

University. Before joining Keller Associates, Curtis was a contractor for nearly 15 years. With his unique skill set, Curtis provides valuable insight into the design and construction processes.

Eric Roundy, P.E., BCEE, Senior Process Engineer for Keller Associates, Inc.

Eric has nearly 20 years of experience in the design and evaluation of wastewater treatment systems. He has a master's degree in environmental engineering from the University of Illinois at Urbana-Champaign, a bachelor's degree in civil engineering from the University of Nebraska – Lincoln, and a master's degree in business administration from Mississippi State University. He is a licensed professional engineer in five states, including Idaho, Washington, and Oregon.

1:15pm - 2:45pm

Session 05B: Stormwater

1:15pm - 2:00pm

ID: 301 / Session 05B: 1

Main Technical Program

Topics: Stormwater, Risk Assessments and Emergency Response, Resiliency, Planning, Climate Science

Keywords: resilience, flooding, climate, extreme storms, community

Rapid and Efficient Modeling of Citywide Urban Flooding for Extreme Storms

Nathan Foged

Brown and Caldwell, United States of America; NFoged@BrwnCald.com

As the magnitude and frequency of extreme storms increase, cities seek to understand the potential risks and possible impacts of a large and intense rainfall event. This type of extreme event produces runoff that far exceeds the design capacity of combined sewers and drainage systems, which generally results in multidirectional surface flows and flow paths are not readily apparent. Coupled 1-dimensional/2-dimensional modeling can simulate extreme flooding conditions in urban settings; however, the time and effort required to do so at a city scale is often impractical. This presentation will discuss a rapid and efficient approach to urban flood modeling implemented by Seattle Public Utilities (SPU) as part of the utility's long-range planning to improve the resilience of local communities. The modeling approach reduces the problem to focus on surface flows and simplifies the 2-dimensional computations using the CADDIES tools developed by the University of Exeter. In addition, simulations were accelerated using parallel processing run through cloud computing resources. As a result of this work, SPU has prepared citywide flood risk area mapping and established a better understanding of the community's vulnerable areas.

Brief Biography and/or Qualifications

Nathan is the Innovation and Technology lead for Brown and Caldwell's Water Resources practice. He is an engineering consultant with over 20 years of experience, specializing in hydrologic and hydraulic modeling of natural and urban systems. Nathan focuses on climate adaptation and resilience planning for the water sector, working with private and municipal clients to make decisions under uncertainty.

1:15pm - 2:45pm

Session 06B: Facility Operations

1:15pm - 2:15pm

ID: 169 / Session 06B: 1

Main Technical Program

Topics: Utility & Assessment Management

Keywords: eO&M, Operations and Maintenance

Creating an Electronic O&M Manual for Pierce County's Chambers Creek WWTP

David McBride[1], Molly Bray[1], Amanda Summers[2]

[1]Brown and Caldwell; [2]Pierce County Planning and Public Works; dmcbride@brwncald.com, mbray@brwncald.com, amanda.summers@piercecountywa.gov

Plant operations and maintenance manuals are often voluminous, stored in cumbersome hard copy binders, or saved as a multitude of electronic files which must be separately opened and browsed, and often neglected because they are difficult to update contemporaneously.

The Pierce County Project Team collaborated to create an IT solution for the operation and maintenance documentation needs of the recent Chambers Creek Regional Wastewater Treatment Plant Expansion (CCRWWTP). The team envisioned and executed an online electronic operations and maintenance (eO&M) manual. The eO&M consolidates and integrates all content related to the plant expansion, including engineer's technical operations manuals, original equipment manufacturer (OEM) O&M manuals, record drawings, SCADA control modules, emergency response protocols, and plant related ancillary libraries. The eO&M is hosted on Amazon Web Services (AWS) and utilizes the OMS-Connect software platform. The CCRWWTP eO&M was structured as an evolving, living document designed to be appended by the County.

This presentation will provide an overview and online demonstration of the Pierce County CCRWWTP eO&M, discussing functionality, enhanced user experience, lessons learned, and tips and tricks for future eO&M authors. Modernizing O&M Manuals is important to sustained utility operations in the information age.

Brief Biography and/or Qualifications

David McBride is a senior principal water resources engineer with Brown and Caldwell. David has assisted numerous public and private clients with water and wastewater projects and their associated environmental permitting for over the past 25 years; taking many projects from inception and planning, through design, construction, start-up and operations.

Molly Bray is a process mechanical engineer in Brown and Caldwell's Seattle office. Molly has been with BC for four years, specializing in pumping system design and services during construction. Prior to BC, she received her master's in Civil Engineering from the University of Washington.

2:15pm - 3:15pm

ID: 148 / Session 06B: 2

Main Technical Program

Topics: Facility Operations & Maintenance, Wastewater Treatment Process, Utility & Assessment Management

Keywords: wet weather, process optimization, secondary clarifier, CFD model, trickling filter effluent

CFD Modeling for Trickling Filter/Activated Sludge Secondary Clarifier Optimization

William Martin[1], Alonso Griborio[1], Steve Celeste[2], Jue Zhao[2], Victoria Lopez Boschmans[1], Paul Pitt[1], Marc Solomon[1]

[1]Hazen and Sawyer; [2]City of Salem, OR; SCeleste@cityofsalem.net, vboschmans@hazenandsawyer.com

Clarifier CFD modeling is relatively common, however, most secondary clarifier studies are conducted in an activated sludge application. Trickling filter effluent (TFE) has different characteristics than conventional activated sludge. To the knowledge of the authors, a similar case study to the one presented here for the evaluation and optimization of TF clarifiers has not been presented before. This study is unique and presents a detailed analysis of settling and flocculation properties of TFE and the

application of secondary clarifier CFD modeling to establish clarifier capacity and identify optimization strategies.

The City of Salem's Willow Lake Water Pollution Control Facility (WLWPCF) has a permitted capacity of 35-mgd average dry and 155-mgd design peak wet weather flow. The City budgeted for clarifier rehabilitation due to ageing mechanical equipment but desired to understand clarifier capacity limitations and evaluate whether modifications could expand existing available capacity.

Hazen conducted stress tests and developed calibrated CFD models for the secondary clarifiers. Model calibration was based on an extensive clarifier testing protocol to simulate peak clarifier loadings, characterize sludge settleability and flocculation properties, and evaluate performance. This work included field testing, zone settling, flocculation and dispersed solids testing.

After development of the CFD models, the clarifiers were evaluated to determine available capacity with the current geometry and mechanism type. Optimization strategies such as the addition of energy dissipating inlet wells, modifications to the flocculation well sizing, and the addition of baffling were evaluated. The City used these results to tailor capital planning for clarifier rehab projects and re-evaluate wet weather capacity and operating strategies at the WLWPCF. Based this work, improvements were identified to potentially expand the combined clarifier peak flow capacity from approximately 105 mgd to over 140 mgd.

Brief Biography and/or Qualifications

Victoria Lopez Boschmans is a wastewater process mechanical engineer. She is skilled in municipal wastewater treatment facility design, biological process modeling, and functional controls for process optimization.

Steve Celeste has 22 years of experience in wastewater engineering with 6 years of experience in hydropower engineering. He currently serves as the operations manager for the City of Salem's Willow Lake Water Pollution Control Facility.

3:00pm - 4:30pm	**Session 04C: Facility Operations**

3:00pm - 3:45pm

ID: 265 / Session 04C: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Leadership, Social Equity, Workforce Development

Keywords: Training, Operations Software, Simulator

Development and Deployment of Gamified Simulation Software for Training Wastewater Operators

Keaton L Lesnik, Kimberly Grey

Maia Analytica, Portland, OR, USA; keaton@maiaanalytica.com

As wastewater treatment has evolved, treatment operations have continued to become increasingly complex. At the same time, our understanding of the environmental, public health, and economic impacts of improperly treated wastes has grown, decreasing tolerance for disruptions. This means new operators are entering into an increasingly demanding environment in which they may not have much time to learn through trial and experience on the job. Additionally, operators are facing these challenges as the work is aging - stressing existing operator training norms. New methods for training operators are needed to help train the changing workforce. Process simulators are particularly well suited to illustrate the complex interrelationships inherent to advanced treatment systems that aren't obvious or intuitive to new operators. Simulators allow operators to explore the consequences of operational decisions across the facility in an interactive, risk-free way. The emerging generation of operations professionals has shown an increasing affinity for hands-on, computer-based training and games provide an additional level of engagement and motivation that improves learning outcomes.

In this work we present a gamified simulator software called Wastewater Integrated Learning Management Activity (WILMA) designed to help operators learn the uniqueness of the system they will be operating, opposed to a generic treatment system. Engineers worked with partners at a full-scale facility to understand what is required to make informed decisions and analysis then designed mini-games around those decision points. Gamification of WILMA significantly improves engagement and motivation, both key pieces of improved learning outcomes. The game design and user interface is based on cognitive science research and state of the art visualization methods. Overall the presentation demonstrates and provides an example of training tools for the future of the wastewater workforce.

Brief Biography and/or Qualifications

Dr. Keaton Larson Lesnik is CEO and co-founder of Maia Analytica, a Portland, Oregon based company who develops training and operational software tools for wastewater operators. Dr. Lesnik received his doctorate at Oregon State University where his primary research focus was developing data-driven models for environmental biotechnological processes that is at the center of Maia Analytica technology. Now, Dr. Lesnik leads an 11 person team that consists of researchers, engineers, software developers, and education specialists whose aim is help facilitate the complex decision making at wastewater treatment facilities.

3:45pm - 4:30pm

ID: 291 / Session 04C: 2

Main Technical Program

Topics: Facility Operations & Maintenance

Keywords: small community, high strength wastewater, interim improvements

Improving Operations at an Aging and Overloaded WWTP

Jack Wallis

Wallis Engineering; jack.wallis@walliseng.net

As small communities grow, increases in wastewater loads can create outsized problems for their wastewater treatment plants. Over the last decade, the City of Stevenson wastewater treatment plant has seen dramatic increases in wastewater BOD and TSS loads and highly variable influent pH. This change in wastewater characteristics was driven by high strength users, including restaurants and beverage industries. Design for a major wastewater treatment plant upgrade began in 2019, but it would be some years before construction would be completed. In the meantime, the City would need to

manage influent BOD loads that were higher than the existing treatment plant capacity, and avoid effluent violations.

To address these challenges, the design team identified improvements that could be implemented quickly to improve WWTP performance, while simultaneously designing the full plant upgrade. Multiple options were considered, including process control improvements, additional aeration, and clarifier modifications. Due to budget constraints, the City selected a low-cost option: adding DO sensors in the oxidation ditch, an influent wastewater pH sensor, additional RAS flow meters, and an improved SCADA system. These interim improvements are integrated with the 30-year old control system. Though they represented a “short-term” fix, they were designed to be integrated effectively into the control system upgrade to be constructed with the full plant upgrade. DOE allowed the City to use design funds to construct the interim improvements, a major budget benefit.

These interim improvements allowed operators to quickly respond to changing influent wastewater characteristics, and more effectively manage secondary clarifiers. In addition, influent pH data has allowed the operators insight into industrial discharges, allowing the City to educate the industrial users on when their discharges were impacting the treatment process, resulting in fewer pH spikes. Process control was improved dramatically at a very low cost, reducing the burden on operators during the interim period before a major treatment plant upgrade.

Brief Biography and/or Qualifications

Jack Wallis is a civil engineer with eight years of experience focusing on wastewater system planning, wastewater treatment plant design, and collection system design. He has worked on a large variety of public infrastructure projects, focusing on rehabilitation and upgrades to aging wastewater infrastructure.

3:00pm - 5:15pm	**Session 01C: Alternate Delivery/Leadership/Wastewater - Livestream**

3:00pm - 3:45pm

ID: 195 / Session 01C: 1

Main Technical Program

Topics: Construction & Alternate Delivery

Keywords: Design-bid-build procurement, collaboration

Transforming Design-Bid-Build to Improve Collaboration and Teamwork

Jason King, Michael Schulz

Keller Associates, Inc., United States of America; jking@kellerassociates.com, mschulz@kellerassociates.com

The design-bid-build procurement process can limit the chance for collaboration between the owner, engineer, and contractor. This drawback has been a driving force toward non-traditional delivery methods such as design-build, construction manager-at-risk, and progressive design-build. However, there are tools to improve collaboration, which can make the design-bid-build process remain the best option. Some of these tools include prequalifying contractors and providing a detailed construction constraint specification. The construction constraints section of bidding documents offers engineers a unique way to communicate challenging project aspects to contractors. When well thought out and detailed, construction constraints can help contractors understand anticipated shutdowns, required bypass pumping provisions, and limitations in the existing equipment's operational capabilities.

Utilizing these and other tools to improve collaboration can also lead to an aggressive competitive bidding process. Recently, the City of Lewiston awarded a contract for the construction of wastewater treatment plant upgrades. The majority of their existing processes were being upgraded and expanded, which created an immensely complex project. Using collaborative tools, the contractors understood the project and had greater confidence in their costs, such that all bids were within ~5% on this $34M project. This presentation will introduce and discuss collaborative methods for improving the design-bid-build procurement process.

Brief Biography and/or Qualifications

Jason King, P.E., Keller Associates, Inc. Project Manager

Jason, a licensed professional engineer in several states, including Idaho, Oregon, and Washington, graduated from the University of Idaho with a bachelor's degree in civil engineering with an emphasis on wastewater treatment design. Jason has extensive experience in wastewater collection, conveyance, and treatment system design and construction. In the past five years, he has led the design and construction of over $50 million in water and wastewater infrastructure projects.

Michael Schulz, P.E., Keller Associates, Inc. Project Engineer

Michael Schulz graduated from Boise State University with a master's degree in engineering, with a water and wastewater emphasis. In the past five years, he has worked on design and construction projects (taking a lead role during construction) totaling over $30 million. Recent representative experience includes the City of Nampa's three-story solids handling facility.

3:45pm - 4:30pm

ID: 215 / Session 01C: 2

Main Technical Program

Topics: Leadership, Social Equity, Workforce Development

Keywords: Leadership, Workforce Development

Panel Discussion: Leadership Perspectives from the Future Workforce

Amy Dammarell[1], Lara Kammereck[2]

[1]HDR, United States of America; [2]Carollo; amy.dammarell@hdrinc.com, lkammereck@carollo.com

A diverse panel of active, local leaders with vast combined experience in water issues will share insight and their vision of the future workforce. In 2019, the Diversity and Leadership Track focused on leadership success and challenges associated with a diverse workforce from the point of view of those in the later stage of their career. In 2021, we will pose similar questions to a panel who are in the first

half of their career looking forward. The panel will answer questions on their vision for future leadership based on tomorrow's workforce, diversity and technology.

A panel of 5 will be developed with Conference Committee and Leadership Committee. Anticipate it will include diverse gender and age leaders at both private and public agencies from Washington, Oregon and Idaho.

Brief Biography and/or Qualifications

Lara is a Vice President at Carollo Engineers, Inc. She has over two decade of civil engineering experience focused on water and wastewater master planning for public utilities. She received her B.S. in Civil Engineering from Gonzaga University and her MBA from Seattle University. She is the vice president on the PNCWA Board.

Amy is a Vice President and the Director of Consulting Services for the HDR's Water Business Group. She has over two decades of experience supporting clients of all types deliver their infrastructure programs. She most enjoys finding solutions that find multiple benefits for human and natural environments. She received her BS in Wildlife Ecology from University of Illinois and her MS in Engineering from Portland State University.

4:30pm - 5:15pm

ID: 141 / Session 01C: 3

Main Technical Program

Topics: Wastewater 101, Wastewater Treatment Process

Keywords: sampling, pooling, protocol, TSS, FOG, screenings, capture efficiency

Screen Capture Efficiency Sampling & Testing Protocol for Waste Water Treatment Plant Screens at Start-up

James Impero

Ovivo USA, LLC, United States of America; james.impero@ovivowater.com

For approximately two decades, consulting engineers have asked screen manufacturers to provide third party, independent test results documenting the capture ratios of their screen's debris removal efficiency. Have these results truly been reproducible at your wastewater plant?

Decades of third-party capture testing of screens in the UK have been a good thing. However, the screenings capture data proved only the "Capability" of that particular screen tested and under those specific UK flow conditions. Expecting identical capture results from the same manufacture's screen at wastewater facilities with differing hydraulics, variable wastewater velocities, TSS & FOG loading characteristics, let alone up-front grinders is neither practical thinking or proven in the field to be true for 40%-45% of the current installation history in the US. Why? It is the very subject of this paper & conference presentation. There are definite wastewater similarities from site to site; however, there are also many dissimilarities that require screening equipment modifications to achieve the true screenings capture capability of any manufacturer's screen. This presentation will discuss an inexpensive upstream and downstream on-site sampling method & procedure, as well as a protocol and accepted test methodology that can be performed at any municipal wastewater treatment facility or local third party laboratory to measure solids capture efficiency of any newly installed screen(s) at startup, including older screen installations that have fallen short of owner expectations.

This presentation will reveal standardized sampling hardware, process & procedure, as well as simple bench-top test method for determining the screenings capture of any headworks or membrane protection screen. A single day sampling method & protocol will be described in detail that will provide a screen's site-specific debris capture efficiency. This standardized sampling and testing protocol can be performed by screen manufacturers, plant operators, and/or third party laboratory technicians.When incorporated into a consulting engineer's screen specifications it will require all bidding manufacturers to meet a desired screen capture efficiency (±X%) in the bid spec. The awarded manufacturer will be responsible for meeting the specified screenings capture.

Brief Biography and/or Qualifications

: OVIVO USA

James E. Impero

Senior Engineering Specialist

25 Years in Industrial Waste Water design

5 Years; BRACKETT GREEN, Group Product Manager

12 Years; EIMCO/OVIVO, Senior Engineering Specialist/Research & Design

BS Chemistry/University of Buffalo

MS Environmental Engineering/Rice University

Post Grad/Rice University in Hydrology/Geology/Formation Modeling

3:00pm - 5:15pm	**Session 02C: Stormwater - Livestream**

3:00pm - 3:45pm

ID: 280 / Session 02C: 1

Main Technical Program

Topics: Stormwater, Utility & Assessment Management, Resiliency, Planning, Climate Science

Keywords: Stormwater, Retrofits, Water Quality, Prioritization

A Scalable Decision-Making Framework For Stormwater Retrofit Investments

Blair Scott[1], Robin Krischbaum[2]

[1]King County; [2]Robin Kirschbaum Inc.; blair.scott@kingcounty.gov, Robin@robinkirschbaum.com

King County (County), WA, Stormwater Services Section (SWS) has identified the lack of stormwater controls in older developed areas as one of the most significant problems preventing recovery of the County's streams, lakes, and Puget Sound. With approximately 150 square miles of untreated developed areas and population growth among the largest over the last decade of any county across the United States, the need to strategically plan and begin implementing stormwater management to control stormwater runoff and restore or prevent further degradation of aquatic health is considered urgent by King County and its regional planning partners.

SWS is working collaboratively with Robin Kirschbaum, Inc. (RKI) to develop clear goals and a strategic decision-making framework for identifying, prioritizing, and implementing stormwater management and engineering projects led or influenced by SWS that restore aquatic resources through improved stormwater controls. Building on existing County programs, policies, and initiatives, the project will not only focus on water quality and aquatic health, but on broader principles of critical importance, such as equity and social justice (ESJ) and climate change preparedness.

The decision-making framework will address subbasin prioritization and individual project identification, evaluation, and prioritization organized around the following multi-benefit outcomes:

- Improve water quality outcomes
- Increase resilience to climate change impacts
- Preserve and restore wildlife habitat
- Implement Environmental and Social Justice
- Increase community stewardship
- Accelerate or exceed regulatory requirements using stormwater retrofits

The decision-making framework will serve as a foundational pillar of the County's 30-year plan for stormwater investments, currently being co-designed and co-implemented by a group of partners from across the region. The stormwater investment plan will rethink the region's approach to addressing polluted runoff and prioritizing the needs of the residents impacted the most.

Brief Biography and/or Qualifications

Blair Scott is a Water Quality Planner for King County, and Robin Kirschbaum is the Project Manager/Stormwater Engineering Lead for this work as well as the president of Robin Kirschbaum inc.

3:45pm - 4:30pm

ID: 225 / Session 02C: 2

Main Technical Program

Topics: Stormwater

Keywords: LID, pfas, copper, zinc, phytoremediation

A Greenhouse Evaluation of Stormwater Remediation Of Heavy Metals And PFAS By 10 Native Oregon Plants

Richard Hilliard, Bethany Parker, Jennifer Field, Tyler Radniecki

Oregon State University, United States of America; hilliarr@oregonstate.edu

Stormwater collects dissolved and particulate phase pollutants from improved surfaces and carries these to receiving water bodies, degrading their quality. Contaminants of particular concern include per- and polyfluoroalkyl substances (PFAS) and heavy metals such as copper and zinc. Infiltration systems of various designs are being implemented widely to provide passive treatment of these waters. Inclusion of plants in these systems provides potential for phytoremediation, prevention of erosion, increased soil porosity, and an aesthetic quality in the built environment.

Plants, along with associate microbes often vary greatly in their provision of degradation and removal of stormwater pollutants. In this study, 10 different native Oregon plants (n=6) including various monocots and dicots were investigated for potential treatment of copper, zinc, and PFASs (spiked-in) in surface runoff collected from a public works utility site in a 10-week greenhouse experiment. Aqueous, soil, and plant samples were analyzed using a combination HPLC-MS/MS and HPLC-QToF for PFAS and ICP-MS for heavy metals. Throughout the experiment, evapotransipration rates were monitored by weighing of the planted units. After the experiment, plant physiological qualities (masses and lengths of roots and shoots) were recorded. Enrichment of plant microbiomes in the rhizosphere and the bulk soil was evaluated by 16s rRNA amplicon sequencing to examine whether microbes are involved in stormwater phytoremediation.

Preliminary data suggest that some plants were much more effective at removing PFAS, particularly the shorter chain compounds. Additionally, some plants showed a net production compared to the control of PFPeS, PFBS, and PFHxS, suggesting the transformation of parent compounds FHxSA and FOSA.

Brief Biography and/or Qualifications

Richard Hilliard is a PhD candidate at Oregon State University in the Environmental Engineering program. He defended his Master's of Science in Environmental Engineering at Oregon State in the fall of 2018 and obtained his BA from College of the Atlantic in Bar Harbor, ME. His research involves the use of engineered biological systems for more efficient treatment of contaminated waters.

4:30pm - 5:15pm

ID: 241 / Session 02C: 3

Main Technical Program

Topics: Stormwater

Keywords: Stormwater, Technology, Permit Requirements, Watershed Management

Emerging Technologies for Stormwater: A CMAC Pilot Project

Josh Van Wie[1], **Peter Holte**[2]

[1]Osborn Consulting, Inc.; [2]City of Redmond; joshv@osbornconsulting.com, pholte@redmond.gov

Emerging technologies for stormwater are playing a crucial role in the Pacific Northwest to help municipalities meet their NPDES permit requirements and watershed management goals. Public agencies and their consultant teams must rely on innovation and collaboration to harness the latest technologies as permit requirements become more stringent and watershed management becomes more critical in urbanized areas.

During 2020-2021, the City of Redmond completed a pilot project to install Continuous Monitoring and Adaptive Control (CMAC) retrofits at two stormwater ponds. The CMAC system uses cloud software to optimize and control pond discharge flow rates through a remotely operated control valve. This technology was selected because of its potential to improve flow durations and protect downstream creek habitat in areas that were developed prior to current regulatory requirements for flow control.

To initiate the pilot project, Redmond identified four stormwater ponds as possible retrofit locations in the Monticello Creek watershed, which was previously selected as a priority watershed for the City's 2013 Watershed Management Plan. A feasibility study was completed by Redmond's consultant team, led by Osborn Consulting, to analyze the four ponds using the Western Washington Hydrology Model (WWHM) to assess potential improvements in flow durations at each pond after installing a CMAC retrofit. The modeling proved to be a valuable step in the process as some ponds showed significant potential improvements while the others showed little to no improvement due to site-specific hydraulic configurations or changes in basin hydrology that had occurred since the original design and construction.

Two ponds were selected to move forward with final design in late 2020 and construction of the CMAC retrofit installations in early 2021. The performance of the CMAC system will be monitored to determine its effectiveness and whether this technology has potential for more widespread use in helping the City meet its stormwater management goals.

Brief Biography and/or Qualifications

Josh Van Wie has worked on a variety of water resources projects in Washington State. His experience includes planning and design for stormwater retrofits, municipal capital improvement projects, and fish passage culverts and habitat restoration. Josh has closely coordinated with agencies including the City of Redmond, Spokane County, Seattle Public Utilities, and others to successfully develop planning studies and PS&E packages.

Peter Holte is Senior Plan for the City of Redmond and coordinates the City's Watershed Management Program. Peter holds Masters of Environmental Studies for the Evergreen State College, Masters in Public Administration for the University of Washington, and has over 20-years of experience working in stormwater management and habitat restoration.

3:00pm - 5:15pm	**Session 03C: Wastewater Process: Biological Intensification - Livestream**

3:00pm - 3:45pm

ID: 247 / Session 03C: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Wastewater Treatment Process

Keywords: CFD, Granular Sludge, solids separation

CFD Modeling Provides Insights into Granular Sludge Separation Devices

Ed Wicklein[1], Beate Wright[1], Sudhir Murthy[2], Charles Bott[3], Bob Angelotti[4], Haydee De Clippeleir[5], Christine deBarbadillo[5], Prarthana Pradhan[1], Tanja Rauch-Williams[1]

[1]Carollo Engineers, United States of America; [2]NEWhub; [3]HRSD; [4]UOSA; [5]DC Water; ewicklein@carollo.com

Granular activated sludge (GAS) consist of dense particles with stratified microbial colonies that provide efficient organics, nitrogen and phosphorus removal along with improving liquids/solids separation in activated sludge systems. GAS has gained broad interest and traction in recent years A growing number of water resource recovery facilities (WRRFs) in the U.S. and abroad have implemented inDense, a technology that uses hydrocyclones to select for GAS by separating it from lighter mixed liquor flocs. While hydrocyclones are an established approach to classify and separate particles in many fields, their application to GAS leaves key questions yet to be answered. Hydrocyclones have been designed, tested, and operated primarily based on empirical field performance data. To date, no group has successfully modeled GAS separation in AS systems by hydrocyclones despite the broad benefits this would bring to many WRRFs, until now. A team comprised of technical experts from equipment inventor, VA and DC utilities, and a consulting team collaborated on this effort to combine inDense installation and performance data from current full-scale inDense U.S. installations, state-of-the-industry understanding of GAS and inDense systems, and state-of-the-art CFD modeling capabilities. Project findings will be presented, illustrating that CFD modeling developed in this project simulating hydrocyclone GAS separation is a useful tool to inform the design and operation of external selector systems. This will lead to clear visualization of internal separation process, expanding our understating of how to adjust operations to different process and seasonal conditions.

Brief Biography and/or Qualifications

Ed Wicklein is a principal technologist with Carollo Engineers who's been evaluating water and wastewater problems with numerical models for over 21 years. He studied Civil Engineering at Washington State University, focused in computational hydraulics. Ed is Carollo's national practice lead for computational fluid dynamics modeling, and has been involved in many projects to evaluate and optimize solids separation.

3:45pm - 4:30pm

ID: 188 / Session 03C: 2

Main Technical Program

Topics: Treatment Innovation and the Future, Wastewater Treatment Process

Keywords: Aerobic Granular Sludge, Nutrient Removal

Experience With Densified Mixed Liquor And Nutrient Removal At Two WWTFs In Washington

Eric Smith, Tom Coleman

RH2 Engineering, Inc, United States of America; esmith@rh2.com, tcoleman@rh2.com

The Cashmere and Peshastin WWTFs discharge to the Wenatchee River, which has a TMDL for phosphorus. The Cashmere WWTF was the subject of the article "Cashmere Quality – Experience with enhanced biological phosphorus removal, surface wasting, and aerobic granular sludge" which appeared in the July 2020 edition of the Water Environment and Technology magazine. This presentation will expand upon that article and share recent findings related to the densified mixed liquor and biological nutrient removal at both WWTFs.

The Cashmere WWTF is a plug flow modified Bardenpho process and the Peshastin WWTF is a sequencing batch reactor. The two WWTFs have significantly different influent characteristics. Cashmere has a moderate strength influent due to a large apple slicing facility that discharges to the City's system. Peshastin has relatively weak wastewater as the community is served by a septic tank

effluent system, which removes settleable solids prior to discharge to the WWTF. Additionally, the Peshastin WWTF receives widely varying flows throughout the year from two fresh fruit packing warehouses that discharge significant quantities of rinse water to the system.

Each WWTF is configured to favor biomass with good settling characteristics. Both plants exhibit significant fractions of aerobic granules as part of the biomass and each process achieves exceptional settling at relatively high mixed liquor concentrations. For instance, the Cashmere WWTF routinely has mixed liquor suspend solids concentrations in excess of 6,000 mg/L with SVIs below 50, in conjunction with a clarifier blanket below 2 feet.

The capacity of a WWTF is generally proportional to the mass of mixed liquor suspended solids that can be carried within the system. The settleability of these solids is a critical parameter as it can significantly affect the footprint necessary to support the process. Implementing bacterial selection processes through WWTF design and process controls can change the structure and function of the microbial communities to provide a densified mixed liquor, as can be found at the Cashmere and Peshastin WWTFs. Insights into these two WWTFs may be useful to other plants needing to increase treatment capacity relative to plant footprint while achieving biological nutrient removal.

Brief Biography and/or Qualifications

Eric Smith is a Project Manager with RH2 Engineering and has 10 years of experience in the design, construction, and operational support of new and retrofit wastewater treatment facilities.

Tom Coleman is a Senior Process Engineer with RH2 Engineering. Tom has over 30 years of experience in environmental engineering related to municipal and industrial wastewater treatment facilities with a primary emphasis on biological nutrient removal.

4:30pm - 5:15pm

ID: 143 / Session 03C: 3

Main Technical Program

Topics: Wastewater Treatment Process

Keywords: Advanced aeration control, Intensification, Hydrocyclone

Advanced Aeration Control with Densification Achieves BNR Intensification: A Full-scale Demonstration of the Ntensify Process

Pusker Regmi, Jose Jimenez

Brown and Caldwell, United States of America; pregmi@brwncald.com

Driven by stringent new nutrient standards and increasing costs of nutrient removal, utilities in the Pacific Northwest must look towards innovative approaches to solve the issue. Advanced aeration controls like ammonia vs NOx (AvN) or ammonia-based aeration control, lower the aeration energy while promoting a more carbon-efficient nitrogen removal via simultaneous nitrification and denitrification (SND). Low dissolved oxygen (DO) maintained by advanced aeration control is the key to aeration savings and SND but often leads to poor settling sludge. The Ntensify approach combines low DO operation with hydrocyclone based wasting to achieve continuous flow aerobic granulation and enhanced nutrient removal. This presentation will describe the results from the full-scale Ntensify installation at the James R. Dolorio Water Reclamation Facility (JRD WRF) in Pueblo, Colorado.

The JRD WRF is a 19 mgd biological nutrient removal (BNR) facility that operates a Johannesburg process. The recently upgraded facility includes hydrocyclones that feed a portion of the RAS to target lighter organism waste in the mixed liquor. Upgrades implemented AvN control, allowing DO setpoints to fluctuate between 0.2 – 2 mg/L while maintaining equal effluent ammonia and NOx concentrations.

Improvement results showed that hydrocyclone-based wasting helped improve settling characteristics [sludge volume index (SVI) < 100 mL/g values ranging from 130 to 300 mL/g before implementation] within weeks of operation. Phosphorus accumulating organisms (PAO) and nitrifiers are preferentially retained in dense flocs and granules, while lighter heterotrophic and filament-type organisms are preferentially wasted. The hybrid floc-granules combination at Pueblo achieved excellent effluent turbidity (effluent TSS < 6 mg/L, turbidity < 2 NTU). AvN control resulted in low DO conditions (< 0.4 mg/L) that reduced air demands by 50% while supporting excellent nitrogen [effluent total inorganic

nitrogen < 11 mg/L] and total phosphorus (TP) removal (effluent TP < 1 mg/L)] at low influent carbon conditions (primary effluent COD/N <6) without supplemental chemicals.

Brief Biography and/or Qualifications

Dr. Pusker Regmi is a Licensed Professional Engineer and Process Engineer with Brown and Caldwell in Washington D.C. area. He has wide-ranging experience in research and development as well as the design of innovative biological nutrient removal technologies. Pusker is the author of over 30 publications in peer-reviewed international technical journals and proceedings of national and international conferences.

3:00pm - 5:15pm	**Session 05C: Regulatory Challenges**

3:00pm - 3:45pm

ID: 175 / Session 05C: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Regulatory Challenges

Keywords: PFAS, biosolids, microconstituents, emerging contaminants, pyrolysis

PFAS in Biosolids Products - What To Do Next?

Todd Williams

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Per- and Poly- Fluoroalkyl Substances (PFAS) are a large family of organic compounds, including more than 5,000 artificial fluorinated organic chemicals used since the 1940s. They have been used extensively in surface coatings and protectant formulations for consumer products including paper and cardboard packaging products, carpets, leather products and clothing, construction materials, and non-stick coatings.

Recent studies have shown PFAS in WWTP influents to be in the tens to hundreds of nanograms per liter (ng/L). Conventional sewage treatment methods do not efficiently remove PFAS. Application of biosolids from WWTPs as a soil amendment can result in a transfer of PFAS to soil, which can then leach to groundwater or be available for uptake by plants and soil organisms and biomagnify to grazing livestock. PFAS have been detected in soils, groundwater, crops, and livestock near agricultural fields that receive PFAS-contaminated biosolids, fueling public concern.

As PFAS are recalcitrant and are not removed through conventional wastewater treatment, management of PFAS in biosolids is gaining increased concern and scrutiny.

This presentation will address the following questions related to PFAS in wastewater and biosolids:

- What are PFAS?
- Why are PFAS in wastewater?
- What is the fate of PFAS in biological treatment systems?
- What is the current status of regulations related to PFAS in biosolids
- What technologies can be used to treat PFAS in biosolids?

Data will be presented on PFAS measured in biosolids before and after various biosolids treatment technologies including digestion, composting, drying, and pyrolysis. This presentation will help utility planners, operators, engineers and administrators understand the nature of the PFAS issue, how these compounds are introduced into wastewater and biosolids, the rapidly changing regulatory landscape, and what technologies are being used to eliminate these compounds from biosolids products.

Brief Biography and/or Qualifications

Mr. Williams has a 40-year career in environmental engineering with operating and design experience and specific emphasis in biosolids management planning, and product utilization. Todd has assisted many wastewater cities, agencies and communities throughout North America in developing sustainable biosolids management programs. He has direct experience with new and emerging biosolids treatment technologies such as digestion, drying, pyrolysis, gasification and composting. Todd is the past Chair of the Water Environment Federation's Residuals and Biosolids Committee and currently serves as Jacobs Engineering's Residuals Resource Recovery Global Technology Leader.

3:45pm - 4:45pm

ID: 205 / Session 05C: 2

Main Technical Program

Topics: Regulatory Challenges

Keywords: biological phosphorus removal, TMDL, monitoring, modeling, aluminum

Water Quality Modeling and Monitoring to Support an Update of the Tualatin River Phosphorus TMDL

Raj Kapur, Scott Mansell, Leila Barker, Ken Williamson, Clint Cheney, Bob Baumgartner

Clean Water Services, United States of America; kapurr@cleanwaterservices.org

Since 1988, the Tualatin River has had a total phosphorus TMDL which established stringent effluent limits. Clean Water Services has used a combination of biological processes and alum addition at the tertiary stage of the treatment process to meet phosphorus limits. Since 1988, the river has changed dramatically in terms of operations, flows, and water quality. Additionally, EPA has recently finalized a new aluminum standard in Oregon that will make it impractical to continue to use alum in the tertiary process for phosphorus removal. Clean Water Services conducted modeling that suggested that the Tualatin River was no longer sensitive to phosphorus inputs as it once was. Clean Water Services conducted a study in 2019 and 2020 where only biological processes were used for phosphorus removal with no tertiary alum addition and the effects on the Tualatin River were assessed. Results indicate that the treatment facilities can effectively reduce total phosphorus using biological processes without negatively impacting water quality in the river. Data gathered during the study will be used to update the water quality model and prepare a technical report to support an update of the Tualatin River phosphorus TMDL.

Brief Biography and/or Qualifications

Education

M.S., Environmental Engineering, Portland State University

B.S., Petroleum Engineering, Pennsylvania State University

Work Experience

Raj works for Clean Water Services as a water resources program manager. His role includes overseeing the implementation of Clean Water Services' watershed based NPDES permit, water quality monitoring program, and water quality trading program. Prior to joining Clean Water Services, Raj worked for CH2M HILL and Oregon DEQ.

4:45pm - 5:45pm

ID: 240 / Session 05C: 3

Main Technical Program

Topics: Wastewater Treatment Process, Regulatory Challenges

Keywords: Puget Sound Nitrogen Regulations, nitrogen removal, site planning

Seeing the Whole Picture – Addressing Puget Sound Nitrogen Regulation Uncertainty as part of Biosolids Planning at Bellingham, WA

Anne Conklin[1], Tadd Giesbrecht[2], Susanna Leung[1], Trung Le[2], Rick Kelly[2], Steve Krugel[2], Rob Johnson[3]

[1]Carollo Engineers; [2]Brown and Caldwell; [3]City of Bellingham; aconklin@carollo.com, tgiesbrecht@brwncald.com

The City of Bellingham (City) provides wastewater service for over 100,000 people at the Post Point facility. The City has been in planning efforts to replace their aging incinerators and implement a Class A biosolids and biogas strategy that aligns with their values and recovers the resources. The Washington State Department of Ecology (Ecology) has taken implementation steps to control nitrogen discharges from wastewater treatment plants to Puget Sound. Ecology recently issued a draft General Permit for public comment that identifies facility action level thresholds as a first step of potential future lower limits.

The City recognizes that nitrogen reduction will ultimately require significant costs and substantial treatment plant space, necessitating the need to plan for nitrogen removal Nestled at the edge of Bellingham Bay and surrounded by environmental critical areas, community amenities, and residential areas, Post Point is land constrained, requiring that "build out" conditions be evaluated to determine the ultimate capacity of the site.

The BC/Carollo project team evaluated the feasibility of two effluent scenarios and treatment strategies that would bookend the likely future range of nitrogen regulations:

- Worst Case: 3 mg/L total inorganic nitrogen (TIN) year-round,
- Moderate Case: 8 mg/L TIN summer only.

At least one treatment strategy was found for each scenario that could fit within the site constraints.

Brief Biography and/or Qualifications

Dr Conklin is a Principal Technologist at Carollo Engineers, and has fifteen years of experience in facility planning and wastewater treatment process modeling. She joined Carollo after earning her PhD in Civil and Environmental Engineering from the University of Washington.

3:00pm - 5:15pm	**Session 06C: Wastewater Process**

3:00pm - 4:00pm

ID: 184 / Session 06C: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Wastewater Treatment Process, Regulatory Challenges

Keywords: Disinfection byproducts, preformed monochloramine

Meeting Stringent Ammonia and Disinfection Byproduct Limits with Preformed Monochloramines

Jennifer Chang[1], Rachel Golda[2], Peter Schauer[2], Larry Schimmoller[1], Matt Noesen[1]

[1]Jacobs, United States of America; [2]Clean Water Services, Oregon; jennifer.chang@jacobs.com, GoldaR@CleanWaterServices.org

The Rock Creek Advanced Wastewater Treatment Facility (RCAWWTF) must balance low effluent ammonia limits, disinfection requirements, and potential low disinfection byproduct (DBP) limits.

The ammonia and disinfection limits are currently met through stable nitrification and use of sodium hypochlorite (SHC) disinfection, respectively. Effluent characterization identified the presence of two trihalomethane DBPs of potential regulatory interest when effluent ammonia concentrations were low: bromodichloromethane (BDCM) and chlorodibromomethane (CDBM). Initial estimates suggest that future discharge limits for CDBM and BDCM may be as low as 1.1 µg/L and 1.5 µg/L, respectively.

Preformed monochloramine (PFM) disinfection was identified as an operational strategy for reducing DBP production. This method utilizes monochloramines that are formed by mixing ammonia and sodium hypochlorite in carrier water before mixing with process water, greatly reducing the opportunity for DBP formation. Bench-scale testing followed by pilot testing was conducted to determine if utilizing a PFM disinfection approach could be an effective solution.

Preliminary bench-scale testing of insitu monochloramines (ISM) versus PFM indicated that PFM was a promising option to meet the disinfection and DBP formation goals; therefore, pilot-scale testing was pursued.

A flow-through pilot system was constructed at the RCAWWTF to receive tertiary effluent where a PFM solution could be added. Testing evaluated:

- Effects of varying PFM dose at a constant chlorine-to-ammonia ratio of 4:1, and
- Effects of varying chlorine-to-ammonia ratio.

Testing demonstrated the benefits of using PFM over free chlorine and ISM by meeting disinfection permit limits and significantly reducing DBP formation potential while still maintaining effluent ammonia concentrations that met permit limits. These results show the viability of implementing PFM disinfection as a solution to more stringent DBP limits. Other clean water utilities may benefit from modifying existing chlorine disinfection to PFM disinfection as a much more cost-effective alternative relative to converting to another disinfection technology.

Brief Biography and/or Qualifications

Jennifer Chang, P.E. is an engineer with Jacobs focusing on disinfection projects. Rachel Golda, PhD is an Operations Analyst at Clean Water Services in Tigard, OR, with experience in water quality research, methods development, and scientific communication.

4:00pm - 5:00pm

ID: 269 / Session 06C: 2

Main Technical Program

Topics: Wastewater Treatment Process, Regulatory Challenges

Keywords: wastewater, nutrient removal, BNR, nitrification, denitrification

BNR Conversion of the Oro Loma/Castro Valley Water Pollution Control Plant

David Seymour

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Maintaining reliability in aging infrastructure has become a significant investment for wastewater agencies as facilities approach the end of their useful life. One such agency, Oro Loma Sanitary District (OLSD), was faced with a significant investment to rehabilitate a 7-mile long 189 MGD deep-water

outfall in San Francisco Bay shared by six agencies. At the same time, nutrient regulation was being considered through a region-wide watershed permit that would require higher levels of treatment at OLSD's 20 MGD Water Pollution Control Plant (WPCP). OLSD identified a project that would address these two challenges.

Implementation of $26M biological nutrient removal (BNR) upgrade of the existing secondary treatment process allowed OLSD to cost-effectively comply with anticipated regulation in the future watershed permit for nitrogen removal. In addition, an improved effluent quality allowed OLSD to renegotiate its NPDES permit to allow for the use of a near-shore outfall during wet-weather as an alternative discharge location to the deep-water outfall. Permitted use of the alternative outfall allowed OLSD's partner agencies additional capacity in the shared deep-water outfall, as well as reducing OLSD's liabilities for future outfall maintenance. The BNR upgrades were designed and constructed over a 3-year period and went into operation in September 2020.

This presentation will highlight how BNR was incorporated into the WPCP, the anticipated benefits of the project, and how the improvements are performing based on the first months of operation.

Brief Biography and/or Qualifications

David's professional career has focused on process upgrades at wastewater treatment plants and he has worked at over 40 wastewater treatment facilities in Washington, Oregon, California, and Hawaii. David served as a process engineer for the Oro Loma Water Pollution Control Plant BNR improvements, which went online in August 2020.

5:00pm - 6:00pm

ID: 167 / Session 06C: 3

Main Technical Program

Topics: Treatment Innovation and the Future, Facility Operations & Maintenance, Wastewater Treatment Process

Keywords: Fermentation, scum management, UFAT, primary sludge, biological phosphorus removal

Primary Sludge Fermentation: A Wretched Hive of Scum and Villainy

Rachel Golda, Adrienne Menniti, Peter Schauer

Clean Water Services, United States of America; goldar@cleanwaterservices.org

The Unified Fermentation and Thickening (UFAT) process is used at two Clean Water Services (CWS) Resource Recovery Facilities (Rock Creek and Durham) for primary sludge fermentation, generating volatile fatty acids (VFA) to support biological phosphorus removal. The Durham plant has a problem with fermenter scum buildup, forming dense mats during warm periods; a problem not shared by the Rock Creek fermentation system. The goal of this project was to inform design decisions on an upcoming fermenter expansion at the Durham plant by clarifying the role played in scum mat formation by three significant design differences between the facilities: 1) sludge heating, 2) sludge screening, and 3) scum removal.

Laboratory experiments using heated primary sludge reactors showed a correlation between scum mat formation and temperature, with mats forming more quickly with increasing heat. Observations of gas bubbles caught in and under scum mats in the laboratory and at full-scale suggest that solids from the sludge blanket may be floated to the surface of the fermenter by biologically-generated gas during fermentation. Laboratory experiments also showed that unscreened primary sludge produced scum mats more quickly than screened sludge, and that these mats persisted longer. Unscreened Durham primary sludge contains irregular, thread-like solids like hair and fibers. We observed these in dense formations in the full-scale mat, suggesting that they provide a structural matrix for scum to congeal to, trapping gas bubbles.

Our observations suggest that gas production from fermentation activity causes solids from the sludge blanket to rise to the surface, creating or exacerbating scum mats. The fermentation process is accelerated at warm temperatures, which is likely why mat formation worsens during warm periods. Screenable solids also likely play a substantial role in providing a stabilizing network for scum solids to adhere to, worsening scum problems at plants that do not utilize primary sludge screens. Installation of capital improvements such as sludge screens and scum handling systems are multi-million dollar investments; this work offers valuable insight into the roles played by fermenter design differences in

mitigating scum accumulation and can inform design decisions regarding installation or improvement of UFAT fermentation systems.

Brief Biography and/or Qualifications

Rachel Golda, PhD is an Operations Analyst at Clean Water Services in Tigard, OR, with experience in water quality research, methods development, and scientific communication.

Date: Tuesday, 14/Sept/2021

8:00am - 9:30am	**Session 07A: Construction & Alternate Delivery/Risk Assessment & Resiliency - Livestream**

8:00am - 8:45am

ID: 290 / Session 07A: 1

Main Technical Program

Topics: Wastewater 101, Construction & Alternate Delivery, Facility Operations & Maintenance

Keywords: Construction, Maintaining Operations, Permit compliance

Changing the Airplane Engine Mid-flight: Best Practices to Manage Construction at Operational Facilities.

Michelle Green

Jacobs, United States of America; Michelle.Green@jacobs.com

Keeping existing wastewater systems running during invasive construction projects requires precise planning and significant collaboration between designers, contractors and O&M staff. Ignoring the practical realities of system operational constraints and requirements can create headaches for O&M staff, increases the potential for contractor claims and schedule delays and heightens risk of discharge permit violations. Successful projects avoid or minimize operations disruptions and carefully manage critical shutdowns.

A diverse panel of agency staff, engineers and contractors experienced in construction at operating facilities will share insights and experience from their careers. The panel will discuss best practices during both design and construction to prepare for interruptions and interface with existing facilities. Common challenges will be highlighted along with specific activities to avoid gaps and hiccups. Potential topics include:

- Early identification of process constraints

- Successful engagement of O&M staff during design

- Incorporating requirements into contract documents

- Structured processes during construction

- Communication strategies to align parties

Brief Biography and/or Qualifications

TBD

8:45am - 9:30am

ID: 306 / Session 07A: 2

Main Technical Program

Topics: Resiliency, Planning, Climate Science

Keywords: Climate science, resiliency, coastal, sea level rise, infrastructure

Assessing Future Coastal Flood Hazards to Water Infrastructure with the Puget Sound Coastal Storm Modeling System (PS-CoSMoS)

Eric E. Grossman[1], S.C. Crosby[1], B. Tehranirad[1], C.M. Nederhoff[1], N.R. vanArenonk[1], P.L. Barnard[1], Shelby Smith[2], Clare Fogelsong[3]

[1]United States Geological Survey; [2]Brown & Caldwell; [3]City of Bellingham Public Works; egrossman@usgs.gov, cfogelsong@cob.org

The combination of rising sea levels, changing storm patterns, and greater rainfall intensity in the coming decades is expected to increase the magnitude and frequency of coastal flooding across the Pacific Northwest. Flood hazards and associated impacts are of concern to many coastal utilities who are engaged in planning efforts to protect infrastructure and ensure resilient operations in the future. The City of Bellingham (City) owns and operates the Post Point Resource Recovery Plant (Post Point), which is located on the coast of Bellingham Bay. The City has partnered with the U.S. Geological Survey (USGS) to implement the Puget Sound Coastal Storm Modeling System (PS-CoSMoS) to help evaluate risks of storm induced flooding in combination with sea level rise, and to evaluate opportunities for increasing infrastructure resiliency. An initial application of the model is to evaluate potential impacts to the City's Post Point facility and guide its planning and design.

PS-CoSMoS is developed to evaluate extreme water level recurrence to help federal, tribal, state and local agencies and communities identify impending hazards and inform coastal planning efforts across the Salish Sea into the next century. Flood hazards associated with sea level rise and climate change effects to river floods and storms are computed across the region at 1-meter resolution integrating regionally downscaled global climate models. PS-CoSMoS predicts tides and storm surge with a mean absolute error of 10 cm across 13 tide gages over the period 2018-2019. The model resolves the relative contributions and projected changes of atmospheric pressure anomalies, outer shelf wind effects, interannual ocean dynamics like the El Nino-Southern Oscillation, and local wind setup to extreme water level. Overland flooding and wave setup are modeled with a rapid 2D flow solver and flood extent, depth, duration, and velocities are mapped for several sea level rise scenarios. This presentation will describe the model and its application to the Post Point facility planning and design update.

Brief Biography and/or Qualifications

Eric Grossman is a Research Geologist with the USGS Pacific Coastal and Marine Science Center. His team is developing the Puget Sound Coastal Storm Modeling System and Eric directs the USGS Coastal Habitats in Puget Sound (CHIPS) Project. Eric's research focuses on natural hazards, sediment transport, and coastal climate change and his publications address past and future sea level rise, coastal evolution, ecosystem functions and services, and habitat restoration. Eric also serves as Tribal Liaison for the USGS Natural Hazards Mission Area and is an active member of the Skagit Climate Science Consortium.

Clare Fogelsong is the Natural Resources Policy Manager for the City of Bellingham. He has managed the development of City climate policy since 2004 and is currently assisting with implementation of climate mitigation programs while updating the City's Climate Adaptation Strategy. He also manages water quality protection programs in the Lake Whatcom watershed, and participates in Water Resources Inventory Area No.1 water issues.

8:00am - 9:30am	**Session 08A: Wastewater Process: Deammonification**

8:00am - 8:45am

ID: 254 / Session 08A: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Wastewater Treatment Process, Recycled Water & Resource Recovery

Keywords: deammonification, recycle streams, natural treatment systems

Zeolite-anammox Deammonification Of Biosolids Dewatering Recycle Stream: A Public Domain Technology

David Austin, Mark Madison

Jacobs, United States of America; David.Austin10@jacobs.com

The Roseburg Urban Sanitary Authority (RUSA) operates an innovative deammonification wetland capable of treating 5,000 gallons per day, of biosolids filtrate that has an ammonia-N concentration averaging nearly 1,000 mg/L. Liquid from solids dewatering can go either to irrigation or deammonification. The purpose of the wetland is to remove ammonia-nitrogen during periods in the spring when irrigation is not feasible. It is the first commercial zeolite-anammox system.

Biosolids generated at RUSA's WWTP are dewatered in a center screw press Monday-Friday, year-round. The filtrate from this screw press flows to an off-line clarifier and then is batch-loaded to two wetland cells by siphons. Wetland media is clinoptilolite (a zeolite). Beds drain by siphons to a recirculation basin where a pump transfers wetland effluent to the dosing siphons. Beds flood and drain excess water is pumped back to the plant's aeration basins.

The wetland started in November 2016 and this presentation will focus on discussing the 4 years of operational experience as well as lessons learned. After a year of complete nitrification, the wetland converted to deammonification (anammox). Since then it has averaged 53 percent deammonification, significantly reduced the ammonia recycle load on the WWTP. Performance has been highly consistent in the past three years. Adding alkalinity to maintain pH above 7.0 while in the nitrification phase was crucial to establish deammonification. Once deammonification started, alkalinity demand stopped. However, recent analysis of performance indicates that maintaining a consistent operational pH of 7.5 to 8.0 – which is ideal - may require occasional alkalinity addition.

This technology is simple and non-proprietary and has potential broad application for small to medium size wastewater systems. Flood and drain contact beds were first used in the 1890s. Anammox was first observed in a contact bed in 1902. Recirculation in flood and drain beds is also public domain technology. With careful attention to design loading criteria, construction detail including the zeolite source, and alkalinity addition during the first nitrification phase; this technology is available to utilities to manage recycle streams with high levels of ammonia-N.

Brief Biography and/or Qualifications

David Austin is a Technology Fellow at Jacobs where he is the Global Technology lead for Natural Treatment Systems. He is an environmental P.E. (MN), Certified Senior Ecologist (Ecological Society of America), Certified Lake Manager (North American Lake Management Society), and a past President of the American Ecological Engineering Society. His projects concentrate on reservoir management, treatment wetlands, wastewater reuse, estuarine remediation, and mine water reclamation. Degrees: Mathematics (BA, University of Minnesota-Twin Cities), Water Resources Management (MS, University of Wisconsin-Madison), and Civil & Environmental Engineering (MS, University of California-Davis).

8:45am - 9:30am

ID: 103 / Session 08A: 2

Main Technical Program

Topics: Treatment Innovation and the Future, Wastewater Treatment Process

Keywords: sidestream, nitrogen, anammox, deammonification, MABR

Sidestream Deammonification MABR Development and Performance in Bench-Scale Reactor Treating Anaerobic Digester Dewatering Centrate

Bryce Figdore

HDR; Bryce.Figdore@hdrinc.com

A partial nitritation-anammox (deammonification) biofilm was grown in a bench-scale membrane-aerated biofilm reactor (MABR) treating dewatering centrate from a full-scale conventional mesophilic anaerobic digestion process. Anammox activity developed within 165 days of startup in absence of intentional seeding events or strategies such as seeding from an external enrichment or an integrated second-stage process treating partial nitritation effluent.

Average surficial NH3-N and TIN removal rates were 2.6 and 2.3 g N/m2-d for the 77-day operating period ending September 28, 2020 after anammox growth occurred and stabilized. In-situ anammox activity tests confirmed anammox activity and showed an average anaerobic TIN removal rate of 5.3 g N/m2-d under non-limiting substrate conditions, indicating that aerobic rather than anaerobic ammonia oxidation activity was rate-limiting under operational conditions.

These results suggest that MABR may be a viable deammonification alternative with reduced energy, seeding, and startup requirements compared to established commercial approaches.

Ongoing operations are further evaluating fundamental research questions, optimization strategies, and full-scale engineering implications.

Brief Biography and/or Qualifications

Bryce Figdore is a senior wastewater process engineer with HDR based in Bellevue, WA. He is enthusiastic about applying his expertise in biological nutrient removal to deliver innovative and robust wastewater treatment and water resource management solutions. Bryce has Bachelor's, Master's and Doctorate degrees, respectively, from Penn State, Villanova, and the University of Washington. He enjoys exploring the great Pacific Northwest while fly fishing or hiking with his family.

8:00am - 9:30am	**Session 09A: Resource Recovery - Livestream**

8:00am - 8:45am

ID: 153 / Session 09A: 1

Main Technical Program

Topics: Collection and Conveyance, Recycled Water & Resource Recovery, Resiliency, Planning, Climate Science

Keywords: Energy recovery, sustainable development, integrated urban water infrastructure

Thermal Energy from Wastewater – A New Role of Wastewater Utilities in the New Energy Economy

James McQuarrie

Tetra Tech, United States of America; jim.mcquarrie@tetratech.com

The Pacific Northwest has become a key area of North America in the application of thermal enegy from wastewater (TEW) for indoor heating. The combination of GHG goals and buidling code requirements has motivated high-density development to look at its options for geo-exchange type heat pump applications for meeting heating needs but with out main reliance on fossil natural gas. Because of its subteranean proximty to high density development in urban landscapes TEW is increasingly becoming yet another resource to be extracted from wastewater. And hence, a new role is emerging for wastewater utilities to contibute towards a circular economy. In temperate and cold climates most of the residential energy requirement is for indoor heating and hot water.

Tapping into TEW for campus and district scale heating in the built envrionment can can be particularly attractive due to the proximity of interceptor sewers in areas where high-density development tends to occur and the fact that by its nature, wastewater is warm. Traditional ground-source heat pump systems are challenging due to the lack of land area for horizontal systems and the challenges of drilling deep systems in urban settings. While much attention is already given to energy recovery from biogas at Water Resource Recovery Facilities (WRRFs) it is only recently that more attention is being given to TEW. The energy recovery potential from TEW is several times greater than the amount of energy that can be recovered through biogas. In the full submission, the author will provide the audience with knowledge transfer based on case study examples of the technical, financial, and partnership opportunities and challenges that need to be addressed in order to bring a TEW campus or district scale system from concept to reality.

The full presentation will provide an overview of the technical as well as the partnership components that must come together in order to deliver a campus scale TEW system.

Brief Biography and/or Qualifications

Jim McQuarrie is Tetra Tech's One Water Innovation Leader responsible for helping utilities evaluate and manage the risk involved in incorporation of the ever more integrated roles in resource stewardship and sustainability that wastewater utilities are now providing to its rate payers.

8:45am - 9:30am

ID: 106 / Session 09A: 2

Main Technical Program

Topics: Resiliency, Planning, Climate Science

Keywords: Climate change, Biochar, Biosolids

Truly Sustainable Biosolids Management For a Waste Free Future

Valentino Villa, Elizabeth Bridges, Garrett Benisch

Bioforcetech Corporation, United States of America; v.villa@bioforcetech.com

Since its founding in 2013, Bioforcetech has been working to prevent carbon emissions from the wastewater treatment process, and create a valuable product from its solid ‘waste.’ In 2018, 18% of the emissions generated in the United States came from organics breaking down in landfills. While this number alone is overwhelming, it doesn’t even begin to capture the total emissions released during the processes of drying and transporting solids from wastewater treatment.

Our proprietary two step process of drying and pyrolyzing biosolids utilizes our patented Bioforcetech BioDryer and P-Series Pyrolysis machines. These two technologies work together to reduce material

volume and weight by 90%, lock available carbon in place for centuries, and produce a clean, valuable biochar at net-zero energy.

The biochar produced from our process is called OurCarbon™, and we're using this material to develop sustainable replacements for petroleum based materials and to close the loop on waste streams both in the municipalities where our plants are installed and in products that are sold across the country. The Parks Department in the community where our California installation is located has begun incorporating our biochar into their local parks and plantings. Our first suite of products, called Den™, is a set of soil mixes showcasing our biochar as its main ingredient formally called OurCarbon™. Other empirical testing in pigmentation, fabric dyes, paint colorants, and material additives to concrete show promising opportunities to expand the use of biochar into these markets. The promise of this investigation allows us to offer a no-cost biochar off-take agreement to municipal clients with a profit share back to our client for any biochar sales made in profitable applications. At no cost guaranteed, our off take agreement ensures that excess biochar will never be a future issue for our clients.

Brief Biography and/or Qualifications

Valentino Villa is the Co-Founder and Chief Operating Officer of Bioforcetech Corporation. He earned the status of "Perito Industriale Capotecnico per l'Elettronica e le Telecomunicazioni," an Italian professional designation for an industrial expert in the field of engineering that is recognized as an industrial engineer outside of Italy. Since co-founding Bioforcetech, Valentino and his team have been rethinking every step of biosolids management to prepare for a carbon free future. Valentino believes that Bioforcetech's biochar is a resource, which is why he and his team are investing in research and development to expand the applications for biochar far beyond soil amendment. Their system results in a deeply carbon negative and cost effective management plan for any resource recovery facility.

8:00am - 9:30am	**Session 10A: Utility Planning**

8:00am - 8:45am

ID: 137 / Session 10A: 1

Main Technical Program

Topics: Facility Operations & Maintenance, Utility & Assessment Management

Keywords: Smart Utility, Utility Management, IoT, SCADA, Utility of the Future

Being "Smart" Is Essential For The Utility Of The Future: Understanding What Is Hard To See In The Data

Kevin Stively

Brown and Caldwell, United States of America; kstively@brwncald.com

Utility leaders find themselves caught in a paradox of working within a society that increasingly achieves benefits through smart technologies and the reality that their organizations remain unable to capitalize on large utility data storage across systems often referred to as "dark data." Bringing this dark data into the light and leveraging past and future investments in digital technologies is essential for effective utility management. Of the nearly 60,000 water and wastewater utilities in the U.S., only a small percentage have tapped into existing data resources to achieve effective utility management.

Today's utilities are challenged by increasing customer expectations, the need to continuously improve efficiency, loss of institutional knowledge, and managing an aging and complex infrastructure. Managers want to believe technology holds the promise of solving problems and improving service. Yet these same managers find themselves asking questions like, "Is my existing data any good", "are smart solutions really going to improve my bottom line", and "do I have the workforce to support more advanced technology solutions". For many, smart solutions have the appearance of "supervisory control and data acquisition (SCADA) with a new coat of paint" or something that seems to over promise as many other new ideas have done.

Answering the questions above is possible by taking a phased approach customized to the utility's vision and digital technology requirements to allow for building confidence in smart utility solutions. A phased approach allows the utility to explore the possibilities of smart solutions on specific use cases testing their efficacy in a practical manner.

Elements of this presentation were featured at 2019 WEFTEC and in a Podcast hosted by Water Online. This paper will present use cases implemented in various utilities using a phased approach that allows the utility to explore the possibilities of smart solutions on specific use cases testing their efficacy in a practical manner.

Brief Biography and/or Qualifications

Over the past 33 years, Kevin Stively has provided Instrumentation and Controls engineering and project management services to municipalities and private-sector industrial clients across the United States. Kevin is presently Vice President and Managing Director for Brown and Caldwell's (BC's) Digital Water Services providing clients with forward thinking technology solutions that leverage smart utility concepts known as BC Blue.

8:45am - 9:30am

ID: 275 / Session 10A: 2

Main Technical Program

Topics: Utility & Assessment Management

Keywords: SCADA, IT, OT, Network, Risk

The City of Vancouver Has Reduced Significant Utility Risk and Improved Use of Enterprise Data Through Re-design and Replacement of the Wastewater Control System IT Infrastructure

Jeff Kanyuch[1], **Frank Dick**[2]

[1]Jacobs, United States of America; [2]City of Vancouver, Washington; jeff.kanyuch@jacobs.com, frank.dick@cityofvancouver.us

IT infrastructure is the heart of the control system used for automated monitoring and control of critical infrastructure, including wastewater systems. Advances in IT components and implementation approaches can be applied to provide faster, more reliable control systems with better access to

integrated enterprise data to help engineering, planning, and O&M staff better understand and manage their facilities. Correct application requires thoughtful planning and regular upgrade to keep the system functional and reliable.

The City and its contract operations partner, Jacobs, are nearing completion of a major Supervisory Control and Data Acquisition (SCADA) system upgrade of the City's two Wastewater Treatment Plants. The SCADA upgrade included complete redesign of the IT systems at the City's Wastewater facilities, which has reduced major risk and provided significant value to the City.

The new core network and computer equipment includes virtualized servers with automated backups to reduce physical space and facilitate disaster recovery, ring networks for improved reliability, a DMZ for protected access of shared system data, updated computer hardware with current operating systems and software to accommodate supportability and reliability, and new fiber optic cable infrastructure. The project will also network-connect large Variable Frequency Drive motors for monitoring of voltage and current, and remote resetting of drive failures. The SCADA system will be linked to the computerized maintenance management system to allow work orders to be automatically triggered based on equipment alarms or runtimes from the SCADA system.

Operators can now monitor and control the entire wastewater system from workstations at either treatment plant or from any remote station. Jacobs support staff provide troubleshooting and maintenance via secure remote access, and are notified of problems in real time to provide faster response.

This presentation will include video interviews with plant staff describing what has changed, current operational practices and lessons learned.

Brief Biography and/or Qualifications

Mr. Kanyuch has more than 30 years of I&C / SCADA system planning, design, and construction/implementation experience for the water and wastewater industries, including alternative delivery. He is Jacobs' design-build project manager for the City of Vancouver SCADA upgrade project.

Mr. Dick oversees sewer and wastewater engineering functions, including capital projects, wastewater system planning, interface with the City's contract operator for wastewater (Jacobs), and the City's fully delegated pretreatment program. He has worked in these functions in Vancouver for 14 years and is City's project manager for the Wastewater SCADA Upgrade project. Prior to his position at Vancouver, Frank spent 17 years at semiconductor and electronics manufacturing facilities in the Portland-Vancouver area, in consultant and staff positions for facilities engineering and environmental compliance.

8:00am - 9:30am	**Session 11A: Planning**

8:00am - 9:00am

ID: 206 / Session 11A: 1

Main Technical Program

Topics: Utility & Assessment Management, Regulatory Challenges, Resiliency, Planning, Climate Science

Keywords: Integrated Plan, NPDES permit, Planning, Long-term Permitting Strategy

Use of Integrated Planning to Facilitate an NPDES Permit Renewal

Raj Kapur[1], Tom Dupuis[2], Jeff Semigran[2], Jody Newcomer[1], Ken Williamson[1], Bob Baumgartner[1]

[1]Clean Water Services, United States of America; [2]HDR Inc; Kapurr@cleanwaterservices.org, Thomas.Dupuis@hdrinc.com

Wastewater and stormwater utilities face significant challenges to manage aging infrastructure, meet customer expectations, and address regulatory obligations. The U.S. Environmental Protection Agency (EPA) recognized that municipalities could more efficiently use their resources to make important, cost-effective environmental improvements that align with community priorities. To support communities in these efforts, EPA released the *Integrated Municipal Stormwater and Wastewater Planning Approach Framework*. Since its inception, Integrated Plans have primarily been used by communities in response to enforcement actions to address combined sewer overflows. More recently, EPA has encouraged the use of Integrated Plans as part of the NPDES permitting process. Clean Water Services has developed an Integrated Plan for submittal with its NPDES permit renewal application. The goal of this Integrated Plan is to establish a long-term permitting strategy to prioritize and schedule actions well into the future to proactively address the challenges it faces. Following EPA's model, Clean Water Services' Integrated Plan includes key items like watershed assessment, watershed objectives, challenges, public outreach, and adaptive management. Unlike many other Integrated Plans, Clean Water Services' plan is not driven by wet weather compliance issues. It therefore provides an example to other utilities that want to use the Integrated Planning framework to establish a long-term permitting strategy.

Brief Biography and/or Qualifications

Raj Kapur, Clean Water Services

Education

M.S., Environmental Engineering, Portland State University

B.S., Petroleum Engineering, Pennsylvania State University

Work Experience

Raj works for Clean Water Services as a water resources program manager. His role includes overseeing the implementation of Clean Water Services' watershed based NPDES permit, water quality monitoring program, and water quality trading program. Prior to joining Clean Water Services, Raj worked for CH2M HILL and Oregon DEQ.

Tom Dupuis, HDR Inc.

Tom has 44 years of professional experience, with a primary focus on the Clean Water Act. He worked initially for a research and consulting firm in Wisconsin, then for the State of North Carolina, and next with international consulting firms while based in Wisconsin and Idaho. He has worked on Clean Water Act projects in nearly every state and territory in the U.S., and has bachelors and masters degrees in environmental engineering from Marquette University.

9:00am - 9:45am

ID: 194 / Session 11A: 2

Main Technical Program

Topics: Collection and Conveyance, Regulatory Challenges, Recycled Water & Resource Recovery

Keywords: Stakeholder involvement, Regional wastewater collection/treatment/disposal solutions, Basin-wide solutions, Sewer master planning, Failing septic systems

Regionalization for Economic Development and Watershed Protection

Peter Olsen

Keller Associates, Inc., United States of America; polsen@kellerassociates.com

Failing septic systems can be a significant health hazard to both the septic tank owner and downstream residents. Additionally, the amount of land needed for drain fields makes it difficult to attract new businesses and developers. For some communities, their financial situation prohibits the addition of a city sewer system. Moreover, for residents of the North Santiam Canyon region of Oregon, *The Three Basin Rule* (OR 340-041-0350) makes it even more challenging to convert to a community-based sewer system. This rule prohibits additional surface water discharges to certain rivers, including the North Santiam River, which supplies drinking water to the City of Salem. Add to all this the recent wildfires that devastated this North Santiam Canyon region and bring up additional questions about rebuilding.

A regional solution to address these regulatory and financial issues has gained traction in the past few years. With the support of Marion County and the Mid-Willamette Valley Council of Governments, the communities of Detroit, Gates, Idanha, and Mill City have engaged in discussions regarding the possible incorporation of a regional system sewer system. In January 2017, a regional sewer system feasibility study was completed. A master plan is currently underway, and these entities are in the final steps of establishing a "sewer authority." This presentation will discuss the difficulty in developing a regional sewer system in this mountainous area, the challenges of creating a sewer authority among the communities, and the steps needed to protect this critically important drinking water source. Added to this will be navigating the planning process during and after the recent wildfires in the canyon.

Technical Areas:

- Infrastructure funding
- Wastewater disposal and treatment alternatives
- Regulatory challenges
- Regionalization
- Establishment of sewer authority

Brief Biography and/or Qualifications

Peter Olsen, P.E., CWRE, Keller Associates, Inc. Project Manager

Peter Olsen manages Keller Associates' Salem Office and is the project manager for the Mid-Willamette Valley Council of Government's North Santiam Joint Sewer Master Plan. He has a master's degree in civil engineering with a water resources emphasis and has a breadth of experience managing many projects, including stormwater, water, and wastewater master planning.

8:00am - 9:30am	**Session 12A: Collection & Conveyance**

8:00am - 8:45am

ID: 185 / Session 12A: 1

Main Technical Program

Topics: Wastewater 101

Keywords: pump stations, design, standards and practices, lessons learned, technology options

Pump Station Systems Design – How they can vary by Agency

Adam Crafts[1], **Phil Roppo**[2]

[1]Murraysmith, United States of America; [2]Clark Regional Wastewater District;
Adam.Crafts@murraysmith.us, proppo@crwwd.com

Building on the popular 2019 presentation on pump system curve and pump selection, this presentation will delve into each pump station system, breaking down the wet wells, valving, power service, backup power, pump drives, level sensors, odor control, force mains, and pigging stations. This discussion will be supported by case studies, tying together the lessoned learned for design criteria, material or technology options, reliability and redundancy, permitting, and easement acquisition considerations. Understand Clark Regional Wastewater District and other local agency policy considerations on redundancy, odor control, force main pigging, or control strategy for facilities of varying size and complexity. Attendees will gain an understanding of fundamentals for pump station systems operations and design considerations. Case studies from local agency facilities will be presented to provide real world examples.

Brief Biography and/or Qualifications

Adam Crafts, PE, Murraysmith, Principal Engineer

Adam Crafts is a Principal Engineer and project manager focused on delivering water and wastewater pumping stations in Oregon and Washington. Adam has over 18 years of experience as a consulting engineer for local agency clients.

Phil Roppo, PE, Project Manager, Clark Regional Wastewater District

Phil is an engineer and project manager with over 30 years of experience designing wastewater infrastructure and pump stations. His career was founded in project delivery as a consulting engineer and is currently serving as a project manager for Clark Regional Wastewater District.

8:45am - 9:30am

ID: 200 / Session 12A: 2

Main Technical Program

Topics: Collection and Conveyance

Keywords: cleaning, process change, O&M process improvement, Internet of Things

How the COVID-19 Challenge Illuminated Opportunity Transformational Change With Collection System Maintenance

Jay Boyd

ADS Environmental Services, United States of America; jboyd@idexcorp.com

COVID-19 (CV19) brought historic disruption to our lives and work. At the onset, wastewater collection systems operations faced exceptional maintenance and safety challenges.

Utilities implemented staff rotations attempting to limit person-to-person contact. Yet, these measures reduced maintenance capacity, affecting essential routines such as cleaning. Adding more stress, sewer-unfriendly objects started to appear in collection systems including “flushable wipes”, face masks and latex gloves. As a result, there was an increase of blockages, SSOs and fouled pumps.

Seeking relief, 83 US utilities leveraged existing flow and level monitoring networks adding new, predictive software for early stage blockage detection. This Internet of Things (IoT) architecture, captured and sent data to cloud-based software where, using machine learning-based analytics, early-stage blockages were identified predictively. Utilities gained weeks-worth of advanced notice enabling them to prioritize their limited O&M resources.

From April to October 2020, 53% of these utilities received at least one notification of a developing blockage. Additionally, none of the monitored sites had SSOs during that time.

Beyond SSO prevention, some utilities creatively applied this predictive IoT technology to determine when to clean. They hypothesized that scheduled cleaning, without the knowledge of actual site conditions, can result in cleaning already clean pipes. To gain site-condition information, utilities used IoT technology to determine when to clean. Three case studies demonstrate how IoT enabled transformational change in the face of sever pandemic-induced challenges. The studies document cleaning reductions of 80% to 87% and with zero SSOs.

These results strongly support the case for employing IoT-based cleaning protocols to fill O&M resource gaps, such as were caused by the pandemic. Furthermore, the results of these studies highlight the opportunity to meet challenges from any circumstance where O&M resources are constrained with the benefit being greater efficiency and lower organizational stress.

Brief Biography and/or Qualifications

Jay Boyd is the Director of Market Development for ADS Environmental Services. He has 39 -years' technology and business experience introducing numerous innovations to the market.

Including his BA in Biology, he has extensively pursued graduate studies in business and technology development. Additionally, he has two Dale Carnegie® Instructor Certifications.

Jay has spoken at more than 30 national and state conferences in the past few years. He is extensively published in leading industry journals including WE&T, MSW Magazine, Water & Wastes Digest, WaterWorld, I&I Magazine, Pumps & Systems, Environmental Science & Engineering and many state journals. He has written about such subjects as Cleaning Optimization, I&I Assessment, Water Internet of Things, and Collection System Odor Control.

Jay is a member of the Water Environment Association, the WEF Intelligent Water Technology Committee and the CWEA.

8:00am - 9:30am

Session 13A: Water Reuse - Livestream

Session 13A: 1

8:00 am to 8:45 am

Sharon Napier & Ashley Harper

The National Water Reuse Action Plan (WRAP) and what it means for the Pacific Northwest

The National Water Reuse Action Plan (WRAP) adopts a proactive approach to strengthening the security, sustainability, and resilience of our nation's water resources. It builds on more than four decades of water reuse expertise and promotes a growing collaboration among federal, state, local, and private sector reuse efforts. The first iteration of the WRAP was released in February 2020 and included over 80 partners who reflect a diverse cross section of the water user community.

The WRAP collaborative continues to grow through the addition of new partnerships and actions that address challenges and barriers and fulfill state, tribal, and water sector needs related to water reuse. More than 100 organizations are currently driving progress on over 40 actions across 11 strategic themes (e.g., finance support, policy coordination, integrated research) which demonstrate the meaningful advancements that action leaders and partners have made across the sector. Progress on action implementation is highlighted through the WRAP Online Platform, which promotes transparency and accountability by reflecting the current implementation status for all WRAP actions.

The success of the WRAP is directly tied to contributions and collaborations from members of the water community. Ultimately, the effort seeks to ensure that water reuse is accessible, straightforward to implement, and sensitive to local needs.

This session will focus on WRAP progress that addresses barriers to reuse across a range of topics including technical, institutional, and financial and will demonstrate cross-action collaboration, identify potential gaps, and exemplify the evolving nature of the WRAP. The session will also recognize and highlight the diversity of action leaders and partners and invite involvement from participants.

A standing goal of the WRAP is to enhance and grow partnerships across the water user community to facilitate integrated action and daylight progress and examples of water reuse.

Brief Biography and/or Qualifications

Sharon Nappier
Environmental Protection Agency
Office of Water, National Program Leader for Water Reuse
Nappier.Sharon@epa.gov

Dr. Sharon Nappier is the National Program Leader for Water Reuse in the Office of Water at the United States Environmental Protection Agency. She specializes in environmental health microbiology and quantitative microbial risk assessment; and most recently helped develop the National Water Reuse Action Plan (WRAP), which was released on February 27, 2020. Sharon holds a BS degree in Biology and Environmental Science from The George Washington University; a MSPH degree from the University of North Carolina at Chapel Hill in Environmental Sciences and Engineering; and a PhD from the Johns Hopkins Bloomberg School of Public Health in Environmental Health Engineering.

Ashley Harper
Environmental Protection Agency
Office of Water, Water Reuse Team
Harper.ashley@epa.gov

Ashley Harper is a team member on the newly formed Water Reuse Team in the Office of Water at the United States Environmental Protection Agency. She recently served as an U.S. Embassy Science Fellow in Ulaanbaatar Mongolia; while there she worked to advance the public health priorities set by the Mongolian government. Ashley holds a BS degree in Geography from Texas State University and an MPH in Environmental Public Health from The George Washington University.

Session 13A: 2

8:45 am to 9:30 am

Nick Smith, Jacque Klug and Holly Tichenor

State focused partnerships towards advancing reuse in Idaho, Oregon and Washington

This session will focus on showcasing results form a series of three professionally moderated workshops held in each state (Idaho/Oregon/Washington) with industrial, agricultural, utilities and municipal reuse stakeholders. The workshops provided opportunities for the participants to network and share various needs and challenges including operational and maintenance, permitting/regulatory, funding and public perception concerns. The workshops culminated in a series of recommended actions for WRA-PNW teams and interested groups from each state. These action items are part of an overall effort to support operators, policy makers, utility manager and interested parties involved in water reuse as a water.

Brief Biography and/or Qualifications

Nick Smith, P.E.
Stantec and WRA-PNW President
nickolas.smith@stantec.com
Nick Smith, P.E. – Mr. Smith is a licensed Civil Engineer with 20 years experience with Stantec Consulting Services Inc. out of Boise Idaho. Mr. Smith is currently serving as WateReuse-Pacific Northwest Section President and is a practicing process engineer with focus on resource recovery along with his additional role as Principal Project Manager within Stantec.

Jacque Klug
King County and WRA-PNW Past President
Jacque.Klug@kingcounty.gov

Jacque Klug is a project manager for King County's Wastewater Treatment Division in Seattle, Washington, supporting customer development, permitting, capital projects, policy development and communication planning efforts relating to King County's Recycled Water Program. Jacque has worked in the water resource field for twenty years and has experience in policy development, planning and permitting on a variety of water issues including water rights, groundwater management, reclaimed water, instream flows, watershed planning and salmon recovery. Jacque has served as the President of the American Water Resources Association Washington State Chapter and is the Past President of the WateReuse Association Pacific Northwest Section. She is a graduate of Duke University and the University of Washington.

Holly Tichenor
Brown and Caldwell
HTichenor@BrwnCald.com

Holly Tichenor, Brown and Caldwell Vice President, is a strategic communications expert that supports stakeholder coordination, communications and strategy for integrated water and reuse program solutions. She specializes in stakeholder alignment, strategic plan framework development, and community outreach and communications. She leads Brown and Caldwell's Oregon operations including client and staff development. Holly worked closely with the WR PNW Board to facilitate a series of discovery workshops to advance water reuse initiative for the region.

10:30am - 12:00pm

Session 08B: Wastewater Process

10:30am - 11:15am

ID: 252 / Session 08B: 1

Main Technical Program

Topics: Facility Operations & Maintenance, Utility & Assessment Management

Keywords: Electrical, Asset Management, Safety

Designing your Plant for Electrical System Reliability

Oskar Agustsson[1], Jim Howard[2]

[1]HDR; [2]LOTT Clean Water Alliance; oskar.agustsson@hdrinc.com

A disruption to treatment plant operations can cause a cascading impact to a utilities' operation as well as the potential for devastating impacts to the environment. However, as with any infrastructure, maintenance must be performed to ensure the long-term reliability of equipment. Electrical systems maintenance is a key aspect of maintaining the overall integrity of your system, but with it comes the risk of a potential disruption to the treatment process.

Maintenance is often not performed on treatment plant electrical systems because most systems do not allow for a partial shutdown of the electrical system without impacting the biological process and/or cutting off electricity to the entire plant. This ultimately leads to unreliable power and the risk of needing to repair or replace electrical equipment and systems at unpredictable intervals.

This presentation will focus on "safety by design;" how plant electrical systems can be designed to ensure maintenance without disruptions to the treatment process and how electrical system maintenance can be performed in a de-energized state. Case studies from LOTT Clean Water Alliance electrical improvements over the past decade will be used as examples in these concepts.

The presentation will cover a brief history of treatment plant electrical systems; how to perform electrical system assessments; which maintenance practices should be implemented on treatment plant electrical systems; and how and why to track your electrical system assets as part of an asset management program.

Brief Biography and/or Qualifications

Oskar Agustsson is a senior project manager in the wastewater group for HDR with over 19 years of experience in the wastewater industry. Oskar started his career out of college doing automation of wastewater systems doing hands-on field work then transitioned these skills into designing instrumentation, controls, and electrical systems for wastewater treatment. He is a licensed professional engineer in Washington, Oregon, Idaho, Utah, Nevada, and California.

11:15am - 12:00pm

ID: 209 / Session 08B: 2

Main Technical Program

Topics: Treatment Innovation and the Future

Keywords: membrane, CSO treatment, innovation, pilot test

Advancing CSO Treatment – Piloting of OVIVO® RapidStorm™ Membrane Treatment

Bob Bucher[1], Mike Snodgrass[2], Marcos Lopez[3], Scott Weirich[4], Pardi Sukapanpotharam[1], Pedro De Arteaga[1], Ashwini Khare[2], H.C. Liang[3], Doug Berschauer[4]

[1]King County Wastewater Treatment Division, Seattle, WA; [2]Ovivo, Round Rock, TX; [3]Tetra Tech, Inc., Seattle, WA; [4]Parametrix, Seattle, WA; bob.bucher@kingcounty.gov

King County and project team identified a new technology for treating CSO discharges. The technology (RapidStorm™ manufactured by OVIVO®) uses silicon carbide (SiC) membranes in conjunction with the addition of a chemical coagulant. A pilot project was conducted at the County's West Point treatment facility.

The RapidStorm™ pilot unit supplied for testing included SiC membranes plates arranged in three stacks installed in a 28-foot-long by 8-1/2-foot-wide by 17-foot-tall steel tank. Ancillary equipment included permeate / backwash pumps, coagulant feed system, a chemical cleaning system, air scour blowers, online instrumentation, and remote communication hardware. The pilot received feed flow from the West Point Treatment Plant primary effluent channel and supplemented with fire hydrant water, as testing required, to simulate lower strength CSO influent.

Process and performance testing objectives for the pilot study included documenting water quality performance and providing a basis of design for full-scale project planning. Water quality was monitored through online instrumentation, grab sampling, and composite sampling during multiple test runs. Process and performance testing was initiated in September 2020 with a total of sixteen test runs completed by the end of November 2020.

The pilot was successfully tested at an average instantaneous flux rate of 100 gallons per square foot per day (gfd), a peak instantaneous flux rate of 200 gfd, and under a simulated CSO hydrograph without exceeding the maximum transmembrane pressures of 10 pounds per square inch (psi). A flux rate of 100 gfd in the pilot was equivalent to approximately 300,000 gallons per day of treatment capacity.

Effluent water quality results were favorable with total suspended solids (TSS) less than 5 mg/l, turbidity less than 0.1 NTU, and fecal coliform count consistently less than 400 MPN / 100 ml without supplemental disinfection.

The development of new innovative technologies such as the one tested in this project have the potential to reduce the receiving water impacts from CSO, SSO and even stormwater discharges.

Brief Biography and/or Qualifications

Bob Bucher is a Principal Wastewater Engineer in the King County Wastewater Treatment Division Technology Assessment Program. He has 25 years of experience in the pilot and demonstration testing of wastewater technologies.

10:30am - 12:00pm	**Session 09B: Climate Science & Stormwater - Livestream**

10:30am - 11:15am

ID: 116 / Session 09B: 1

Main Technical Program

Topics: Wastewater 101, Collection and Conveyance

Keywords: I&I, Monitoring, Smart, Sewer, Savings

Pinpointing and Prioritizing I&I Impact with Climate Change

Brogan Quist[1], Mike Fritschi[2]

[1]SmartCover Systems, United States of America; [2]South Suburban Sanitary District, OR;
bquist@smartcoversystems.com, mike@sssd.org

The Klamath Falls South Suburban Sanitary District encompasses roughly 10 square miles and serves a population of approximately 25,000 people in Klamath Falls, Oregon. SSSD owns and maintains over 100 miles of sewer pipe and over 1000 manholes. Most of the sewer mains were installed in the 1960's and 1970's.

One of the key focus areas for SSSD is the management of Inflow and Infiltration (I&). Excessive I&I can overwhelm a collection system's capacity creating overflows. Climate change indicates more severe weather in the future. These changing weather patterns and frequency of severe weather is more and more relevant to sewer operators. I&I increases wastewater treatment plant flows unnecessarily increasing treatment plant processing costs.

SSSD started monitoring in 2012 by installing four initial monitoring units for a cost of $50,000 but, when the need arose for expanding our efforts to more locations, they required a more flexible, easy-to-install and cost-effective solution.

To address I&I monitoring expansion plans, SSSD designed a smart sewer system with SmartCover technology.

By leveraging SmartCover patented design and deployment, SSSD has been able to both expand I&I monitoring and enhance the granularity and detail of information compiled. SmartCover flexibility has proven to improve existing I&I monitoring processes at a much lower cost than the alternatives. Deployment is turnkey because no confined entry is required, allowing a collection system to get up and running fast without a lot of wasted staff time or traffic management.

SmartCover customized the solution to aggregate flow information from multiple locations, thereby enabling more flexibility to analyze relationships between sites and to better understand the dynamics within sub-basins.

RESULTS

It is anticipated that ROI on the first round of SmartCover deployment will yield better information on I&I and provide a more refined capital improvement decision making process, while also controlling costs and enhancing usage of valuable staff and resources.

Brief Biography and/or Qualifications

Mike Fritschi: Mr. Fritschi has 20 years of experience in the management, operation, design, and inspection of wastewater systems. Mr. Fritschi is a licensed Civil Engineer and holds a Grade IV wastewater facility and collections system operations license. Mr. Fritschi received a B.S. degree in Environmental Resources Engineering from Humboldt State University.

Brogan Quist: Brogan has a Bachelors of Science Degree from Westmont College, located in Santa Barbara, CA. Brogan has over 10 years of experience in the wastewater and technology sector. Brogan first started in the industry by installing and maintaining monitoring devices in the field, beginning in 2008. He has completed over 500 site visits, troubleshooting, and installations. Currently, Brogan works with customers in the Western/Central region of the United states to help solve their challenges by providing remote monitoring systems. The Goal of SmartCover Systems is to assist wastewater utilities by helping them make informed decisions, based on data collected in the field.

11:15am - 12:00pm

ID: 302 / Session 09B: 2

Main Technical Program

Topics: Stormwater, Risk Assessments and Emergency Response, Resiliency, Planning, Climate Science

Keywords: resilience, flooding, climate, rainfall, risk

And the Rains Came: Characterizing Rainfall for Climate Impacts

Nathan Foged[1], Sierra Gawlowski[2]

[1]Brown and Caldwell, United States of America; [2]City of Shoreline, Washington, United States of America; NFoged@BrwnCald.com

Prolonged wet weather and extreme storms can overwhelm drainage systems, cause urban flooding, or potentially lead to uncontrolled discharges of contaminated waters. While we understand these as potential impacts, quantitative risk-based analyses can be challenging given the natural variability of rainfall and the uncertainty associated with changing climate conditions. As the City of Shoreline (Washington) plans for a resilient future, the Surface Water Utility has recently compiled and analyzed precipitation data to create a library of rainfall time series and design storm events for use in stormwater planning and design studies. These data include observed storm events, updated intensity-duration frequency curves, and synthetic design storms—based on both historical conditions and adjusted for future climate conditions. This presentation will not only describe the development of these data, but also discuss appropriate use, uncertainty ranges, and how results should be interpreted for stormwater management decisions.

Brief Biography and/or Qualifications

Nathan is the Innovation and Technology lead for Brown and Caldwell's Water Resources practice. He is an engineering consultant with over 20 years of experience, specializing in hydrologic and hydraulic modeling of natural and urban systems. Nathan focuses on climate adaptation and resilience planning for the water sector, working with private and municipal clients to make decisions under uncertainty.

10:30am - 12:00pm	**Session 10B: Utility & Assessment Management**

10:30am - 11:15am

ID: 303 / Session 10B: 1

Main Technical Program

Topics: Utility & Assessment Management, Resiliency, Planning, Climate Science

Keywords: strategic planning, utility management

Strategic Planning to Define the 4P's – People, Policies, Pricing, and Projects

Matt Gregg

Brown and Caldwell, United States of America; mgregg@brwncald.com

Projects – the first of the 4P's and the typical focus for utility planning efforts. Planning efforts usually being with a similar question: what things do I need to build to solve my problem? Whether it be a new pipeline to serve a new area, a new tank to replace a failing tank, or maybe a whole new facility to provide more capacity in the system, we have used planning simply as a means to define a capital improvements program. However, utilities are much more than just projects and infrastructure. They are dynamic, thriving organizations that embody they communities they serve. In our drive to define the physical projects we need to complete we have lost sight the ways utilities truly interact with their communities – through their people, policies, and pricing.

Robust strategic planning efforts should strive to define all of the components that will allow them to enact their outcomes. This requires focus on PEOPLE and organizational roles, POLICIES and business processes, PRICING and financial strategies, and PROJECTS. Each of the 4P's is critically important to define for a plan to be successfully implemented. Doing so requires a commitment from utilities to define a broader scope for strategic planning efforts.

This presentation will highlight the recent successes of several northwest utilities in defining each of the 4P's in their strategic planning efforts. This will include a discussion on how each of the 4P's was investigated and how changes were enacted by the utility to support the implementation of the strategic plan. It will draw on these projects to highlight lessons learned and best practices for utilities looking to implement similar efforts for their next planning effort.

Brief Biography and/or Qualifications

Matthew Gregg is Brown and Caldwell's Western Business Unit Client Services Director. He has experience as a program manager, client service manager, project manager, and wastewater engineer. Matt's primary focus is assisting clients with long-term utility management decisions and large program execution. Matt has a master's degree in civil engineering with a focus in wastewater engineering and a bachelor's degree in civil engineering, both from the University of Idaho.

11:15am - 12:00pm

ID: 288 / Session 10B: 2

Main Technical Program

Topics: Regulatory Challenges

Keywords: Integrated planning, regulatory, compliance

Boise City's Integrated Plan for Long-term IPDES Permit Compliance

Kate Harris[1], Tom Dupuis[2], Haley Falconer[1]

[1]City of Boise; [2]HDR; kharris@cityofboise.org, Thomas.Dupuis@hdrinc.com

The City is committed to providing effective and affordable water renewal services that protect public health and the environment, meet customer expectations, and support long-term community planning efforts. To this end, the City has made considerable investments to construct and maintain these assets. These investments include upgrading water renewal capabilities, optimizing collection system maintenance and renewal efforts, and improving conveyance (i.e., lift stations) facility performance.

Notwithstanding these significant efforts, the City continues to face aging infrastructure needs, increasingly complex water issues, and growing service demands. There are a number of current and future Clean Water Act (CWA) regulatory drivers that will require major capital investments and impact financial and management resources. The City is concerned that potentially overlapping compliance timelines for multiple federal and state regulatory drivers will limit their ability to efficiently manage resources and make system improvements difficult going forward. The City needs an approach for

managing the largest capital investments such as one period being when the City does some asset management to complete regulatory upgrades alternating with a second period being when the City focuses on asset management and regulatory conditions remain status quo. Condition driven projects, including asset management, are fundamental to meeting regulatory requirements, thus the need for this managed approach.

The regulatory framework for an IP was developed and adopted by the U.S. Environmental Protection Agency in 2012 and was recently incorporated into the Clean Water Act via the Water Infrastructure Improvement Act passed by bipartisan action in Congress in 2018 and signed into law in January 2019. The IP framework explicitly recognizes that appropriate long-term planning for most municipal utilities needs to extend beyond the traditional five-year duration of a discharge permit. The City's Utilities Plan extends out 20 years and beyond, and funding, design and construction of new or upgraded facilities cannot be reasonably achieved in 5 years or less. The IP provides a mechanism for both the City and DEQ to look at a longer horizon and be adequately prepared for needed requirements and employ an adaptive process to address new or emerging water quality considerations.

Brief Biography and/or Qualifications

Kate Harris is the Water Quality Programs Manager within the Environmental Division at the City of Boise. When she is not working, she enjoys exploring Idaho with her family.

Tom Dupuis has over 40 years of Clean Water Act technical and regulatory experience, including NPDES permitting, TMDLs, water quality modeling and assessment, and stormwater management. He has bachelor's and master's degrees from Marquette University and has worked for research, state agency and consulting organizations.

10:30am - 12:00pm	**Session 11B: Industrial Pre-Treatment**

10:30am - 11:15am

ID: 295 / Session 11B: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Regulatory Challenges, Industrial Pre-Treatment

Keywords: pretreatment, trading, local limits

Trading Futures for Long Position on BNR Performance

Austin Walkins[1], Tyson Schlect[2]

[1]City of Boise; [2]HDR; awalkins@cityofboise.org, tyson.schlect@hdrinc.com

Wastewater Recovery Facilities (WRRFs) can leverage permitting, integrated planning, and water quality trading to stabilize biological nutrient removal (BNR) performance. Collection system industrial inputs affect BNR at WRRFs. A renewed emphasis on states' involvement in Clean Water Act regulation has stimulated efforts to establish innovative sewershed nutrient management strategies. Water quality trading has been documented by EPA since the early 1990's, but recent emphasis has led to consideration of pretreatment trading in the context of nutrient management at the WRRF. Integrated planning is a final piece of the puzzle, having recently been added to federal law as an amendment to the Clean Water Act.

Pretreatment allocations for discharge to a WRRF have the potential to de-stabilize otherwise robust BNR systems. The West Boise Water Renewal Facility (WBWRF) received high nitrate concentrations through a long collection main, allowing for depletion of readily biodegradable carbon. The resulting impact at WBWRF was a severe diurnal variation in raw influent volatile fatty acid (VFA) concentration, with typical levels of 23 mg/L VFA at midnight and 4 mg/L VFA at 11:00AM. This effect was verified through a robust collection system sampling effort which captured diurnal phosphorus and nitrogen species concentrations at strategic points in the collection system, showing correlation with periods of decreased VFA. The collection system nutrient study also characterized transformation of nutrient species, so that collection system kinetics could be quantified and modeled as a "plug-flow" reactor system in which nitrogen, phosphorus, and VFA species change over time. The study provided further context for implementing a successful pretreatment program.

This effort was paired with a pretreatment trading evaluation. H.R. 7279 amended the Federal Water Pollution Control Act to allow permitting authorities to incorporate integrated planning into renewed permits. The scope of the amendment highlights pretreatment trading in which the permitted WRRF administers a trading program for industrial users. The City undertook an evaluation which showed that trading of nitrogen and phosphorus credits in an exchange open to industrial users could potentially result in net economic benefit while reducing the nutrient headworks loading faced at the WBWRF.

Brief Biography and/or Qualifications

Austin Walkins serves as the Source Control Manager for the City of Boise where he oversees the City's Pretreatment and Stormwater programs. Austin holds a B.S. in Hydrology and M.S. in Geology with an emphasis in fluvial geomorphology. Austin's professional career has involved contaminated site remediation, policy development, and environmental advocacy.

Tyson Schlect is a wastewater process engineer at HDR whose interests extend to economics, particularly economics of the environmental flavor. He is curious if innovative economic frameworks could be used to stabilize both influent and effluent at WRRFs.

11:15am - 12:15pm

ID: 197 / Session 11B: 2

Main Technical Program

Topics: Regulatory Challenges, Risk Assessments and Emergency Response, Industrial Pre-Treatment

Keywords: nitrification inhibition, local limits, zinc, copper, metals

Development of Facility-Specific Zinc and Copper Nitrification Inhibition Thresholds for Local Limits Analysis

Leila Barker, Rajeev Kapur, Ana Aranda, Mercie Hodges, Steve Anderson

Clean Water Services; barkerl@cleanwaterservices.org, kapurr@cleanwaterservices.org

Controlling industrial discharges to a Publicly Owned Treatment Work (POTW) is an integral part of the NPDES permit program. POTWs conduct a local limits analysis to establish limits for industrial users. Factors that are considered in this process include water quality standards, water quality-based NPDES permit effluent limits, biosolids use and disposal, and the potential for inhibition of biological processes within the treatment plant. Nitrifying bacteria are often highly sensitive to environmental stressors and pollutants, and local limits are frequently driven by the need to protect the biological nitrification process.

The U.S. EPA has published nitrification inhibition threshold values for a variety of substances in its *Local Limits Development Guidance* (EPA, 2004). For many substances, a wide range of possible inhibition levels have been identified. However, because these data are decades old and studies are not well documented, there is limited confidence that even the most conservative thresholds would be protective of biological treatment processes. Additionally, use of the most conservative values can result in overly stringent local limits that place a significant burden on industrial users.

Clean Water Services (CWS) is in the process of revising local limits for its four wastewater treatment facilities (WWTFs). Three CWS facilities have ammonia limits and rely on nitrification to meet these limits. Copper and zinc were of particular interest due to prior operational data. Preliminary analysis suggested that local limits for these metals would likely be driven by the nitrification inhibition threshold. At times, CWS WWTFs have experienced copper and zinc levels higher than the minimum threshold concentrations in the EPA *Guidance* with no discernable impact to the biological processes.

In order to establish site-specific inhibition levels, CWS conducted nitrification rate testing using two methods: a modified version of ISO 9509:2006 and a simplified respirometry protocol. Biomass from the three nitrifying WWTFs was spiked with varying concentrations of zinc and copper. Results were analyzed to determine nitrification inhibition thresholds. The resulting facility-specific nitrification inhibition levels were higher than the EPA-published minimum thresholds for both metals while providing confidence that local limits would be protective of biological nitrogen removal processes at each WWTF.

Brief Biography and/or Qualifications

Leila Barker is a Water Resources Analyst in the Treatment Plant Services division at Clean Water Services in Washington County, Oregon. She holds an M.S. in Environmental Engineering from Oregon State University and a B.S. in Biology and Music (Violin Performance) from Emory University.

Raj Kapur

Clean Water Services

Education

M.S., Environmental Engineering, Portland State University

B.S., Petroleum Engineering, Pennsylvania State University

Work Experience

Raj works for Clean Water Services as a water resources program manager. His role includes overseeing the implementation of Clean Water Services' watershed based NPDES permit, water quality monitoring program, and water quality trading program. Prior to joining Clean Water Services, Raj worked for CH2M HILL and Oregon DEQ.

10:30am - 12:00pm	**Session 12B: Collection & Conveyance - Pumping Systems**

10:30am - 11:15am

ID: 152 / Session 12B: 1

Main Technical Program

Topics: Wastewater 101, Collection and Conveyance

Keywords: surge, transient pressure, pumping, transmission

Decoding Water Hammer: Comparing Real Measurements With Modeling Predictions

Brandon Billing

Brown and Caldwell, United States of America; bbilling@brwncald.com

Transient pressures can cause significant damage to force mains and pumping systems, leading to pump station down-time, sewage overflows or water loss, and costly repairs. Numerical modeling can help address the issue, but results can be difficult to understand or implement correctly. This presentation will use three case studies to explain water hammer and how numerical modeling helps to avoid problems with transient pressures in pumping and pipeline systems.

In the first case, an existing sewage force main experienced pressure damage. After monitoring data confirmed hydraulic transient presence, numerical modeling identified that installing a surge tank at the pump station would be the most effective mitigation strategy. Following the installation of the tank, field measurements closely agreed with pressures predicted by the modeling.

In the second case, monitoring equipment detected transient pressures during the startup of a new pump station. Using field measurements to calibrate a numerical model of the system, the team determined that the addition of flywheels on the pumps would address the issue. Field measurements closely agreed with pressures predicted by the modeling following the flywheel installations.

In the third case, a numerical modeling study performed during design led to a recommendation to install surge tanks at the pump station. Transient pressure measurements obtained during pump station startup closely agreed with those predicted in the numerical modeling study.

This presentation will detail the convincing evidence that transient pressure numerical modeling is a critical step for developing resilient force main and pumping system designs. Numerical modeling provides reliable data for developing a surge mitigation strategy and reliably assess when a surge mitigation strategy is successful.

Brief Biography and/or Qualifications

Brandon Billing is a lead hydraulic modeling engineer at Brown and Caldwell. He has been using hydraulic modeling tools to evaluate water and wastewater conveyance engineering problems for over 13 years, specializing in hydraulic and hydrologic modeling and surge analysis. He is a leader in Brown and Caldwell's (BC) national Surge Analysis group, which implements best practices and quality control for surge modeling, analysis, and mitigation. He enjoys any opportunity to shed some light into the dark and mysterious world of hydraulic transients.

11:15am - 12:15pm

ID: 182 / Session 12B: 2

Main Technical Program

Topics: Collection and Conveyance

Keywords: pump stations, diversion structures, conveyance

Challenges and Opportunities Presented by Diversion Pump Stations

Mike Carr[1], Frank Dick[2], Jeff Hart[3]

[1]Murraysmith, United States of America; [2]City of Vancouver, WA; [3]Clean Water Services;
Michael.Carr@murraysmith.us, Frank.Dick@cityofvancouver.us, HartJ@CleanWaterServices.org

When sewer trunk systems reach capacity, agencies occasionally elect to install a pump station to pump past the bottlenecks rather than upsize the line or build a parallel pipe. This is typically due to the higher capital expense of a trunk sewer caused by environmental mitigation requirements, pipe depth, and traffic disruptions. On the upside, constructing a diversion pump station can often be the more expedient way to meet upstream development demands or reduce risk of overflows. Conversely, a diversion pump station also provides new challenges for Operations through increased maintenance time and cost. However, the facility can also offer flexibility to an agency's overall operations, providing opportunities

to address operational concerns elsewhere in the system through automation, flow control, and redirection of flow to underutilized infrastructure in the conveyance and treatment facilities.

This presentation will provide two recent case studies in diversion pumping: the City of Vancouver's Burnt Bridge Creek Pump Station, a 7-mgd diversion pump station that was mothballed 20 years ago because of maintenance-related issues; and Clean Water Services' Dawson Pump Station, a 20-mgd facility built to increase conveyance capacity for supporting industrial growth, hampered by constituents in the industrial wastewater. Discussion will include the projects' origins, the operational issues encountered along the way, the solutions engineered to optimize the facility's operation, and the opportunities to use the diversion to further improve overall conveyance system performance and reliability.

Brief Biography and/or Qualifications

Mike Carr, PE, Murraysmith, Principal Engineer

Mike is a project manager primarily focused on leading water and wastewater pumping and conveyance projects in the region. Mike serves as Group Manager of Murraysmith's Water/Wastewater Pumping team for Oregon & Southwest Washington. He has over 27 years of experience as a consulting engineer for local agency clients throughout the Pacific Northwest.

Frank Dick, PE, Wastewater Engineering Supervisor, City of Vancouver

For 14 years, Frank has overseen sewer and wastewater engineering functions, including capital projects, wastewater system planning, interface with the City's contract operator for wastewater, and the city's industrial pretreatment program. Previously, Frank served in facilities and environmental engineering functions at semiconductor facilities in the Portland-Vancouver area.

Jeff Hart, PE - Pump Station and Natural Treatment System Engineer, Clean Water Services

Jeff oversees and manages the District's pump station capital improvement program and performs engineering for their Fernhill Natural Treatment System, where he previously was design engineer as a consultant. Jeff is the President of the Lower Columbia Section for the PNCWA and is heavily involved in the planning of the annual Oregon Water Education Foundation Water Environment School.

10:30am - 12:00pm

Session 13B: Water Reuse - Livestream

10:30am - 11:15am

Session 13B: 1

Pat Heins, Shawn McKone, and Tressa Nicholas

So you need a permit in the Pacific Northwest…now what?

Regulators from Idaho, Oregon and Washington will discuss the steps for obtaining a permit to use recycled or reclaimed water in their state.

Brief Biography and/or Qualifications

Pat Heins
Department of Environmental Quality
pat.heins@deq.state.or.us

Pat Heins has over 25 years of experience working in environmental compliance. He started out working as an analyst for an environmental laboratory and an assistant environmental compliance manager for a manufacturing facility, before working as a consultant for 14 years. Pat started working for Oregon Department of Environmental Quality in 2014 in the NW region and is now working in DEQ's headquarters as the state biosolids and recycled water program coordinator. He also serves as a permit writer for individual and statewide Water Pollution Control Facility permits.

Shawn McKone
Washington Department of Ecology
shawn.mckone@ecy.wa.gov

Shawn McKone a senior Environmental Engineer in Ecology's Northwest Regional office. He has been with Ecology for 17 years working as a municipal facility engineer responsible for writing and managing NPDES and reclaimed water permits as well as reviewing and approving engineering documents for new or modified treatment facilities. In late 2015 he became part of Ecology's internal team tasked with helping to develop the state's reclaimed water rule and was part of Ecology's internal technical review team for developing the state's "Reclaimed Water Facilities Manual" or "Purple Book". Shawn has also been part of Ecology's internal team charged with overseeing revisions to the "Criteria for Sewage Works Design manual" or "Orange Book" since 2006.

Tressa Nicholas
Idaho Department of Environmental Quality
Tressa.Nicholas@deq.idaho.gov

Tressa Nicholas serves as a Wastewater Analyst for the Idaho Department of Environmental Quality's State Wastewater Program. In her role, she provides technical support in wastewater and water reuse, serves as the State Biosolids Coordinator and organizes training for wastewater professionals.

Tressa has a Master's of Science in Civil Engineering and a Bachelor of Science in Biochemistry. She has over 17 years of experience working with recycled water and wastewater projects. In 2015, at the 30th annual WateReuse Symposium, she received the David Requia Presidents award for her outstanding leadership and initiative as a champion for WateReuse. She currently serves on the National Blue Ribbon Commission for Onsite Non-potable Water Systems.

11:15 am - 12:00 pm

Session 13B: 2

Jay Irby

Water Reuse: Waste of Time or Innovative Opportunity?

21 years ago, a small community located just North of Boise decided to lay down some roots. 7 years later, another planned community sprang up. As we all know, there are some rather large obstacles immediately North of Boise that create some interesting infrastructure challenges that would be far too costly for these small communities to encumber. As luck would have it, there was an option. Hidden Springs and Avimor both made a bold decision to build and operate their own wastewater renewal

facilities and find beneficial uses for the renewed water onsite as opposed to piping several miles and lift stations to the nearest municipal treatment plant or becoming point source dischargers. These decisions created incredible growth potential as it allowed the communities to reduce treatment costs for their residents, it allowed builders to build without exorbitant connection fees, and it helps keep irrigation costs low because they didn't have to purchase irrigation water from the municipal supplier. This presentation will take a look at the current situations for both of these communities, some lessons that have been learned over the years, and provide insight for any engineers or operators looking to pursue reuse, and how both parties should work together to accomplish the needs of their constituents.

Brief Biography and/or Qualifications

Jay Irby, PO
OMCS General Manager
jayirby.omcs@gmail.com

Jay Irby P.O. is an expert in the water renewal industry as co-owner of Operations Management and Consulting Services. He has served in the water renewal industry for over 10 years with the City of Boise at both the West Boise and Lander Street Water Renewal Facilities. He joined the Operations Management and Consulting Service's team in February of 2016. He graduated from Nampa Christian in 2002. He currently holds a Professional Wastewater Operator Class 4 license, an Idaho Wastewater Treatment Class 4 and an Idaho Wastewater Collections Class 4 license as well as a Wastewater Land Application license. He has served and is currently serving a term on the Southwest Idaho Operators Section which is a non-profit group that provides industry related education opportunities for maintaining licensure. He served on the Idaho Operator's Conference Committee as a planner in 2016 and in 2019 served on the Idaho Reuse and Operator's Conference Committee. He is an avid fisherman and has a tremendous sense of pride in protecting Idaho's natural resources and citizens.

1:15pm - 2:45pm

Session 14A: Resource Recovery/Collection & Conveyance - Livestream

1:15pm - 2:00pm

ID: 147 / Session 14A: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Recycled Water & Resource Recovery

Keywords: anaerobic digestion, biogas, hydrogen sulfide, micro-aeration, energy recovery

Full-scale Digester Micro-Aeration Study to Reduce Hydrogen Sulfide in Biogas

Bart Kraakman[1], Terri Prather[2], Matt Noessen[1], Matt Kennelly[2]

[1]JACOBS, United States of America; [2]LOTT Clean Water Alliance, United States of America; TerriPrather@lottcleanwater.org

Biogas generated from anaerobic digestion typically requires gas conditioning before it is used to generate energy. The H_2S concentrations in the digester gas at the Budd Inlet Treatment Plant typically range from 950 to 1,050 ppmv, which is approximately double the average inlet design concentration of the existing H_2S removal system, resulting in increased O&M costs.

Full-scale piloting of micro-aeration technology (MA) was undertaken to test its feasibility to reduce H_2S from the biogas, as limited experience is available of this new technology in full-scale digesters at wastewater resource recovery facilities (WRRF). The full-scale tests were undertaken during a one-year period under different configurations and generated the following findings:

- Reducing the H_2S concentration to 200 ppmv (or a removal efficiency of approximately 80 %) is technical feasible in the current digesters.
- Injecting micro-aeration air in the sludge heating recirculation stream is more effective than injecting in the bottom of the digester.
- Measuring the ORP of the sludge continuously was reasonably successful after several installation modifications, but is not recommended for MA process control because of accumulation of debris on the ORP sensor requiring frequent (daily) cleaning.
- The biogas production and sludge volatile solids reduction are not negatively affected by the MA process, while there is some evidence that the dewaterability of the digested sludge may slightly increase as a result of micro-aeration.

In summary, the full-scale pilot tests showed that this new process-integrated MA technology has potential using minimum plant upgrading while contributing to the sustainability and economic efficiency of the energy recovery process of waste sludge digestion at WRRFs.

Brief Biography and/or Qualifications

Terri Pratcher is Operations & Process Control Supervisor Operations LOTT Clean Water Alliance

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2:00pm - 2:45pm

ID: 208 / Session 14A: 2

Main Technical Program

Topics: Collection and Conveyance

Keywords: I/I, Partnership, Rehabilitation, Wastewater

Clackamas Water Environment Services and the City of Gladstone Oregon – Joining Forces in the Fight Against I/I

Jessica Rinner

Clackamas Water Environment Services, United States of America; jrinner@clackamas.us

Clackamas Water Environment Services (WES) completed a collection system master plan (CSMP) in 2019. One of the findings of the CSMP is that it is more cost effective system wide over the next 20 years to reduce I/I in 19 key basins rather than increase the conveyance and treatment capacity of the system to accommodate the extraneous wet weather flows. The collection system is comprised of multiple jurisdictions or member communities as well as WES owned infrastructure. Every jurisdiction contains a basin in which it was found to be more cost effective to reduce I/I rather than increase the downstream system capacity.

WES and the City of Gladstone (City) both have jurisdiction over portions of the collection system within the 19 key basins, and have immediate capacity needs to reduce the I/I. The good working relationship between WES and the City made it possible for the two entities to establish an IGA and enter into a

contract with a consulting engineering firm to address the I/I in both jurisdictions simultaneously. The consulting contract will identify the sources of the I/I and design rehabilitation projects to remove it.

The joint project provides efficiency and cost savings to both of the partner entities. Project management costs are reduced since there is only one project not two. There is economy of scale and reduced mobilization costs when combining the field investigation activities. There are cost savings in the designs when applying the same standards across multiple sets of construction documents. These are just a few of the financial benefits of working together for a common goal.

The I/I identification activities are currently underway and should be completed in June 2021. At that time, the project will move into the phase of designing rehabilitation projects to remove the I/I identified. It is anticipated upon completion of the designs each partner will bid out their own construction projects.

Brief Biography and/or Qualifications

Ms. Rinner has over 25 years experience with sanitary sewer conveyance systems. She has worked for both municipalities and consultants on projects ranging from preparing planning studies, and building hydraulic models to conducting I/I identification and rehabilitation programs.

1:15pm - 2:45pm	**Session 15A: Wastewater Process: Nutrient Removal**

1:15pm - 2:00pm

ID: 204 / Session 15A: 1

Main Technical Program

Topics: Wastewater Treatment Process

Keywords: Nutrients, Nitrogen, GHG, LCCA

Planning for Nitrogen Removal in King County

Matt Winkler[1], Rick Kelly[1], Patricia Tam[1], Eron Jacobson[2], John Conway[2]

[1]Brown and Caldwell; [2]King County WTD; mwinkler@brwncald.com

The Washington State Department of Ecology (Ecology) has been evaluating the impact of nitrogen on dissolved oxygen concentrations in Puget Sound for over a decade. More recently, Ecology has taken steps towards implementing nitrogen limits on wastewater treatment plants (WWTP) that discharge into Puget Sound, and has begun to implement nitrogen load action levels on WWTPs as part of a nutrient general permit process that would trigger sequential tiers of nitrogen removal upgrades. King County operates three large, regional WWTPs (West Point, South Plant, and Brightwater) that discharge directly into Puget Sound. To better understand nitrogen removal options, costs, and other impacts, King County completed an evaluation of the potential for implementing various nitrogen removal options at these three WWTPs.

To evaluate nitrogen removal potential at the different facilities, pre-screening of over twenty different nitrogen removal, sidestream treatment, and intensification technologies was first completed, considering cost, nitrogen removal capabilities, greenhouse gas emission (GHG) potential, and other screening criteria. Then, pre-screened technologies were evaluated for various nitrogen removal scenarios for each facility, such as adding sidestream treatment only or meeting a range of seasonal or year-round effluent total inorganic nitrogen targets.

Potential conceptual site layouts and sizing for the alternatives for each scenario were developed based on modeling with calibrated process simulators. The results were used to identify a range of potential capital/operating costs, footprint requirements, and GHG emissions for each nitrogen removal scenario. In general, the results showed that capital/operating costs, GHG emissions, and footprint increase as the level of nitrogen removal increases, with some exceptions. The results also demonstrated that all three WWTPs have potential footprint limitations for nitrogen removal. This presentation will discuss the methods and results for the various effluent nitrogen removal scenarios for each of the three WWTPs.

Brief Biography and/or Qualifications

Matt Winkler is a wastewater treatment process and design engineer with experience in municipal and industrial wastewater treatment. Matt has worked in Brown and Caldwell's Seattle office for ten years. He has specific experience in process modeling and design of biological wastewater treatment systems, including nitrification, denitrification, and biological phosphorus removal processes, as well as specialized aeration control strategies for simultaneous nitrification/denitrification (SND). His graduate research focused on developing a novel post-anoxic denitrification process for achieving biological phosphorus and nitrogen removal from municipal wastewater. Matt also has experience with many other aspects of WWTP design and operation, including headworks screening, grit removal, pumps and pumping systems, fermentation, secondary clarifier capacity modeling, nitrification growth rate and inhibition testing, sidestream treatment, solids stabilization processes, and solids thickening/dewatering.

2:00pm - 2:45pm

ID: 115 / Session 15A: 2

Main Technical Program

Topics: Wastewater Treatment Process

Keywords: ABNR, Biomaterial, Phosphorus, Nutrient Recovery

Construction, Commissioning and Start Up of the World's First Advanced Biological Nutrient Recovery (ABNRTM) Facility at the Village of Roberts, WI

Jordan Lind

CLEARAS Water Recovery, United States of America; jlind@clearaswater.com

As wastewater treatment facilities face the challenge of selecting long-term and cost-effective solutions to meet more stringent discharge permit requirements, resource recovery has become a vital component for consideration. This presentation will highlight the construction, commissioning, and startup of the world's first Advanced Biological Nutrient Recovery (ABNR™) by the Village of Roberts, WI to meet their ultra-low-level total phosphorus discharge limit of 0.04 mg/L.

Prior to integration of ABNR, the Village of Roberts utilized alum for chemical phosphorus removal to meet a discharge limit of 1.0 mg/L total phosphorus. To meet compliance, Roberts explored source minimization, facility optimization and performed a centrate evaluation, only to achieve 0.41 mg/L. Further exploration of facility modifications, led to piloting cerium chloride, ultra-filtration and ABNR. CLEARAS ABNR was the clear choice in consistently meeting future limits.

The Roberts ABNR facility is designed for 0.150 MGD and 4.0 mg/L TP. ABNR allowed the facility to leverage existing infrastructure and eliminate upstream chemical phosphorus removal resulting in cost savings. The flexibility of ABNR has also given Roberts the opportunity to plan for increased nutrient loadings from a future septage receiving program with a phased approach. See Figure 1.

Resource recovery has become critical to the wastewater industry and the CLEARAS process integrates the core principles of this concept. ABNR maximizes existing treatment infrastructure, extends the life of existing assets, allows for optimization of secondary treatment processes resulting in cost savings and residual algae-based sales. ABNR is a sustainable solution that enables wastewater treatment plants to transition to resource recovery facilities. In addition to the Roberts, WI project, ABNR has been pre-selected for three additional full-scale projects (two in WI and one in UT) which will be constructed in 2021 – 2022.

Brief Biography and/or Qualifications

With more than 20 years of senior-level leadership experience in business development, sales, marketing, strategic planning and operations management, Jordan blends his corporate and entrepreneurial knowledge to lead the business development strategy for CLEARAS.

Prior to joining CLEARAS he oversaw business development for ALPS Corporation, a nationwide financial and professional services firm, increasing annual gross sales from $20 million to $40 million during his tenure. Jordan led an aggressive diversification strategy into health care, outsourced professional services, and information systems management.

An active investor in early-stage technology and service-based businesses, Jordan has an excellent track record of navigating the commercialization of products and services.

Jordan received both his BA and MBA from the University of Montana; the latter in which he graduated magna cum laude.

1:15pm - 2:45pm	**Session 16A: Facility Operations & Lessons Learned - Livestream**

1:15pm - 2:00pm

ID: 251 / Session 16A: 1

Main Technical Program

Topics: Wastewater 101, Facility Operations & Maintenance

Keywords: Project Management, Virtual, Remote

Remotely Designed: Lessons Learned Designing during a Pandemic

Oskar Agustsson[1], Kip Summers[2]

[1]HDR; [2]LOTT Clean Water Alliance; oskar.agustsson@hdrinc.com

This presentation will share lessons learned from the design of a complex WWTP upgrade project performed during the COVID-19 pandemic, forcing all parties to work remotely. It showed the importance of existing project management tools and the development of additional tools. In March of 2020, HDR was contracted to design and install new turbo blowers at the LOTT Clean Water Alliance Martin Way Reclaimed Water Plant. Due to stay-at-home" orders our team quickly pivoted to advancing the project with the use of remote tools to facilitate collaboration and communication among consultant team members as well as LOTT staff. Clear meeting topics and agendas are always key to project management and even more so with remote or virtual connections. The presentation will include a discussion of the following elements which contributed to this project's success:

- **Data gathering up front** such as 360-degree photographs were taken and linked on a site plan at the beginning of the project which allowed for the design team to go on "virtual plant walks" to orient themselves.
- **As Built Verification** relied on plant staff, that was already on site to operate the plant.
- **Light Detection and Ranging (LiDAR)** scanning eliminated the need for continual visits to the plant for field measurements.
- **Building Information Modeling (BIM) used** in conjuncture with LiDAR minimized known conflicts with field conditions.
- **Succinct presentation materials** to ensure clear sharing of project details and decision making.
- **Polling features on virtual platforms** was useful during meetings and helped project stakeholders make key decisions by guiding the conversation about what the Owner stakeholders agreed on and what needed further discussion.
- **Documentation** with traditional meeting minutes, decision logs, comment logs.
- **Virtual pre-bid meetings and walkthroughs** scheduled separately for each contractor.

The project is currently under construction and is scheduled to be completed by June, 2021.

Brief Biography and/or Qualifications

Oskar Agustsson, P.E. - Has over 19 years of experience in the wastewater field and is a senior project manager in the wastewater group at HDR. He has a degree in electrical engineering and is a licensed professional engineer in Washington, Idaho, Oregon, Utah, Nevada, and California. He was the HDR project manager for this project case study.

2:00pm - 2:45pm

ID: 198 / Session 16A: 2

Main Technical Program

Topics: Facility Operations & Maintenance, Wastewater Treatment Process

Keywords: Major expansion startup and operation

Lessons from the Startup of Meridian WRRF's New Primary and Secondary Treatment Systems

Zach Dobroth[1], Clint Dolsby[2], Dave Bergdolt[1], Dan Berthe[2], Rick Kelly[1], Travis Kissire[2], Rick Murray[2]

[1]Brown and Caldwell; [2]City of Meridian, Idaho; zdobroth@brwncald.com, cdolsby@meridiancity.org

To meet stringent effluent ammonia and phosphorus requirements, the City of Meridian recently expanded its Wastewater Resource Recovery Facility (WRRF) capacity to 15 mgd (maximum month flow) with the addition of an influent pump station, a headworks facility, two primary clarifiers, four

aeration basins, two secondary clarifiers, a return activated sludge (RAS) classifying selector/anoxic basin, and sludge pumping stations. With the new facilities in place, the City planned to shut down the existing primary and secondary treatment trains until the trains could be retrofitted to meet the more stringent effluent limits. To commission the new facilities and quickly shut down the existing facilities, the City needed to plan for a complex transfer procedure of the existing mixed liquor into the new aeration basins. Our team envisioned three options:

1. Slow: Transfer waste activated sludge (WAS) from the existing aeration basins to the new aeration basins over a period of days or weeks, operating both sides temporarily until the new basins are fully commissioned.
2. Intermediate: Transfer half of the mixed liquor from the existing basins directly to the new basins, operating both sides temporarily. After the new basins are stable, complete the transfer.
3. Quick: Transfer all of the mixed liquor from the existing basins directly to the new basins in one day.

The City selected a quick transfer as the preferred method and extensive planning began. Beginning over a year in advance, the City, engineer, contractor, and systems integrator held a series of meetings to identify critical connections and key tasks to be completed before, during, and after the transfer. This presentation will discuss the successes, challenges, and lessons learned from the planning and startup of the new systems at the WRRF. It will also include WRRF performance data from startup and from a year into operation.

Brief Biography and/or Qualifications

Zach Dobroth, P.E. (Idaho), is a senior wastewater engineer in Brown and Caldwell's Boise office. Zach has experience designing municipal wastewater treatment facilities and with process modeling of advanced biological nutrient removal systems.

Clint Dolsby, P.E. (Idaho), is an Assistant City Engineer for Meridian. He served as one of the City's project managers for the liquid stream capacity expansion project at the Meridian WRRF.

1:15pm - 2:45pm	**Session 17A: Construction & Alternate Delivery**

1:15pm - 2:00pm

ID: 294 / Session 17A: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Construction & Alternate Delivery

Keywords: BIM, VDC, 3D Design, Construction, Technology

Digital Delivery - "Tools" For Optimized Project Delivery, Not "Gadgets" Of The Future

Daniel Lister

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Picture a time prior to the advent of cell phones, where only calls were made from a stationary telephone, and thankfully “selfies” were *not a thing yet*. Fast forward to 2021, and now we carry around a computer device that is more advanced than NASA’s computer used in 1969 to launch The Saturn V Rocket, thus putting a man on the moon.

This analogy can be applied to the evolution of Virtual Design & Construction. Where we once had a 2D design delivered on paper, we now have and 3D model that serves as the foundation for most water projects today. However, the over-arching challenge is unlocking the full utility of having a 3D design model and validating its use as the primary communication & data storage tool.

To meet this challenge Slayden Constructors strategically deploys state-of-the-art modeling, visualization, tools in a cost-effective, field-tested practice we refer to as Digital Delivery.

This presentation will provide an overview of several digital construction practices being deployed on our projects that have positively impacted project delivery performance in terms of cost, schedule, quality, and safety. These include the following –

- Digital Design & Constructability Review - Utilizes 3D models and immersive technology (VR/AR) to review constructability, and plant operation in preconstruction.
- Digital Design & Trade Coordination - Integrates BIM design models and multi-discipline trade models to analyze for clashes and potential alignment issues to resolve in advance of potential rework.
- Digital Survey – Using reality data capture methods such is Laser Scanning, and Drone Photogrammetry to stream real-time, accurate site data from the project to all stakeholders and clients.
- Digital Construction Rehearsal – Applying 4D software to identify conflicts and challenges in the construction sequence so that planning can be optimized before starting work at the jobsite.

In conclusion, we will be showcasing our latest projects and demonstrating that these “gadgets” are actually battle-tested tools & workflows that we use concurrently throughout the project life cycle. We will also walk through the challenges of getting to the *ultimate goal* of delivering a valuable digital asset for the client and operations staff.

Brief Biography and/or Qualifications

Daniel has 16 total years in the water & construction industries utilizing software and technology to solve common problems. With his 5 years as a BIM/VDC Manager at Slayden, he and his team are responsible for the planning and execution of all BIM/VDC deliverables

for current projects, estimates, and proposals.

He also takes pride in the implementation of cutting edge technology and software. Things like laser scanning, UAV Photogrammetry, and the usage of 4D Scheduling have been monumental in keeping Slayden relevant and competitive in this industry.

When he is not in the office you will likely find him outdoors backpacking with his family, on the river fly fishing, or volunteering in the non-profit sector working on various environmental & humanitarian projects.

2:00pm - 2:45pm

ID: 232 / Session 17A: 2

Main Technical Program

Topics: Construction & Alternate Delivery, Facility Operations & Maintenance, Wastewater Treatment Process

Keywords: Startup and Commissioning, Control System Integration, Biological Nutrient Removal

Startup and Commissioning of Biological Nutrient Removal Facilities

William Leaf, Stephanie McGregor

Jacobs, United States of America; william.leaf@jacobs.com

The startup and commissioning of biological nutrient removal (BNR) systems can be one of the more challenging aspects of a Water Resource Recovery Facility (WRRF) project. Proper design, coordination, and scheduling is required for an efficient commissioning phase, ensuring the unit processes work on day one of operation. Startup and commissioning of a WRRF project is one of the most important phases, where the respective unit process, associated equipment, instrumentation, and communication system must all work together as intended to achieve the project goals. Use of predictive tools leading into the commissioning phase can greatly increase the odds of success of this complicated endeavor.

The presentation provides guidance on the best practices in starting up BNR facilities, bridging the gap between the traditional methods with the new control strategies and innovations available in the industry today. Any biological treatment system requires a level of acclimation prior to meeting the expected treatment performance, and this needs to be addressed to ensure the effluent quality from the facility is achieved throughout the duration of the commissioning phase. There are a number of strategies and approaches available to mitigate a reduction in effluent quality during unit process startup. Implementation of the SCADA system is a key component, requiring a systematic approach to allow a smooth transition for the integration of any updated control logic. Predictive tools are available in the industry to help prepare and address issues that may arise during startup, helping develop mitigation strategies before the actual startup and commissioning phase begins (e.g. – Replica™ control system integration and dynamic hydraulic simulator, whole plant process simulators). Incorporating WRRF operations and maintenance staff in the startup planning and follow-on activities is critical to the success of the project, providing the necessary training together with hands-on operation of the new equipment and instrumentation. Lessons-learned from the recent startup and commissioning projects will be presented, highlighting actual challenges and associated mitigation steps at the respective WRRFs (Grants Pass, OR and Lahaina, HI will be used as reference projects).

Brief Biography and/or Qualifications

William Leaf is a Principal Technologist with Jacobs, specializing in wastewater treatment projects (planning, design, plant optimization, and commissioning). He has been in the industry for over 25 years in the Northwest, and is based in Jacobs' Boise office.

1:15pm - 2:45pm	**Session 18A: Utility Planning**

1:15pm - 2:00pm

ID: 100 / Session 18A: 1

Main Technical Program

Topics: Wastewater 101, Regulatory Challenges, Risk Assessments and Emergency Response

Keywords: Cloud-based SCADA systems

Your Crystal Ball – How Cloud-Based SCADA Allows Operators To See The Future – And Avoid Problems

Colin Bunyard, Kevin Liscovitz

XiO; colinb@xiowater.com

Collection systems play a critical role in public health. Aging underground sanitary and combined sewer systems are prone to infiltration, inflow, and stormwater runoff, while lift stations are overwhelmed by a rise in personal care wipes which wreak havoc on the pumps. As regulatory frameworks become more stringent, agency staff must do more to maintain compliance.

The rise in IIOT (Industrial Internet of Things) technology makes it possible to combine remote sensors and cellular communications with the power of cloud computing. Cloud-based SCADA systems allow operators to monitor conditions, receive alarms, control equipment, and view data and trends. We will examine case studies from two agencies that have used cloud-based SCADA to improve their operations and lower the risks of overflows.

Concerned about excessive false alarms from an auto-dialer system, a Southern California Community Services District turned to a cloud-based SCADA system in an effort to gain better visibility into the system and reduce overtime callouts. The cloud-based system allowed them to monitor wet well levels, pump statuses, and AC power remotely from their mobile phones and tablets. The District gained greater visibility by integrating their remote sewer level data into the cloud-based SCADA platform's user interface. Gaining insight into pump run times before, during, and after rain events enabled District staff to visualize the impacts of inflow and infiltration on their system. The upstream sewer water level data also gave the staff a heads-up in terms of the downstream impacts on the wet wells and lift stations during storm events.

Another Community Services District used a cloud-based SCADA system to calculate the volume of raw sewage they were delivering to a neighboring agency for treatment to reconcile service fees. The system provided district staff with alarms during a power outage when malfunctioning equipment threatened to overflow a lift station. The high water and loss of power alarms received via SMS text and email-enabled staff to get generator power up and running to avoid an overflow event.

Much like a crystal ball, cloud-based SCADA systems allow operators can monitor conditions remotely and take proactive measures to maintain their systems.

Brief Biography and/or Qualifications

As Regional Sales Manager, Colin works directly with operators, supervisors, owners, and engineers to design and configure cloud-based SCADA solutions to address real issues. His experience includes working on SCADA systems for fuel supply storage and distribution with the US Air Force.

2:00pm - 3:00pm

ID: 136 / Session 18A: 2

Main Technical Program

Topics: Utility & Assessment Management

Keywords: Business process modeling, utility management, change management, customer value

Is your Utility Looking to Improve? There's a WISE way to join your Peers!

Mark Poling

Clean Water Services, United States of America; polingm@cleanwaterservices.org

WISE, the Water Intraprenuers for Successful Enterprises Program, is a comprehensive framework and methodology that helps utilities create value and improve performance. Now an on-going effort housed with the Water Environment Federation, the program was a project called Utility Analysis and Improvement Methodology (UAIM) that was sponsored by the Water Research Foundation (WRF) and the Leaders Innovation Forum for Technology (LIFT). This collaborative effort includes leading utilities

from all over the U.S. including Clean Water Services and the City of Portland, as well as utilities in Denmark, Canada, and the United Kingdom. This comprehensive approach to improve management and performance in water sector utilities includes the development of a business reference model that also helps us determine how to better leverage information technology systems, and research into topics related workforce and organizations. This is a multifaceted approach that considers different execution timeframes – including operational, tactical and strategic. One of the greatest strengths of the WISE program is the collaboration among the participating utilities: the Utility Partners. Subject Matter Experts from a number of utilities have created models of processes and practices for Capital Improvement Programs, Asset Management, capital project Business Case Analysis, and several other topics. The presentation will include an overview of the methodology and several case studies where utilities have successfully employed elements of the approach. Learn how you can become part of the consortium of utilities improving their business practices in meaningful and comprehensive ways.

Brief Biography and/or Qualifications

Mark is a Strategic Business Associate with Clean Water Services and has more than 35 years of experience working for utilities; serving in a management role for more than 25. Mark is a Past President of the Pacific Northwest Clean Water Association and has served on the Water Environment Federation Board of Trustees. A certified Group 4 operator he also holds a B.S. from Grand Valley State and an M.S. in Environmental Engineering from the University of Washington.

1:15pm - 2:45pm	**Session 19A: Workforce Development**

1:15pm - 2:00pm

ID: 262 / Session 19A: 1

Main Technical Program

Topics: Leadership, Social Equity, Workforce Development

Keywords: inclusion, conflict, teams

Who is in Your Circle of Trust?

Amy Dammarell, Joslynn Hon

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It is natural to seek out friends and colleagues with whom we share common interests, experiences, background, thoughts and feelings. We tend to surround ourselves with people we share "like" characteristics with. In fact, the more like us someone is, the more apt we are to trust them. What affect does this have on our ability to foster a diverse and inclusive workplace?

Approach: Through large group activities and small group discussion, participants will explore the composition of their "Circle of Trust". These activities will allow participants to understand how who they choose for their Circle may impact diversity of thought, perspective, decision-making, hiring, and promotion within an organization.

Results: Participants will create practical action steps to form connections, add to their "Circle of Trust" and think differently about diversity.

Conclusion: Participants will build awareness of how to be more intentional to build diverse teams.

Brief Biography and/or Qualifications

Amy is a Vice President and the Director of Consulting Services for the HDR's Water Business Group. She most enjoys finding solutions that find multiple benefits for the human and natural environments. Amy has been a facilitator of HDRs leadership development courses and led the development of a technically based on-the-job training and knowledge transfer programs. She received her BS in Wildlife Ecology from University of Illinois and her MS in Engineering from Portland State University.

Joslynn Hon is HDR's Director of Learning and Organizational Development. She has spent the last 20 years coaching people to their fullest potential. She develops and delivers effective learning opportunities for staff throughout the company.

2:00pm - 2:45pm

ID: 263 / Session 19A: 2

Main Technical Program

Topics: Leadership, Social Equity, Workforce Development

Keywords: inclusion, conflict, teams

How to be an Inclusion Champion

Amy Dammarell, Joslynn Hon

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It's the little things that mean the most. That's true in so many ways, including our efforts towards creating inclusive cultures and workplaces. While most people rarely experience radically, aggressively prejudicial behavior, many people often experience small, seemingly tiny acts of prejudice, referred to as micro-aggressions. This can cause conflict, misunderstandings, and resentment, which impacts a team's ability to perform and deliver results, as well as damaging relationships in and out of the workplace.

Approach: Using scenarios and small group discussion, participants will explore real-life situations and determine appropriate action whether they are the subject of the micro-aggression, the offender or and observer.

Results: Participants will create action steps and practice "conversation tools" to effectively handle some common situations and the courage to become an Inclusion Champion.

Conclusion: Participants will learn the signs of micro-aggressions and steps to counteract.

Brief Biography and/or Qualifications

Amy is a Vice President and the Director of Consulting Services for the HDR's Water Business Group. She most enjoys finding solutions that find multiple benefits for the human and natural environments. Amy has been a facilitator of HDRs leadership development courses and led the development of a technically based on-the-job training and knowledge transfer programs. She received her BS in Wildlife Ecology from University of Illinois and her MS in Engineering from Portland State University.

Joslynn Hon is HDR's Director of Learning and Organizational Development. She has spent the last 20 years coaching people to their fullest potential. She develops and delivers effective learning opportunities for staff throughout the company.

1:15pm - 2:45pm

Session 20A: Water Reuse - Livestream

1:15 pm - 2:00 pm

Session 20A: 1

Todd Miller

Launching Community Recycled Water Use Through Collaborative Planning for Multiple Drivers

The Eugene/Springfield Metropolitan Wastewater Management Commission (MWMC) is preparing to launch its first-ever outside-the-fence recycled water use. This milestone is being reached after a decade-long planning process to explore, study, and collaborate on "the right water at the right time at the right place." The MWMC is now looking to break ground on construction of Class A recycled water facilities combining creative use of existing infrastructure, partnerships to demonstrate meaningful and growth-oriented applications, and establishing the MWMC as community water resource partner with an eye toward future regulatory compliance and climate resiliency assets.

Brief Biography and/or Qualifications

Todd Miller
Environmental Services Supervisor
Springfield DPW-ESD
tmiller@springfield-or.gov

Todd has been working toward water resource and environmental restoration and protection for over 30 years in a career spanning local government, small and large companies, and nonprofit organizations. Currently, Todd is an Environmental Services Supervisor leading planning and policy support for the MWMC's capital improvement program at the City of Springfield, where he is entering his 15th year of service. Todd's background is as an Oregon registered geologist with a BS in Biology-Geology and an MS in Environmental Studies.

2:00 pm - 2:45 pm

Session 20A: 2

Jacque Klug

Using Research to Inform Community Decisions about Recycled Water Use

Contaminants of Emerging Concern (CECs) is the term applied to a broad array of trace chemicals that come from consumer, commercial and industrial products that are measurable in the environment. CECs are generally unregulated. Wastewater effluent and recycled water has been identified as a potential source of CECs. This session will describe CEC research projects being done to examine CEC presence in recycled water and the risk of CEC exposure from uses of recycled water for food crop irrigation and groundwater recharge. The research study design will be presented along with preliminary research results. The session will describe how research is being shared within the community and informing community discussions about the future of reuse in the respective regions. These presentations will provide a research and communication framework for communities that can be applied in discussing CECs and risk.

Brief Biography and/or Qualifications

Jacque Klug
King County and WRA-PNW Past President
Jacque.Klug@kingcounty.gov

Jacque Klug is a project manager for King County's Wastewater Treatment Division in Seattle, Washington, supporting customer development, permitting, capital projects, policy development and communication planning efforts relating to King County's Recycled Water Program. Jacque has worked in the water resource field for twenty years and has experience in policy development, planning and permitting on a variety of water issues including water rights, groundwater management, reclaimed water, instream flows, watershed planning and salmon recovery. Jacque has served as the President of the American Water Resources Association Washington State Chapter and is the Past President of the WateReuse Association Pacific Northwest Section. She is a graduate of Duke University and the University of Washington.

3:00pm - 4:30pm	**Session 14B: Pump Performance/Wastewater Treatment - Livestream**

3:00pm - 3:45pm

ID: 258 / Session 14B: 1

Main Technical Program

Topics: Facility Operations & Maintenance, Collection and Conveyance, Utility & Assessment Management

Keywords: Pump Testing, Condition Assessment, Asset Management

Pump Performance Assessment; A Panacea for Predictive Maintenance?

Jennifer E. Murphy, Brandon Moss

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Assessing the condition of pump stations can be a significant undertaking for many utilities, and the specific approaches and techniques of assessment can vary widely. Among the many working components within the pump station its namesake, the pump, is often a key focus. Significantly reduced capacity or excessive vibration are easily identifiable signs of a failed pump; however, quantifying the specific degradation of an individual pump can be difficult. If accurate quantitative data is available the useful life of a pump can be prolonged by targeted maintenance, and premature rebuild or replacement can be avoided.

Methodology for field testing pumps and the differing approaches in testing both flood control and wastewater pumps will be presented. The technical requirements and constraints and opportunities of instruments and data logging equipment will be reviewed. Some of the common and uncommon insights into centrifugal pump performance, implications for the health of the force main, and specific indicators of wear on various components will be discussed.

Two client case studies will be presented detailing how results from pump testing can be applied to assess equipment condition as well as make predictive maintenance and capital improvement decisions. The City of Spokane, WA, tested pumps at five wastewater pump stations to confirm condition and capacity. Multnomah County Drainage District in Portland, OR, has conducted a variety of condition assessments for its 13 flood control pump stations and has performed testing to confirm the flood control pumping capacities and remaining useful life of most of the pumps it maintains. The specifics of testing wastewater and flood control pumps will be covered, in addition to how the resulting test data, in combination with operational data, can be used to perform targeted rebuilds and prioritize replacements.

Brief Biography and/or Qualifications

Jen Murphy is a senior engineer at Parametrix in the Water Solutions Group for the Pacific Northwest. She has over 14 years of experience on both the construction and design sides of the industry, with the last decade focused on providing clients with engineering services related to drinking water, waste water, and storm water. She has been a significant contributor for design projects at 35 pumping stations and 10 treatment facilities with capacities up to 800 MGD.

Brandon Moss is a professional engineer at Parametrix in the Water Solutions Group for the Pacific Northwest. He provides hydraulic, mechanical, and civil engineering design and construction support to local agency and tribal clients. His work supports water and wastewater projects including rehabilitation and replacements of force mains and pump stations, treatment processes and hydraulic designs, and reclamation plant upgrades.

3:45pm - 4:30pm

ID: 174 / Session 14B: 2

Main Technical Program

Topics: Wastewater 101

Keywords: CFD, Modeling, Wastewater, Tanks, Pumps

CFD in Wastewater Treatment: A Useful Design Tool or Design Dollars Down the Drain

Zachary Hahm Taylor

Osborn Consulting, Inc., United States of America; zacht@osbornconsulting.com

With continual improvement of computer processing and software algorithms, there is an ever-growing number of applications for computational fluid dynamics (CFD) to improve the design operation of wastewater treatment facilities. However, the costs of CFD modeling studies are significant, not all applications warrant a detailed study, and some studies are not realistic in addition to being unwarranted.

CFD studies are warranted when 1) their cost can be recovered by savings in capital or operations and maintenance 2) an overall reduction in project risk can be achieved 3) the added benefit of flow visualization warrants the added expense. An example is the utilization of CFD studies for contact tanks. These studies can provide an accurate estimate of baffle factor and result in tanks with smaller footprints than would be allowed using empirical equations or design charts. Reduced footprint size and/or reduced disinfection byproducts justify the cost of CFD studies for contact tanks, storage tanks, settling basins, etc.

CFD studies of pump stations that do not require physical models can be used to evaluate pre-swirl and velocity distribution in the pump throat and develop modifications to improve approach conditions to the pumps. However, CFD has yet to advance to where it can be used to evaluate the potential for vortices or for accurate estimation of turbulence entering the pump. Some consultants and software providers may claim that they can, but buyer beware.

Successful studies require proper application and experienced CFD consultants who can both properly execute a model study and interpret/present the results to design engineers and stakeholders. Attendees will gain an understanding of CFD as a tool that can be useful when properly applied and when the design team understands how close to reality the results are.

Brief Biography and/or Qualifications

Zach is a Professional Engineer with experience in hydraulic modeling and design. His particular expertise is in computational fluid dynamics (CFD) modeling, hydrodynamic modeling, and physical hydraulic modeling, with experience in studies involving dams, levees, pump stations, spillways, upstream and downstream fish passage facilities, flood control, and river navigation. He has extensive modeling experience using a variety of modeling platforms (including Flow-3D, Star-CCM+, Fluent, HEC-RAS, SRH-2D, AdH, PTM, CMS-WAVE) and understands the value and capabilities of each in addressing project site evaluation and design.

3:00pm - 4:30pm	**Session 15B: Wastewater Process**

3:00pm - 3:45pm

ID: 257 / Session 15B: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Wastewater Treatment Process, Leadership, Social Equity, Workforce Development

Keywords: Primary Treatment Disruption Paradigm Goals

Disrupting the Paradigm of Primary Treatment

Ann-Marie Doerhoff

Lakehaven Water and Sewer Authority, United States of America; doerhoffa@gmail.com

How do you change paradigms? In his book “The Structure of Scientific Revolutions” Thomas Kuhn explains one must keep pointing at the anomalies and failures in the old paradigm. Don’t waste time with reactionaries; rather work with active change agents and with the vast middle ground of people who are open-minded. Wastewater treatment operators, with their unique perspectives on treatment and large numbers in the industry, have the power to drive real improvement in primary treatment and be the change agents.

Misaligned goals led to the current paradigm.

WWTP Owners: Sustainably take in wastewater, remove the solids then return the separated water and solids to nature with a reliable, easy to operate system.

Consulting engineer: Make money by selling billable hours.

Clean Water Act Regulators: Restore and maintain the chemical, physical and biological integrity of the nation's waters.

Equipment manufacturer: Sell the most equipment for the highest price by producing low maintenance, easy to operate equipment that needs replacement every few years.

I want to tell a story, through the example of an attempt at primary treatment disruption, of how misaligned goals of the various market players make disruption difficult. Clear Cove recognized primary treatment has not changed significantly since humans started building wastewater treatment plants and the industry solution to regulation has been adding in layers of treatment from secondary biological treatment to tertiary filtration. How about a solution that removes as much of the solids and carbon at the start of treatment? Clear cove built and tested this type of system starting in 2008 at small, medium and large WWTP’s but today if you go to their website you get “Not Found The requested URL /municipal/harvester-sewage-treatment/ was not found on this server.”

What happened to Clear Cove and what can we learn from their attempt at disruption? I will tell the story of their three pilot projects aimed at radically improving the separation of solids during primary treatment Reducing the treatment load on secondary treatment would make WWTP’s easier to operate and reduce energy use. This future is possible but only with operators' ideas and wisdom.

Brief Biography and/or Qualifications

Ann-Marie Doerhoff, PE

doerhoffa@gmail.com

303-522-6967

OBJECTIVE: Make a difference in the world of water by joining a team for the next 20 years to work on planning, designing, building and improving sustainable water public works for current clients and future generations to help ensure economical, safe and resilient water infrastructure for all.

EXPERIENCE SUMMARY

United States Air Force Civil Engineer Officer (8 years): Separated as a Captain and served at Los Angeles AFB, Kunsan AFB Korea, Ramstein AFB, Germany and Al Udied AFB, Qatar

Carollo Engineers (6 years): Construction on $150 to $200 million large water treatment projects

Tetra Tech (8 months): Energy use improvement study for 15 MGD wastewater treatment plant

Pennsylvania American Water (1 year): Pipeline and booster station permitting, design, construction

Water Project Engineer for Mott MacDonald (4 months): 50 MGD Pump Station Design

Short employment periods: lack of work and ethics concerns…I want to work and value integrity

Lakehaven Water and Sewer District (4 months) - Project Engineer Wastewater Risk and Resiliency Assessment, Primary Clarifier Equipment Replacement, Water main replacement projects, Inflow and Infiltration Pipe Lining Project

LICENSES

Pennsylvania Professional Engineer 23376373 : expires 09/30/21

Colorado Professional Engineer 0047634 : expires 10/31/21

Washington Professional Engineer: Pending reciprocity licensure, submitted August 17, 3-week's

Drinking Water Operator test in Pennsylvania

EDUCATION

BS Civil Engineering, University of Missouri, Rolla: May 99 , GPA 3.7/4.0 (Magna Cum Laude)

MS Environmental Engineering, University of Colorado, Boulder: December 06, GPA 3.9/4.0

MA Economics Coursework, University of Colorado, Denver: finished 26.5 semester hours, GPA 3.6/4.0

Project Management Courses at Tetra Tech and Mott MacDonald

COMPUTER SKILLS: Expert in Microsoft PowerPoint, Excel, Word, and SharePoint, intermediate at Microsoft Project and Stata (data analysis software) and beginner in BioWin and Arc GIS

PERSONAL STRENGTHS: Grit, energetic, hardworking, honest, organized, dedicated, optimistic, friendly

EXPERIENCE STRENGTHS: Project scheduling, budgeting and documenting, working with contractors and consultants, water infrastructure construction, design process, technical writing, reviewing technical information, non-revenue water reduction, meeting with stakeholders, communicating with utilities, quality control and assurance, process improvement, utility engineering, worn a lot of different shoes and boots

HOBBIES: Reading (recent books include The Wizard and the Prophet: Two Remarkable Scientists and Their Dueling Visions to Shape Tomorrow's World, How to Measure Anything and Into the Raging Sea), cooking foreign foods, listening to podcasts (favorites 99% Invisible, Freakonomics, Hidden Brain, Reply All, Conversations with Tyler, Econ Talk with Russ Roberts, The Indicator, In Deep), jogging, yoga, playing cribbage and other games, listening to live music, biking, self-improvement, home renovations (flipped four homes in Aurora, Denver, Pittsburgh and Frisco)

3:45pm - 4:30pm

ID: 124 / Session 15B: 2

Main Technical Program

Topics: Wastewater 101

Keywords: Polymer

Optimizing Polymer Mixing and Activation: Following the Science

Jeff Rhodes

UGSI Solutions, United States of America; jrhodes@ugsicorp.com

Despite the wide-spread use of polymers in water and wastewater treatment and their associated high recurring expense, understanding exactly how to optimize polymer use in water and wastewater treatment is not well understood. With many equipment options available to operators, it makes sense to start with the basics of polymer chemistry and then apply those principles to polymer activation

equipment options. This discussion will review the basics of polymer chemistry, goals of activation, the development of polymer mixing equipment and equipment configuration basics.

Factors such as charge site exposure, polymer hydration, application of mixing energy and the effects of dilution water will be detailed as they influence proper polymer activation. Additionally, the impact of water quality attributes such as disinfectant residual levels and hardness on optimal polymer hydration are explored. Given the industry trend of using reclaimed water for polymer mixing, it is crucial to understand the effects of residual chlorine, turbidity, and various dissolved ions.

Finally, the benefits of utilizing two-stage mixing - very high initial mixing energy followed by low and uniform mixing energy - are demonstrated by theoretical consideration and practical test data. Emulsion polymer systems with sufficient residence time have proven to provide a more efficient polymer solution. Lastly, both mechanical and hydraulic polymer activation systems will be analyzed to assess their efficiency and adherence to the principles of polymer activation previously discussed. Included in this discussion are equipment features and the latest improvements that help ensure efficiency and reliability for utilities and treatment plant operators.

Brief Biography and/or Qualifications

Jeff Rhodes serves as the Vice President of Commercial Development and as a technical specialist in chemical feed applications for the central United States. He maintains over 30 years of experience in chemical feed, analysis and control for water and wastewater treatment processes. Jeff earned his industry experience serving in municipal, industrial and agriculture markets. Additionally, Jeff is the co-inventor on three patents in the area of disinfection control and polymer activation.

3:00pm - 4:30pm	**Session 16B: Collection & Conveyance - Intelligent Collection Management - Livestream**

3:00pm - 3:45pm

ID: 220 / Session 16B: 1

Main Technical Program

Topics: Collection and Conveyance, Utility & Assessment Management

Keywords: Sewer inspection, artificial intelligence, technology, innovation, efficiency

Artificial Intelligence, Real Solutions. Identifying Sewer Defects with AI

Joshua Ford, Molly Loucks

Burgess & Niple; joshua.ford@burgessniple.com, molly.loucks@burgessniple.com

Traditional sewer inspection methods such as internal CCTV can be time-consuming and can overlook defects due to inaccurate identification and subjectivity in how people code. When assessing the future degradation of a sewer line or determining which asset to prioritize for rehabilitation, the difference and accuracy of coding is critical.

The goal of integrating artificial intelligence (AI) with sewer inspection is to supplement workers in the field, not to replace them. AI takes on the more common defects allowing field workers to focus on work at hand (access, MOT, cleaning) and codes that are more difficult and less frequent.

As with any project, the more accurate the data that goes in, the better quality of data that comes out. It is necessary to capture clear and unobstructed video, whether a field technician or an AI-based platform performs the assessment. When provided clear video, B&N's AI has an accuracy rating of approximately 90%.

Our AI captures and recreates the workflow in coding and performing the quality assurance/quality control (QA/QC) of sewer inspections. With this technology, we have substantially reduced the time required to review sewer inspection data, increased the number and accuracy of defects identified and coded, and supplemented the human element that is prone to bias. Removing the burden of coding all defects from the contractor allows them to inspect more footage in a day and reduce the cost-per-foot for the owner. Utility providers can quickly move through existing video to provide a database that shows the condition of their storm and sanitary infrastructure, allowing them to make data-driven decisions that are transparent and repeatable.

This presentation will demonstrate the benefits of using AI as a low-cost way to evaluate systems and better maintain assets to prioritize rehabilitation and coordinate with other work such as roadway improvements.

Brief Biography and/or Qualifications

Joshua Ford, PE, PACP has experience in flow monitoring and Sanitary Sewer Evaluation Surveys for systems across the nation. He is a trusted resource for I/I issues and currently serves as the Village Engineer for the Village of Marble Cliff, Ohio. This experience makes him a valuable part of project teams because he is aware of challenges inherent with buried infrastructure and can work through them to find practical solutions. Joshua's design experience includes storm sewer improvements, utility relocations, wastewater collection systems and water transmission and distribution systems. He is an Ohio Northern University graduate with a B.S. Degree in Civil Engineering.

Molly Loucks, PE is a transportation engineer with experience in roadway design with projects typically focusing on drainage, ADA, urban design, roundabouts, bikeways, and complete streets solutions. Molly is routinely involved as the lead roadway and drainage designer for Burgess & Niple's complete streets projects. Molly holds a Bachelor of Science in Civil Engineering from the University of Idaho

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3:45pm - 4:30pm

ID: 138 / Session 16B: 2

Main Technical Program

Topics: Collection and Conveyance

Keywords: Digital Twins

Real Time – Decision Support Systems For Intelligent Watershed Management

Alex Puryear

Xylem Inc., United States of America; alexander.puryear@xyleminc.com

Technological advances have enabled Real-Time Decision Support Systems (RT-DSS) to dynamically optimize collection system operations using a stream of data from sensors placed in the network, Supervisory Control and Data Acquisition (SCADA) systems, and real-time weather ensemble forecasts.

Giant leaps forward in computing power, combined with advances and cost reductions in sensor and telemetry technologies, have made it possible to go far beyond the status quo and break into a new echelon of opportunities. We can now run high-resolution models in real-time, with real-world precipitation data, while correcting critical downstream model nodes with observed sensor data. The outcome is perpetually calibrated digital copies of the urban watershed designed for operators providing far more effective real-time operational decision making and control.

The RT-DSS provides operational intelligence, including:

- Active, automated, and continuous monitoring of the sensor network.
- Real-time collection system condition assessment identifying hydraulic anomalies.
- Guidance providing consistent actions that are continually updating to achieve designed objectives such as reducing energy consumption, minimizing overflows, and balancing diurnal curves to treatment plants.
- Real-time models infused with artificial intelligence and probabilistic weather forecast to predict future outcomes in the collection systems.
- Realize capacity in existing assets that otherwise could not be achieved using traditional control methods.

The RT-DSS output is actionable information provided to the operation staff, engineering, and leadership using web-based dashboards.

Attendees of this presentation will benefit by better understanding what a Real-Time Decision Support System (RT-DSS) is and how they can help utilities better manage their collection systems. This presentation will discuss the development and implementation of several RT-DSS for utilities here in the Pacific Northwest and across the Country.

Brief Biography and/or Qualifications

Alex's time within the water industry has focused on solving utilities biggest challenges using digital solutions. Alex holds a B.A. from Arizona State University, School of Technology and Innovation and a MBA from Gonzaga University, School of Business.

3:00pm - 4:30pm	**Session 17B: Construction & Alternate Delivery**

3:00pm - 3:45pm

ID: 286 / Session 17B: 1

Main Technical Program

Topics: Construction & Alternate Delivery

Keywords: Project Delivery, Construction, Risk Management

Rethinking Risk Management Approaches in Design-Bid-Build Projects

Michelle Green

Jacobs, United States of America; Michelle.Green@jacobs.com

As the use of Collaborative Delivery models (e.g. CM/GC, GC/CM, Progressive Design Build) expand, Owners and Engineers are becoming exposed to the risks that Contractors regularly manage and price. These models inherently require characterization and negotiation of risk allocation, with the goal of shifting risks to the party best able to manage them. This analysis of likelihood and consequence of failure, along with an understanding of the practical cost implications associated with simply shifting risk to the Contractor, results in better informed decision-making. A similar approach can be implemented in traditional Design-Bid-Build delivery models to support better project outcomes.

This presentation will first provide an overview of the risk management process utilized in collaborative models. Then, examples of how to apply these techniques in a traditional delivery model to manage project costs and reduce potential for claims will be discussed. Specific areas of focus include:

- Actively managing scope growth during design
- Use of a Risk Register during design development
- Minimizing unknowns through additional pre-construction investigations
- Good and bad examples of allocating risk to the contractor
- Effective utilization of Allowances, Contingencies, incentives, etc.
- Risks that Owners should retain

Brief Biography and/or Qualifications

Ms. Green has over 25 years of experience delivering a variety of water and wastewater projects. Her responsibilities have included the full range of project development—from planning and design through Construction Phase services—in all delivery formats. These have included providing project delivery analyses, leading design services for CM/GC projects, leading Fixed Price and Progressive Design-Build projects, and providing Owner's Advisory services for both CM/GC and Progressive Design-Build projects.

3:45pm - 4:30pm

ID: 186 / Session 17B: 2

Main Technical Program

Topics: Collection and Conveyance

Keywords: UV-CIPP, Trenchless, Rehabilitation, Sanitary sewer

Between a Lake and a Hard Place: Constructability Constraints & CIPP Lining

Brendan O'Sullivan

Murraysmith, United States of America; Brendan.O'Sullivan@murraysmith.us

The City of Fairview's Interlachen trunk sewer, constructed in 1966, is a 12-inch-diameter concrete sanitary sewer along Fairview Lake's northern shoreline. To extend the service life of their system, the City decided to rehabilitate approximately 12,000 linear feet of the degraded concrete trunk sewer.

The trunk sewer is located predominantly in private backyards routed through backyard easements of nearly 70 private properties along the lakeshore within an existing easement, presenting a unique set of construction challenges. Any excavation along the Fairview Lake shoreline would trigger floodplain permitting and likely an archaeological investigation, as the project area was once the site of a large Multnomah Native American village known as ničáqʷli. Since development of the land in 1911, an abundance of artifacts and burial remains associated with ničáqʷli have been uncovered.

These challenges provided the opportunity for an innovative solution. In the case of the Interlachen Trunk Sewer, constructability constraints presented the perfect opportunity to use UV-CIPP lining. The

small construction footprint helped minimize impacts to residents, requiring less equipment to install the liner than steam or water cured CIPP methods.

This presentation will provide an overview of the challenges faced during the Interlachen Sewer Rehabilitation Project and the advantages of using UV-CIPP lining to minimize private property impacts.

Brief Biography and/or Qualifications

Brendan O'Sullivan, P.E.

With a bachelor's in civil engineering from the University of Portland Brendan is a principal engineer and project manager at Murraysmith for public improvement projects involving rehabilitation and new installation of municipal water and wastewater infrastructure. And was the recipient of the NASTT 2019 Trent Ralston Young Professional Achievement Award.

3:00pm - 4:30pm

Session 18B: Utility Planning

3:00pm - 3:45pm

ID: 273 / Session 18B: 1

Main Technical Program

Topics: Utility & Assessment Management, Leadership, Social Equity, Workforce Development

Keywords: affordable housing, impact fee, sdc

Affordable Housing and Tiered Development Impact Fees

Chris Storey, Erin Blue, Ron Wierenga

Water Environment Services, United States of America; chrissto@clackamas.us, eblue@clackamas.us

One of the emerging issues in utility management and capital financing is how to address the impact of affordable housing on a wastewater system. Utilities often receive pressure to waive or reduce development impact fees for what is seen as more desirable or diverse and potentially more equitable housing supply. This is counterbalanced by the challenge that if those developments do not pay for the cost of their impact to the system, another segment of the customer base will. This leaves the utility stuck between two valid policy goals and leaving both groups unhappy with any changes made.

To create a path forward, Clackamas Water Environment Services (WES) explored a more nuanced effort to measure the impact of housing size as a proxy for water consumption on the wastewater system. As a regional wastewater system crossing multiple water providers, WES does not assign equivalent dwelling units (EDUs) based on direct water consumption data, but used the traditional “a house is a house” model with a 20% discount for multi-family dwellings. WES pulled winter water consumption data from several underlying water providers, then cross-indexed with census data and home size information to create a model of flow contributions to the system.

WES found a statistically significant difference in wastewater discharges that correlated to the size of the dwelling, with small 800 square foot dwellings at one end and 3000 square foot dwellings at the other. After slicing the data several different ways, WES established key deviations from the baseline consumption of a 2000 square foot home. These deviations supported the creation of a 5-tiered EDU assignment (and therefore development impact fee assignment) for new development that reduced the cost of affordable housing, and increased the cost of large homes.

This nuanced distinction created a path forward to enabling lower affordable housing fees while having a strong, evidence-based approach that there was no subsidy being given by another customer segment. WES proposes to share how the analysis was done, how to draw conclusions from the data, and how to implement a tiered development impact fee structure.

Brief Biography and/or Qualifications

Chris Storey, WES Assistant Director: Chris joined WES in 2018 as the Assistant Director, where he oversees the administrative, financial, regulatory and main policy initiatives of the utility. Prior to becoming Assistant Director, Chris was Senior Legal Counsel for WES and other areas of Clackamas County and led the County’s transaction group. He joined WES and Clackamas County in 2006.

Erin Blue, Financial Analyst: Erin serves as WES’ lead for budget development and key financial analysis, and provides overview and support to virtually all areas of WES’ financial system. Prior to joining WES, Erin was co-owner of a business and then manager of that division after it was acquired, and brings a deep intellectual curiosity and knack for analysis to complex challenges.

3:45pm - 4:30pm

ID: 177 / Session 18B: 2

Main Technical Program

Topics: Utility & Assessment Management, Recycled Water & Resource Recovery

Keywords: Funding strategies, affordability, ratepayer communications, planning

Five Things to Know About Saving Ratepayers Millions of Dollars with WIFIA

Clark Worth, David Stangel

Murraysmith, United States of America; clark@barneyandworth.com, David.Stangel@murraysmith.us

Every water and wastewater utility in the United States should be aware of and consider participating in the Environmental Protection Agency’s Water Infrastructure Finance & Innovation Act (WIFIA) loan program. The benefits to your community and ratepayers can have generational impact. Our staff has

supported more than $1.4B in WIFIA loan Letters of Interests and subsequent applications. This presentation covers the five things utilities should know about WIFIA:

1. *What projects are eligible for WIFIA?* Projects that qualify for Drinking Water SRF and Clean Water SRF are also eligible for WIFIA. Projects that cost $20M+ (or $5M+ for communities less than 25,000 population) can apply. The WIFIA loan can cover 49% of eligible project costs.
2. *What are the benefits to ratepayers of WIFI loans?* Very low interest rates, funds disbursed on a reimbursement basis, and flexible loan terms give utilities a flexible financial tool that maximizes the benefits to your ratepayers.
3. *How do you apply?* The annual cycle starts as early as April with a call from the EPA inviting communities to submit a Letter of Interest (LOI). This LOI provides the EPA with a detailed analysis of project costs, revenue, benefits, impacts, and risks that takes months to prepare but is due in just 90 days. Top scoring LOIs are invited by EPA to submit a loan application. Approved loans close in 12 to 18 months.
4. *What are the chances of success?* WIFIA is well funded—the right projects have good odds of success. In FY 2020, there was $5.5B in loan authority. EPA selected 55 of 67 projects to apply.
5. *A strong LOI is key to success.* Applicants need to approach it like a proposal, providing evidence that the project meets all 16 review criteria. Projects that are ready to proceed and creditworthy applicants are likely to score well.

Attendees of this presentation will have the information they need to take a closer look at WIFIA funding for their agency, potentially saving their ratepayers millions—or hundreds of millions—in interest payments

Brief Biography and/or Qualifications

Clark Worth, principal at Barney & Worth, specializes in funding and ratepayer communications for water-wastewater-stormwater utilities. A consultant for over 40 years, Clark has served hundreds of clients in the Pacific Northwest and across the U.S. He completed a bachelor’s degree in political science and graduate studies in public administration at the University of Oregon. He began his career working for two Oregon Governors.

David Stangel, PE, principal at Murraysmith, has more than two decades of engineering experience, specializing in the master planning of water and wastewater collection systems. Based in Murraysmith's Boise office, David serves as a senior advisor to clients across the Pacific Northwest as they face the increasingly difficult need to balance infrastructure investment needs with affordability. He completed his bachelor's degree in geography and a master's in water resource engineering from Oregon State University.

3:00pm - 4:30pm	**Session 19B: Workforce Development**

3:00pm - 3:45pm

ID: 180 / Session 19B: 1

Main Technical Program

Topics: Leadership, Social Equity, Workforce Development

Keywords: Management, Staff Support, Staff Engagement, Leadership, Communication

Stepping into Management During a Pandemic: What have we learned?

Adam Schuyler, Nichole Kruse

Murraysmith, United States of America; Adam.Schuyler@murraysmith.us, Nichole.Kruse@murraysmith.us

Nichole and Adam both took on new roles within the organization as the COVID-19 pandemic started to spread in early 2020, significantly disrupting the status quo. Nichole was promoted to Group Manager and Adam to Puget Sound Regional Manager and Corporate Management Team member. They were both charged with unifying and growing the Puget Sound Region that operates in four offices, and improving regional performance across multiple metrics (i.e., revenue, sales, profit). At the end of 2020, the Puget Sound region had met and, in certain areas, exceeded its performance goals, making significant strides towards operating as a cohesive region.

During the presentation, Nichole will share what she has learned as a first-time staff manager. Adam will share his experiences stepping into new roles and what has changed or shifted from his previous experience managing staff during “normal” non-pandemic circumstances. The presentation will include a discussion of lessons learned, and how they plan to apply their experiences moving forward in the era following the COVID-19 crisis.

Brief Biography and/or Qualifications

Adam Schuyler, PE, PMP, is the Puget Sound Regional Manager for Murraysmith. In his current role, Adam leads engineering staff management, project delivery, and business development efforts that align with the corporate strategies and initiatives of Murraysmith. Adam is responsible for the management and oversight of Murraysmith’s four offices located in the Puget Sound (Bellevue, Everett, Seattle, and Tacoma). He has 22 years of experience in engineering specializing in the design of pump stations, pipelines, utility planning, and hydraulics for municipal water and wastewater projects. Adam also has a passion for excellence in project management and project delivery. Adam is a Washington State University graduate with a B.S. and M.S. in Civil Engineering.

Nichole Kruse, PE, is a Puget Sound Group Manager for Murraysmith. In her current role, Nichole oversees and supports a group of roughly 13 engineers to help successfully deliver projects, achieve career goals, and meet regional delivery and business development goals. Nichole has 11 years of experience in engineering, specializing in municipal water and wastewater projects. Nichole is a Colorado State University graduate with a B.S. in Environmental Engineering. Her favorite part of her work is collaborating with her project teams and clients to identify project needs or issues, then implementing solutions to challenges.

3:45pm - 4:45pm

ID: 173 / Session 19B: 2

Main Technical Program

Topics: Leadership, Social Equity, Workforce Development

Keywords: Education, outreach, tool, virtual, video, field trip, tour, students, teachers, classroom, public, community

Developing New Tools for Virtual Outreach

Joanne Lind, Siri Nelson

LOTT Clean Water Alliance, United States of America; joannelind@lottcleanwater.org, sirinelson@lottcleanwater.org

Problem Statement

The LOTT Clean Water Alliance’s active education and outreach program helps forge strong connections with the community. LOTT has invested in their WET Science Center, partnerships with

local school districts, and public outreach that includes providing tours to community groups. When LOTT's treatment plant and WET Science Center had to temporarily close to the public because of the COVID-19 pandemic, we quickly changed our focus to develop strategies and tools for connecting with our community virtually. Using a collaborative process, we began creating new programming and outreach tools, including a virtual plant tour and virtual field trip.

Approach

A team of LOTT staff worked with a video production company to create a virtual tour and related videos to explain the wastewater treatment process, resource recovery, clean water careers, and what not to flush.

LOTT's education staff quickly shifted gears to produce a new live web-based program to continue serving our three partner school districts within LOTT's service area, and to continue to support science teachers and reach middle school students.

Results

Joanne Lind, LOTT's Public Communications Manager, worked with LOTT staff and a video production company, Twisted Scholar, to create an engaging and accurate portrayal of the treatment process. Staff were encouraged to contribute ideas and input in each step of production, resulting in a series of videos that everyone is proud of. Even after in-person tours resume, these videos will be used to increase accessibility for community members to learn about the treatment process.

The education team, led by Siri Nelson, Education Program Manager, created a virtual wastewater field trip program that incorporated input and feedback from teachers and district staff to ensure the program met the rapidly changing needs of virtual classrooms while remaining effective. The virtual field trips have received positive feedback, and the education program is on track for meeting outreach goals for the 2020-21 school year.

Conclusions

Presenters will discuss how they created virtual tools to continue to provide public outreach without in-person contact. They will offer lessons learned, best practices, and ways to use virtual tools to reach members of your community.

Brief Biography and/or Qualifications

Joanne Lind

Public Communications Manager, 2017 – present

LOTT Clean Water Alliance, Olympia, WA

Responsible for planning, developing, and implementing a broad range of public information, involvement, education, outreach, marketing, and internal communications, effectively engaging the public in LOTT programs and projects.

Communication & Outreach Unit Supervisor, 2005 –2017

Department of Ecology, Hazardous Waste & Toxic Reduction (HWTR) Program, Olympia, WA

Managed a team of professional staff to provide communication and outreach for the HWTR program. Responsibilities included planning, developing, and marketing outreach products and services to educate businesses and the public about hazardous waste and pollution prevention.

Siri Nelson, LOTT Clean Water Alliance

Education Program Manager, 2019 – present

LOTT Clean Water Alliance, Olympia, WA

Responsible for planning, developing, and managing LOTT's education program to further LOTT's mission and public engagement goals. This includes managing LOTT's interactive education center – the WET Science Center – and LOTT's partnerships and programming for out three local school districts.

Manager, Mercer Slough Environmental Education Center (MSEEC), 2015 – 2019

Pacific Science Center, Seattle, WA

Managed Early Childhood, Field Studies, Outreach and Youth Programming, budget and staff at MSEEC, a collaboration between the Pacific Science Center and the City of Bellevue. Program oversight included a nature preschool, experiential school field trip program, and an award winning high school internship program focused on environmental science and habitat restoration.

3:00pm - 4:30pm

Session 20B: Water Reuse - Livestream

3:00 pm to 3:45 pm

Session 20B: 1

Bob Davis

Case Study for Datacenter Cooling Water Reuse

The Quincy Water Reuse Utility (QWRU) has just been commissioned by the City of Quincy to treat non-contact cooling water for reuse back into a portion of the Quincy datacenters. Microsoft, Washington Department of Ecology, US Bureau of Reclamation, and the Quincy-Columbia Irrigation District have played major roles in the success of this utility; the first of its kind in the State of Washington. Non-contact cooling water blowdown is treated to remove cations and anions that reduce the efficiency of evaporative cooling and helps to reduce the volume of cooling water used. In the past, potable water has been used for cooling water; however, this water is very hard and contains high levels silica. Both components negatively impact the cooling equipment; requiring additional equipment maintenance to retain the equipment's cooling efficiency. The QWRU treats the cooling water to remove hardness and silica before being pumped back to the datacenters for cooling water. Cooling requires make-up water to replace from 60 to 80 percent water loss due to evaporation. Make-up water is provided by USBR M&I Water, potable water and, in the future, municipal Class A water. The QWRU consists of 10 distinct and specific water treatment unit processes to provide reuse water suitable for cooling. The QWRU is capable of providing from 2,304,000 to up to 3,600,000 gallons of treated water per day. Residuals from the treatment system is managed with on-site evaporation ponds and sludge management systems. The QWRU saves a precious potable water resource in an arid region of Washington State and will save up to 398,000,000 gallons of potable water in a year; enough to provide 5,450 residents potable water for a year.

Brief Biography and/or Qualifications

Bob Davis
Worley Group
Bob.Davis@advisian.com

Bob Davis has been delivering water projects for over 45 years both inside and outside of the United States. His experience in all as aspects of a water project; study, design, construction, commissioning & start-up, operator training, and troubleshooting provides client with high quality, cost-effective water facilities. With a Master's Degree in Civil Engineering (Water Emphasis) from the University of Illinois, Bob started his career in the Pacific Northwest in Corvallis, Oregon with CH2M HILL. After traveling throughout the United States and some over-seas experience, he is now back in the Pacific Northwest; a great place to live and work. Over the last 3 years, Bob's assignment has been to deliver the Quincy Water Reuse Utility to treat and reuse non-contact cooling water from the Quincy datacenters with multiple make-up water options.

Presentation Development with:
Bob Davis, Worley Group - Presenter
Pat Haley, City of Quincy
Ariel Belino, City of Quincy
Carl Worley, City of Quincy
Brien Waldron, Microsoft
Robert Moyer, Microsoft

3:45 pm to 4:45 pm

Session 20B: 2

Haili Matsukawa

Strategic Planning: the key to internal alignment and program momentum

Can't seem to reach agreement? Often times, project progress is stifled by a difference of opinions. How can we create alignment among technical professionals, management, elected officials, and ratepayers?

Meaningful engagement, clear goals, consistent communications can create the synergy needed to get complex programs off the ground and the momentum required to carry them out. Even within a

divided community, strategic planning can identify common threads, shared values, and a desired vision of the future.

Using regional and interstate case studies, we will discuss how strategic planning, inclusive communications, and two-way engagement create alignment, public trust, and confidence in water reuse solutions. This interactive session will provide you with the tools and tactics needed to turn barriers into breakthroughs.

Brief Biography and/or Qualifications

Haili Matsukawa, MPPA
Strategic Communications Project Manager
Water System Consulting, Inc.
hmatsukawa@wsc-inc.com

Haili Matsukawa is an accomplished communications professional with Water Systems Consulting, Inc. (WSC), specializing in strategic planning, community outreach, stakeholder coordination for water agencies. Before joining WSC, Haili served as a Management Analyst for the City of Ventura, responsible for the department's water efficiency programs, outreach, and engagement efforts. She has developed and executed strategic communication plans for complex initiatives, including advanced capital improvement programs, water supply projects, and utility rate increases.

With years of experience working as a public servant, Haili brings a strong understanding of the emerging challenges and opportunities facing local government and public utilities. Haili is a thoughtful facilitator with a passion for community-driven solutions.

She holds a Bachelor of Science in Environmental Science and a Master of Public Policy and Administration. With years of experience working as a public servant, Haili brings a strong understanding of the emerging challenges and opportunities facing local government and public utilities.

Date: Wednesday, 15/Sept/2021

8:00am - 10:15am

Session 21A: Facility Operations - Livestream

8:00am - 8:45am

ID: 183 / Session 21A: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Facility Operations & Maintenance, Wastewater Treatment Process

Keywords: Alkalinity, Chemical, Treatment

Exploring an Alternative Alkalinity Source - Full Scale MBR Pilot Using Ultra-Fine Calcium Carbonate

Anthony Benavidez[1], Jeremy Weisser[2], Stan Heimburger[3]

[1]Jacobs, United States of America; [2]Columbia River Carbonates, Woodland, WA; [3]Heimburger & Company, Blaine, WA; anthony.benavidez@jacobs.com, jweisser@carbonates.com, stan@heimburgerandco.com

Jacobs and Columbia River Carbonates worked closely together in 2020 to trial alternative RAS alkalinity and pH control at the 8.0 MGD Spokane County Regional Water Reclamation Facility (SCRWRF) operating in Spokane, WA. Jacobs has had responsibility for operating this facility for Spokane County since its start-up in 2011. Currently, the SCRWRF uses nearly 100% of its Class A reclaimed water for Spokane River streamflow augmentation. The remaining amount is used for process water and irrigation of the facility site. This membrane bioreactor (MBR) facility uses state-of-the-art membrane technology and is designed to meet or exceed Washington State Department of Ecology permitted limits for contaminants in discharged effluent.

In June 2020 Jacobs and Columbia River Carbonates began a full-scale pilot replacing the 25% active sodium hydroxide with Microna™ Aquacal 70, a 70% active micronized calcium carbonate aqueous slurry, for alkalinity and pH control of mixed liquor in the MBR. At this facility, phosphorous removal from wastewater is achieved by addition of ferric chloride in 1st and 2nd stage treatment. This trial of Aquacal 70 continued for 90 days while closely monitoring wastewater quality and membrane permeability while maintaining standard operating conditions.

Results from the Aquacal 70 operating period that began in late June and continued until the end of September 2020 were found to a) fully replace NaOH in mixed liquor with a significantly lower volume (and operating cost) requirement, b) decrease variability of alkalinity and pH in MBR mixed liquor, c) have no negative impact on membrane functionality during or after the trial d) decrease the requirement for 25% sodium hydroxide added for final effluent pH control, and e) increase solids content of sludge and cake to waste from anaerobic digestion. These will be fully documented and presented.

Additionally, extensive use of a similar product at municipal and industrial wastewater treatment plants in Western Europe – and particularly in Germany, Austria, and Switzerland, built confidence in the trial and use of Aquacal 70 by Jacobs at the SCRWRF.

Brief Biography and/or Qualifications

Anthony Benavidez - Anthony is the Assistant Project Manager at the Spokane County Regional Water Reclamation Facility in Spokane, WA. He has over 15 years experience operating wastewater treatment facilities throughout the country holding operator licenses in three different states. Anthony was instrumental in the start up and continued operation of the 8.0 MGD Facility in Spokane. He continues optimization at this facilities and has aided other facilities throughout the company to optimize those plants.

Jeremy Weisser is a graduate from Central Washington University with degrees in Biology and Chemistry. Out of college Jeremy took a job at Columbia River Carbonates in research and development. This was a prime opportunity to travel to customer locations and problem solve on a regular basis, learning customer needs and then developing products that would meet those needs. Focusing primarily in paper markets to start, Jeremy has developed a detailed understanding of industrial chemicals used in water treatment. After 13 years with CRC, he is now using that background to bring new products to market in order to optimize waste water treatment alkalinity demands.

Stan Heimburger is President & CEO of Heimburger & Company, inc., an environmental consulting company dedicated to working with municipal, industrial and government entities in the Western U.S. with a focus on those that operate in the Pacific Northwest. Stan earned a BS in Chemical Engineering from Missouri University of Science and Technology (Rolla, MO), an MBA from Duquesne University (Pittsburgh, PA) and has operated Heimburger & Company for over twenty years.

8:45am - 9:30am

ID: 150 / Session 21A: 2

Main Technical Program

Topics: Wastewater 101, Facility Operations & Maintenance, Utility & Assessment Management

Keywords: Septage, high-strength waste, nutrients

Septage: Regional Water Quality and Practical Considerations in Managing and Treating High-strength Wastes

Patrick Roe

HDR, United States of America; Pat.Roe@hdrinc.com

In Washington State, there are nearly 950,000 individual on-site wastewater disposal systems, primarily septic tanks connected to drain fields. Recommended practice is for the septic tank contents to be removed for disposal every 3 to 4 years. Historically, septage collected from septic tanks has been treated in publically-owned treatment works (POTWs). This presentation will address septage characteristics, water quality objectives, vehicle management, and in-plant handling of septage.

A large number of septic systems exist in the Puget Sound basin in western Washington. On-site sewage system management areas have been formed in basins with critical water quality considerations to ensure the proper management of septic systems to protect water resources. Septage treatment in municipal treatment plants is therefore consistent with regional water quality objectives.

However, there are also drivers away from septage receiving at POTWs. Due to declining water quality in Puget Sound, nutrient loading caps will soon be implemented, and nitrogen limits will follow. An individual utility could chose to restrict septage receiving to meet near-term nutrient discharge loading caps, contrary to regional water objectives. Also, microorganisms in biological nutrient removal systems are sensitive to heavy metals which are typically prevalent in septage. Future restrictions on septage receiving may be necessary to protect biological nutrient removal processes.

Septic tank effluent pump (STEP) collection systems have become common in some areas. The disadvantages and disadvantages to a utility of accommodating STEP systems will be discussed.

The final part of the presentation will review practical considerations for managing vehicles on treatment plant sites and designing septage receiving facilities at municipal wastewater treatment facilities. At many facilities, septage is introduced into influent wastewater, but other facilities have had success with feeding septage into solids handling processes. Alternate methods of introducing the septage into the treatment process will be discussed and examples presented.

Brief Biography and/or Qualifications

Pat Roe is the wastewater treatment program manager in HDR's Bellevue office. He has 41 years of experience as a consulting wastewater engineer.

9:30am - 10:15am

ID: 151 / Session 21A: 3

Main Technical Program

Topics: Facility Operations & Maintenance, Wastewater Treatment Process

Keywords: phosphorus, sludge, clarifier, denitrification

Return Activated Sludge Rate Impacts to Biological Phosphorus Removal

Brent Deyo[1,2], Erik Coats[2]

[1]T-O Engineers; [2]University of Idaho; bdeyo@to-engineers.com

Biological phosphorus removal (BPR) is necessary to realize sustainable recovery of phosphorus from wastewater. In achieving BPR, perhaps the most accepted characteristic of a successful process is the necessary cycling of a mixed microbial consortium through anaerobic and aerobic conditions. Key to the anaerobic state is the absence of nitrate. However, most BPR facilities, which commonly achieve nitrification and operate with pre-anoxic denitrification, have moderate to significant levels of nitrate within their return activated sludge (RAS). It has been suggested that nitrate can be reduced by slowing the RAS rate such that organisms within the secondary clarifier can perform denitrification, thereby reducing the concentration of nitrate within the RAS. Even though RAS is the backbone of all activated sludge treatment, there appears to be little research on the impacts of RAS rate on overall system performance, as well as BPR specifically. There is also limited understanding on the specific impact of nitrate loading on the BPR system and the anaerobic capacity for nitrate. To investigate these topics further, a full-scale water resource recovery facility (WRRF) performing BPR was monitored before and after RAS rate changes to assess and evaluate impacts to the BPR process. Denitrification was assessed in the secondary clarifier, and key anaerobic BPR metabolisms were

evaluated. Correlations noticed within the full-scale system were investigated further with batch tests and process modeling software. Data indicates that even low nitrate loads can have a significant impact on the BPR system but may not lead to a noticeable change in effluent phosphorus concentrations until a failure-inducing nitrate load is reached. The findings from this research will help guide WRRF operators to make informed decisions related to adjusting RAS rate to enhance and maintain BPR. Results will also lead to more stable operation and application of BPR.

Brief Biography and/or Qualifications

Brent Deyo is currently a practicing consulting engineer at T-O Engineers. He recently earned his MSc in Civil Engineering from the University of Idaho where this research was conducted. He received his BSc in Environmental Engineering from Oregon State University in 2014 and has worked within the consulting engineering industry since 2015.

8:00am - 10:15am	**Session 22A: Innovation & Technology**

8:00am - 8:45am

ID: 119 / Session 22A: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Wastewater Treatment Process, Industrial Pre-Treatment

Keywords: PFAS, Ground Water Remediation, Ion Exchange, Granular Activated Carbon

Installation, Startup, and Operation of World's First Regenerable Resin System for PFAS Removal

Patrick McKeown. PE[1], Steve Woodard. PhD[1], Tim Gould[2]

[1]ECT2; [2]Ahtna Engineering Services, LLC; nmbolea@ect.com

The United States Air Force Civil Engineering Center (AFCEC) is conducting on-going response activities to remove and remediate groundwater impacted by poly- and perfluoroalkyl substances (PFAS) at the former Pease Air Force Base in New Hampshire.

AFCEC responded by contracting with Wood Group PLC to conduct a side-by-side pilot test in 2016, comparing the performance of Emerging Compound Treatment Technology's (ECT2) regenerable ion exchange (IX) resin and bituminous granular activated carbon (GAC). The regenerable resin system was selected for full-scale application, based on system performance and a lower overall lifecycle cost than GAC.

A 200-gpm system was provided to meet the primary project objective of producing treated water with combined PFOS plus PFOA concentrations below the 70 ng/l Health Advisory Level (HAL). The full-scale IX resin system was installed from fall 2017 through spring 2018.

The PFAS remediation system has treated more than 31 million gallons of groundwater having a total average influent PFAS concentration of 55 µg/l. The effluent quality from the IX resin system has been consistently non-detect for PFOS and PFOA, readily achieving compliance with the 70 ng/l HAL target.

Five successful resin regenerations have been performed to date. Operational modifications have been made to address and correct minor challenges with the distillation system, and regenerant recovery and super-loading processes have proven successful. The original superloading media is still operational, having removed and concentrated greater than 99.99 percent of the recovered PFAS mass, and therefore no PFAS waste has needed to be hauled off site to date.

Brief Biography and/or Qualifications

After graduating from the University of Maine with a degree in Civil and Environmental Engineering, Mr. McKeown began his career in the environmental engineering field, focusing on wastewater and stormwater design. Mr. McKeown then joined ECT2 as an engineer on the design and fabrication team, building and operating systems treating PFAS contaminated water on project sites around the globe. After earning his Professional Engineering license in Maine, he transitioned to the business development team, where he currently manages the northeast and southeast United States markets.

8:45am - 9:30am

ID: 246 / Session 22A: 2

Main Technical Program

Topics: Treatment Innovation and the Future, Wastewater Treatment Process

Keywords: Phosphorus, tertiary membrane, tertiary filter

A Pilot Scale Evaluation of Coagulant Selection and Dose on HF UF Membrane Performance at the West Boise Water Renewal Facility

Dan Hugaboom[1], Ryan Anderson[2], Brad Jeppson[1]

[1]Carollo Engineers Inc, United States of America; [2]City of Boise; dhugaboom@carollo.com

In 2019, the City of Boise completed a pilot study of tertiary coagulation and hollow fiber microfiltration and ultrafiltration (MF/UF) membrane technologies at its West Boise Water Renewal Facility (WBWRF) for phosphorus removal. The work was done to support planning for plant improvements required to comply with anticipated reductions in phosphorus discharge limits from the WBWRF.

The pilot study investigated the performance of a wide range of coagulants and membrane technologies to achieve two primary process goals:

1. Tertiary treatment train effluent total phosphorous of less than 0.1 mg/L TP-P. Five coagulants were tested across a range of doses to meet the TP goal without overloading the membrane process with coagulated solids. Ferric chloride, ferrous chloride, alum, ACH and RE300 (cerium chloride) were evaluated to achieve a treatment goal of reducing TP from approximately 1 mg/L in the secondary effluent to <0.1 mg/L.
1. Demonstrate reliable membrane performance. Membrane performance was evaluated using quantitative goals for maximum fouling rates, residuals production and off line chemical cleaning frequency. Three different membrane systems, each with unique design and performance characteristics were evaluated for this application. They include pressurized (cartridge style) UF membrane and two submerged (vacuum driven) systems. The experimental matrix allotted significant amount of time for optimizing backwash, air scour, cross flow and chemical cleaning strategies as well as a range of flux rates.

Below doses of about 5 mg/L (as product), membrane fouling was low and chemical cleaning cycles met goals for maximum allowable frequency, however filtered effluent TP did not consistently meet the goal of <0.1 mg/L. As required dosages increased to meet filtrate TP goals, more energetic and frequent cleaning strategies were necessary to meet membrane performance goals. This presentation will include a detailed analysis of phosphorus removal across the range of coagulants, as well as membrane process performance.

Brief Biography and/or Qualifications

Dan Hugaboom is a senior technologist with Carollo Engineers, specializing in design and operation of membrane systems.

9:30am - 10:15am

ID: 297 / Session 22A: 3

Main Technical Program

Topics: Treatment Innovation and the Future

Keywords: innovation, sustainability, CO2e, technology, efficiency

The Facility of The Future for the Utility of the Future

Layne McWilliams

Cascade Energy, Inc., United States of America; layne.mcwilliams@cascadeenergy.com

The “Utility of the Future” program has given a name to the management and organizational principles that will be needed for wastewater organizations to thrive in the years to come. Features include professional training programs, labor recruiting programs, CMMS programs, improved public and customer relations, collaborative working relationships with regulators, resiliency for extreme events, energy management programs, etc.

But, what about the physical plant? In many ways, most of the new plants being built today would look familiar to a time-traveling engineer from the 1950’s. Part of this is expected – for very good reasons, our industry is slow to embrace new ideas until they are proven out through many years of full-scale use.

My hypothesis is that our industry could create some VERY different facilities if the design requirements were changed. I propose to collect, organize, and share ideas from volunteers from at least 10 separate PNCWA-member engineering firms and vendors who will help answer this question: If you were asked to design a 5 MGD, greenfield facility located near Coeur d’Alene, to meet a 5/5/1 standard, year-round, that would minimize the total carbon footprint of its construction and operation over 30 years, what features would you include? You must select from materials, equipment, and processes that are currently commercially available somewhere in the world, though it does not need to be used currently in the wastewater sector. Ideas for collection and disposal alternatives will also be welcomed.

For the conference, we will present a design summary of each major process area and briefly describe the alternatives and the reasoning for them suggested by the survey participants. The calculations and assumptions for embedded and operational CO2e will be summarized along with the pros and cons of each alternative. The names of volunteers will be shared but will not be associated with specific solutions.

The over-arching goal of the presentation is to provide new ideas to the audience and show what might be achieved when efforts are focused not on lowest first cost but on lowest ultimate impact to the environment.

Brief Biography and/or Qualifications

Layne McWilliams started his career on the jobsite of a large wastewater construction project and was involved in the design and construction of water and wastewater infrastructure for 15 years. For the past 11 years, he’s worked with the aquafficiency team at Cascade Energy trying to atone for the energy sins he committed as a designer. As part of

that effort, he spends a good deal of time helping water and wastewater systems through strategic energy management engagements. He is a PE with a Mechanical Engineering degree from MIT and a law degree from Lewis & Clark Law in Portland, OR. He lives in Hayden, ID with his wife Margaret, who find themselves, with the exception of two big dogs, recent and somewhat sad “empty nesters.”

8:00am - 10:15am	Session 23A: Construction & Alternate Delivery: Collaboration & Communications - Livestream

8:00am - 8:45am

ID: 299 / Session 23A: 1

Main Technical Program

Topics: Construction & Alternate Delivery, Leadership, Social Equity, Workforce Development, Resiliency, Planning, Climate Science

Keywords: Change, Resiliency, Teamwork, COVID, Communication

Building Resilient Communities Through Building Resilient Teams

Josh Baker[1], Jeff Hodson[2], Mike Zeltner[3], Tyler Resnick[4]

[1]City of Boise; [2]Jacobs; [3]Brown and Caldwell; [4]McAlvain Companies, Inc.; jcbaker@cityofboise.org, jeff.hodson@jacobs.com, mzeltner@brwncald.com, tylerr@mcalvain.com

Four years ago, the Lander Street Water Renewal Facility Phase 1 Improvements project team set out to create a resilient team that could deliver the City of Boise's largest construction project in recent history. The project was well under way replacing deteriorating infrastructure when the global pandemic hit. This presented many different challenges which have changed the way we all work. Throughout this experience, our patience has been tested, relationships strained, and processes challenged, but the work put into developing the team paid dividends throughout those difficulties.

The City selected the Construction Manager/General Contractor (CM/GC) delivery model for this project and elected to bring the CM/GC into the project at the start of the engineering effort. This allowed for early team chartering and branding to prevent tripartite silos from forming. The project team quickly adapted the mindset of "we are protectors of infrastructure and of the Boise River."

One of the key attributes of the project team's approach is their willingness to challenge the status quo and modify a process if it is not working as intended. An example of this is the design coordination log (the process formerly known as requests for information). This use of this log has resulted in issuing early engineering clarifications that have outpaced subcontractor questions and allowed work in the field to progress without delays.

The project team has also enhanced communication by using multiple, real-time methods between engineering and field staff while leveraging asynchronous communication to manage the project narrative with stakeholders. The result has been optimized teamwork and collaboration, better informed management, increased communication with subcontractors, and decreased risk of miscommunication.

The project to date has not lost any schedule (even considering COVID) and has a deductive change order value while being almost halfway complete. This is attributed to the strong relationships that have formed and the resilient team approach that has been taken. The lessons that have been learned are being applied to the next phase of improvements in an effort to continue to overcome difficult situations and create our future.

Brief Biography and/or Qualifications

Josh is a project manager for the City of Boise's Water Renewal Engineering Department. He is currently the project manager for the Lander Street Phase 1 improvements project. He has been in the water/wastewater industry for the past 8 years working on projects across Idaho focusing mostly on wastewater design and construction. He graduated from Boise State University in 2012 with a B.S. in Civil Engineering. Josh prefers a hands-on approach to engineering spending time in the field.

Jeff is a project manager in Jacobs' Boise office with more than 20 years in the engineering profession. His experience includes managing a variety of projects in the water, wastewater, and facilities markets, with emphasis on multi-discipline delivery of complex projects. He is a graduate of Utah State University (go Aggies!) with BS and MS degrees in Civil Engineering. When not in the office or at a construction site, he loves getting into Idaho's backcountry with his friends and family.

As a Construction Manager and General Contractor, Tyler Resnick has had the opportunity to work on numerous water and infrastructure projects. He has experience as an early preconstruction collaborator and construction manager on interesting water, urban and infrastructure projects in the Treasure Valley such as the Dixie Drain Phosphorus Removal Facility, Grove Plaza Renovation, and the Lander Street Water Renewal Facility Improvements Program. Throughout his career, he has had an emphasis on planning, handling and treating of water and wastewater infrastructure that drives his passion for responsible development.

Mike is a senior project manager and design engineer with experience leading and supporting multidiscipline and multi-consultant teams throughout the planning, design, and construction of drinking water and wastewater treatment systems. His expertise includes project management, process mechanical design, and construction support for new and improved facilities. Mike also leads BC's Project Management Office efforts in the Pacific Northwest.

8:45am - 9:30am

ID: 233 / Session 23A: 2

Main Technical Program

Topics: Construction & Alternate Delivery, Collection and Conveyance

Keywords: Progressive Design Build, Collection System, mitigate impacts on operations, evaluation of alternatives

Pumping Up Communication Through Progressive Design Build

Katie Spilker[1], Amanda Mesick[1], Jessica MacClanahan[2]

[1]Kennedy Jenks Consultants; [2]City of Bend; AmandaMesick@kennedyjenks.com, jmacclanahan@bendoregon.gov

The City of Bend's North Interceptor Sewer Project (NISP), identified in the Collection System Master Plan (CSMP), consists of design and construction of a sewer transmission system to accommodate the City's growth plans, policies, and incorporate redundancy into the system. Along with serving an expanding UGB, the proposed alignment also allows for the decommissioning of up to ten (10) lift stations as an added benefit.

At the confluence of the existing Plant Interceptor and the newly planned NISP, a critical deficiency in hydraulic capacity for future growth was identified. It required the evaluation of alternatives for pipeline sizing, configuration, and routing, with an overall goal to set the City of Bend up for success long into the future. Through a collaborative decision-making process, our team leveraged a broad range of City stakeholders and arrived at a consensus to add an influent pump station at the Water Reclamation Facility (WRF). As a result, a significant challenge emerged with how to limit impacts on WRF operations during start-up and testing of the pump station.

This presentation will outline the vision and drivers for this project, along with sharing a success story on how utilities can use Progressive Design Build to deliver projects that mitigate impacts on operations. Attendees will learn about developing an integrated team, establishing the correct level of communication, and lessons learned that can be applied to future projects. Finally, the presentation will focus on creating a culture of change in project implementation that emphasizes integration of operations into the decision-making process. Pumping up Communication through Progressive Design Build resulted in a seamless transition from a gravity-fed treatment plant to one supplied by an influent lift station at the City of Bend's WRF.

Brief Biography and/or Qualifications

Jessica MacClanahan, PE, PMP:

Jessica has been with the City of Bend since 2016 and currently serves as a Principal Engineer managing the City's Collection System Capital Improvement Program. Jessica is responsible for managing all aspects of the design and construction of City infrastructure projects including project scope, budget, schedule, quality and safety. She serves as Project Manager for the North Interceptor Sewer Line phases 1 & 2 that includes 28,000 LF of large diameter sanitary sewer pipeline, irrigation canal crossings, numerous trenchless crossings, and an influent pump station at the Water Reclamation Facility.

Amanda Mesick, PE:

Amanda has over 10 years of experience as a civil engineer, specializing in the planning and design of municipal conveyance systems, hydraulic and hydrologic modeling, and utility performance. Recent project work has been focused on municipal pipeline and pump station design. Along with design, Amanda also is experienced at managing projects under construction.

9:30am - 10:15am

ID: 248 / Session 23A: 3

Main Technical Program

Topics: Construction & Alternate Delivery, Wastewater Treatment Process, Recycled Water & Resource Recovery

Keywords: Collaboration, Reuse, Class A Biosolids, GC/CM, Cultural Resources, Construction, Membranes

Going Beyond Expectations: Collaborating to Deliver an Award-Winning Facility

Michael Borrero[1], Brett Arvidson[2]

[1]Carollo Engineers, United States of America; [2]City of Oak Harbor; mborrero@carollo.com

The City of Oak Harbor (City) completed construction of its new $125 million Clean Water Facility (CWF) producing Class A reclaimed water quality effluent to the Puget Sound. Two overriding project goals for the City were protecting the environment and constructing a facility that was integrated into the community. With the greenfield CWF located downtown and adjacent to the waterfront Windjammer Park, the City incorporated architectural features and park amenities with the CWF project to become a civic asset woven into the community fabric.

Getting the project permitted and completed on schedule was a complex task due to site constraints, environmental restrictions, and the likelihood of encountering cultural resources. The City became one of Washington State's first wastewater projects to be delivered under the alternative project delivery approach of a heavy-civil General Contractor/Construction Management (GC/CM). The GC/CM's suggested approach shortened construction by 2 years from a conventional design-bid-build project by including:

- Early procurement and segmented work packages proceeding during design
- Development and timing of design packages to always keep the GC/CM productive

Schedule related challenges were ultimately overcome by developing a genuine partnership with an eye to keeping quality expectations high. Implementation of these early design packages were successful and reinforced positive work relationships with the City, Engineer and GC/CM Contractor.

Presentation will include specifics on:

- Lessons learned of the project challenges including start-up and commissioning
- Collaborative efforts examples between the Engineer, City and GC/CM to integrate the CWF into the community
- Results to the cultural resources approach

The efforts to bring the CWF to life have been recognized by the national American Public Works Association (APWA), American Council of Engineering Consultants (ACEC) and the Engineer-News Record (ENR) Best Projects for the Pacific Northwest region.

Brief Biography and/or Qualifications

Mr. Borrero has 23 years of experience in the design and construction of water and wastewater facilities. He worked on the design of the Oak Harbor Clean Water Facility and served as its Resident Engineer.

8:00am - 10:15am	**Session 24A: Risk Assessment & Emergency Response - Livestream**

8:00am - 8:45am

ID: 176 / Session 24A: 1

Main Technical Program

Topics: Risk Assessments and Emergency Response, Resiliency, Planning, Climate Science

Keywords: Strategic Planning, Resiliency, Emergency Preparedness

Assessment of Critical Dependencies for Rapid Disaster Recovery

Wayne Gresh[1], Dave Breitenstein[2], Kent Yu[3]

[1]Carollo Engineers; [2]City of Eugene, OR; [3]SEFT Consulting Group; wgresh@carollo.com, DBreitenstein@eugene-or.gov

The Metropolitan Wastewater Management Commission (MWMC) mission is to protect the community's health and environment by providing high-quality wastewater services to the Eugene-Springfield metropolitan area. In alignment with that mission, MWMC identified and assessed critical dependencies that could impact its ability to respond and recover from a disaster. The effort was part of developing a Disaster Mitigation and Recovery Plan that assessed expected performance of conveyance and treatment facilities and outlined actions and upgrades needed to achieve Oregon Resiliency Plan level of service goals for the Cascadia Subduction Zone earthquake and MWMC's internal goals for a catastrophic flood adjusted to reflect climate change effects.

To identify critical dependencies, staff used a matrix provided by its consultant team to explore and rank what was most needed for disaster response and recovery. This effort identified employee and family preparedness; City and regional roads; telecommunications; post-event structural assessments; up-to-date Emergency Operations and Continuity of Operations plans; power; data; vendor and shipping services; fuel; and post-event mechanical, electrical, and plumbing assessments as the ten most critical dependencies.

Each of the critical dependencies were assessed by the consultant team in partnership with staff members. This included (a) staff responding to a survey that assessed employee and family preparedness and (b) identifying critical materials and supplies and the respective vendors. The consultant team worked with staff and Eugene and Springfield Emergency Managers to develop actions that could be taken to be better prepared and minimize the potential for cascading failures.

MWMC has found this effort very valuable to gain a better awareness and understanding of the critical dependencies through staff engagement. The effort provided a direct benefit in the effort needed to respond to the COVID-19 pandemic. In March 2020 Eugene updated its continuity of operations plan, one of the dependencies identified. Based on that update they were prepared and successfully implemented procedures to address chain of command, reduced staffing, and accounting procedures needed during the emergency. This presentation will focus on the critical dependencies identified and the actions outlined to better prepare for disaster response and recovery.

Brief Biography and/or Qualifications

Wayne Gresh is a project manager with over 40 years experience in planning, design, and construction of wastewater conveyance and treatment facilities. He has led and/or participated on several vulnerability and resiliency planning efforts for utilities throughout the PNW, helping them to prepare for the Cascadia Subduction Zone earthquake and other disasters.

Dave Breitenstein is the Wastewater Division Director for the City of Eugene, where he manages the operation of MWMC's wastewater facilities. Dave has 39 years of experience in wastewater operations. He earned a Bachelor of Science degree from Linfield College and an Associate of Science degree in Water/Wastewater Technology from Linn-Benton Community College.

Dr. Kent Yu is Principal of SEFT Consulting Group located in Portland Oregon. He is a nationally recognized champion for community resilience planning, and have been involved in more than 20 resilience planning projects in the Pacific Northwest.

8:45am - 9:30am

ID: 231 / Session 24A: 2

Main Technical Program

Topics: Risk Assessments and Emergency Response, Resiliency, Planning, Climate Science

Keywords: Seismic; Resilience, Infrastructure, Assessment; Earthquake

Seismic Resilience and Implications on Critical Infrastructure

Scott Schlechter, Jason Bock

GRI, United States of America; sschlechter@gri.com, jbock@gri.com

The Cascadia Subduction Zone (CSZ) located off the coast of Washington, Oregon and California can produce some of the largest earthquakes (magnitude 9.0) in the world. Over the past 10,000 years, this fault has had 41 significant ruptures with the last large event in 1700. This equates to an approximately 30% chance of another major rupture (Mw 8+) in the next 50 years. Oregon legislature recognized the potential hazard and in 2013, the Oregon Seismic Safety Policy Advisory Commission published the Oregon Resilience Plan to determine likely impacts of a CSZ earthquake. The plan addresses acceptable timeframes to restore infrastructure after an earthquake/tsunami event and changes that Oregon can take to reach resilience targets. During the plan's development, a Water and Wastewater Task Group was created to review vulnerabilities of the state's pipelines, treatment plants, and pump stations. Per the findings of the plan, drinking water and sewer infrastructure could take up to three years to restore services. Since then it has been left to individual agencies to figure out what to do with aging infrastructure and ways to reduce the damage a CSZ earthquake will have on critical drinking water and sewer systems. Navigating various seismic codes and identifying the right plan is not an easy task. The Oregon Resilience Plan is not specifically tied to design code guidance and therefore there is not a clear approach to seismic resiliency that will be the right fit for every agency. This presentation will focus on how owners and design teams can collaborate to prepare a risk assessment model that will establish how to define resilience, system impacts, and solutions for mitigation. A case study completed at the Port of Portland will demonstrate how to implement a risk assessment model. Through the case study, we will cover the roles of the owner and designer, hazard identification, risks to the economic structure, developing practical mitigation strategies, and cost-benefit analysis. Key takeaways will include steps for understanding state and regional expectations for resilience, demystifying seismic analyses and design, and strategies to prepare infrastructure to be resilient.

Brief Biography and/or Qualifications

Jason Bock, PE

Principal

Jason brings 14 years of experience with all phases of investigation, design, reporting, construction specifications, and contract administration for a variety of projects. Jason's core focus is on seismic engineering and seismic resiliency. Jason is actively involved with Earthquake Engineering Research Institute and ASCE 7-22 subcommittees, he is shaping the profession's understanding of the interaction of seismic forces on soil and structures and brings a deep understanding of complex methodologies and equipment.

Unique Expertise:

~Specializes in interaction of seismic forces on soil and structures and brings a deep understanding of complex design methodologies and equipment.

~Promotes community awareness for preparation of a major seismic event.

~Designed practical and constructible foundation solutions for critical infrastructure in seismically hazardous areas.

~Recipient of the American Council of Engineering Companies (ACEC) National 2020 Young Engineer of the Year.

~Actively involved in current research focusing on seismic hazards in the Pacific Northwest.

Scott Schlechter, PE, GE, D.PE

Principal

Scott Schlechter is a principal with GRI and has 20 years of experience completing a wide range of geotechnical studies that have focused on challenging soil-structure interaction, deep foundation design, liquefaction studies, and ground improvement for reservoirs, pump stations, water and wastewater treatment plants, pipelines, and waterfront facilities. Scott leads GRI's seismic design group that has completed seismic upgrade studies for many essential water infrastructure projects. He actively participates in industry forums for improving and refining the seismic engineering guidelines.

Unique Expertise:

~Has helped develop, refine, and implement the seismic design requirements for the Willamette Water Supply Program.

~Has extensive deep utility design experience in representative hazardous soil conditions.

~Recognized expertise in seismic hazard evaluations and applications for critical infrastructure in the Pacific Northwest.

~Has developed site-specific deformation criteria and reviewed ground improvement and seismic mitigation for numerous critical riverfront infrastructure projects.

9:30am - 10:15am

ID: 162 / Session 24A: 3

Main Technical Program

Topics: Utility & Assessment Management, Risk Assessments and Emergency Response

Keywords: Risk, Resource, Treatment, Planning, Water

Regional Water System Risk Analysis and Planning

Jason Hurless[1], **Byron Smith**[2]

[1]Stantec Consulting Services Inc., United States of America; [2]City of Hermiston, Oregon;
jason.hurless@stantec.com, bsmith@hermiston.or.us

The City of Hermiston and the Port of Umatilla are partners in the ownership and management of the Regional Water System (RWS) located in the Greater Hermiston, OR area. The RWS was created in the mid-1990's to convey up to an ultimate flow of 27,000 gpm of Columbia River water to connected and rate paying users. The water is pulled from just upstream of the McNary Dam by the Intake Pump Station and conveyed through nearly nine miles of 42-inch Ameron pipeline to booster stations, a water treatment plant and the end users. These users range from food processors, power generating facilities, data centers, agricultural growers and the City of Hermiston for potable water treatment. The RWS infrastructure is nearly 30 years old, however, the number of users and the sophistication of the system has expanded greatly since it's creation. With the aging facilities in mind and overall economic importance of the RWS increasing, the RWS requested that Stantec Consulting Services Inc. perform the RWS's first facility plan. As part of this facility planning effort, Stantec performed a condition assessment on the RWS facilities and worked closely with the users, City and the Port on a system by system risk evaluation. The risks were assigned occurrence probabilities and associated costs if the risks were realized. The weighted risks were monetized and ranked for prioritization purposes. Three main output were developed resulting from this effort:

1. *Future projects were prioritized and an overall CIP for the system established.*
2. *Targeted emergency reserve funds were established to manage the potential risks.*
3. *Non-potable and potable water rates were updated to create adequate reserve funds as part of the risk mitigation strategy.*

The CIP framework was finalized and communicated to the users with the first year of capital upgrades projects underway.

Brief Biography and/or Qualifications

Mr. Nick Smith is a Principal Project Manager and civil engineer with Stantec Consulting Services Inc. out of the Boise, ID office. Mr. Smith has 20 years experience in facility planning, wastewater treatment and water conveyance systems and has performed work on the Regional Water System for nearly ten years.

Mr. Byron Smith is the City Manager for the City of Hermiston, OR.

8:00am - 10:15am	**Session 25A: Collection & Conveyance**

ID: 236 / Session 25A: 1

Main Technical Program

Topics: Collection and Conveyance

Keywords: Collection, Rehabilitation, Manholes, Corrosion

Corroded Manhole Assessment, Rehabilitation Design, and Construction

Neil Jenkins[1], Chris Kossow[2]

[1]Jacobs, Boise ID; [2]Eagle Sewer District, Eagle ID; neil.jenkins@jacobs.com, ckossow@eaglesewer.org

Concrete manholes should have more structural strength than peanut butter, but PB-consistency concrete is exactly what Eagle Sewer District found as they conducted their periodic inspection of one section of collection system manholes. The culprit was found to be hydrogen sulfide corrosion from two nearby forcemain discharges. These forcemains, coupled with a very steep sloped pipe (up to 8 percent) down a hillside farther down the main were enough to release H_2S that corroded the manholes faster than expected. Compounding the problem was the location of this main, through a high-end neighborhood and adjacent to a golf course. The groundwater up on the hill was not a factor, but the section at the bottom of the hill was in nearly 10-feet of groundwater.

The manholes were assessed first visually and then with a scrape test. From the ground, the 15 to 18-foot deep manholes appeared to be in good to fair condition. The scrape test was performed and the softened concrete sluffed from the wall like tooth paste or soft plaster. The downstream section of the system yielded less than 1-inch of concrete loss. As we worked upstream to the base of the hill and closer to the pump station discharges, up to almost 2-inches was discovered. Next to the pump station discharge, 3 inches of the 5-inch thick manhole wall was missing.

In addition to the condition assessment approach, this presentation will discuss the manhole rehabilitation methods that were considered. These include manhole replacement, liners, inserts, structural coating, and non-structural coatings for corrosion protection. The final design that resulted and the ultimate rehabilitation project will be presented. Lessons learned that will be shared include the how to complete rehabilitation technologies and coordination with neighbors and interested agencies. The manholes were successfully rehabilitated and have performed well for nearly a year and a half.

Brief Biography and/or Qualifications

Chris Kossow

Mr. Kossow is the Assistant Operations Manager at Eagle Sewer District. He is a seasoned collection system manager and plant operator who holds both collection system and wastewater treatment licenses. He coordinates the collection system assessment, cleaning, and maintenance activities for the District. He also leads the wastewater operations team for the District.

Neil Jenkins, P.E.

Mr. Jenkins is a water and wastewater engineer with Jacobs in Boise, Idaho. He has a diverse background and experience supporting water and wastewater facility planning efforts, stormwater management plans, capital improvement plans, condition assessment, facility design, and construction management. His experience spans all phases of the design process from field data collection and initial investigations, to concept development and final design, to construction management and startup services.

ID: 226 / Session 25A: 2

Main Technical Program

Topics: Collection and Conveyance

Keywords: collections, conveyance, spiral winding

Bringing Spiral Winding Rehabilitation to the Pacific Northwest

Ron Bard[1], Yang Zhang[2], Angela Richardson[1]

[1]Brown and Caldwell, United States of America; [2]City of Portland, Bureau of Environmental Services; rbard@brwncald.com, Yang.Zhang@portlandoregon.gov

Spiral Wound Technology ™ (SPR) is a pipeline rehabilitation method using strips of PVC or HDPE. Winding machines unroll strips of material that form to the pipe's shape, creating a new lining. The City of Portland Bureau of Environmental Services (BES) will be using the PVC SPR material on the Carolina Trunk rehabilitation project. Utilities across the globe have installed lining using SPR, including a few in the USA, but this is the first application in the Pacific Northwest. BES often uses pipeline rehabilitation on its aging infrastructure to extend the useful life of its sewer

pipes. Upon successful completion of this pilot project, BES plans to add SPR to its toolbox of available rehabilitation techniques for future projects.

A significant advantage of SPR is the ability to install the material without flow diversion. With this method, it is possible to install lining with live flow during low flow periods. Since the Carolina Trunk is a combined sewer, we scheduled the work to take place at night during the summer when there are no rain events expected. Due to the Carolina Trunk's location along a busy arterial, being able to rehabilitate the sewer without diverting flow is critical to project success.

Constructed in 1909, the Carolina Trunk is a 51-inch diameter cast-in-place monolithic concrete circular sewer pipe. Several inspections revealed that the pipe is in fair to poor condition and needs rehabilitation. Defects observed throughout the pipe included longitudinal cracking and pipe deterioration with exposed aggregate and pitting. This project will rehabilitate approximately 800-feet of the trunk using SPR rehabilitation.

Brief Biography and/or Qualifications

Ron Bard has over 40-years of experience in civil engineering. He specializes in conveyance system design and is an expert in pipelines, pump stations, and rehabilitation of wastewater facilities. Ron is highly experienced in the technical elements and project management. He has a Project Management Professional (PMP) certification. Ron helps public utilities find innovative and creative solutions to their difficult infrastructure problems, finding cost-effective ways to extend the useful life of their aging facilities. He is highly effective in facilitating a collaborative process with diverse stakeholders.

Yang Zhang is a Senior Engineer in the City of Portland Bureau of Environmental Services. He has a PhD degree of Civil & Environmental Engineering, and over 15 years of experience in municipal water and wastewater industry. He has worked in multiple engineering consulting firms and completed over 30 water and wastewater projects. He currently manages sewer rehabilitation projects in the BES Large Scale Sewer Rehabilitation Program and serves as a design manager to oversee design and construction services provided by engineers and consultants.

ID: 159 / Session 25A: 3

Main Technical Program

Topics: Collection and Conveyance, Utility & Assessment Management, Industrial Pre-Treatment

Keywords: water quality sensing, collection systems, telemetry, FOG, ragging

Implementation of Telemetered Water Quality Sensors in the Sanitary Collection System

Scott Mansell, Jason Cook, Greg Arrigotti, Jeff Van Note, Ting Lu, Ken Williamson

Clean Water Services, United States of America; mansells@cleanwaterservices.org

Collecting continuous, reliable water quality data from the sanitary collection system without an excessive maintenance burden is a serious challenge for utilities, but one that is increasingly necessary for developing enhanced source control programs and protecting treatment plants from potential upsets. For several years, Clean Water Services (CWS) piloted various technologies, implementation methods, installations, and cleaning devices. While none of these pilots were ultimately successful, important lessons were learned in each of them that helped drive CWS towards successful implementation. Over the past two years, CWS has successfully developed and implemented a telemetered, continuous water quality sensing network in its sanitary collection system and has already been successful in tracking down and eliminating a consistent source of problems for one its treatment plants. CWS has developed a unique sensor holder that minimizes ragging and made use of robust sensors that are less sensitive to fats, oil, and grease buildup. To test this technology in addition to future technologies, CWS developed a test flume at its Forest Grove treatment plant that uses post-grit screen influent. This flume can be adjusted to simulate various velocities, depths, and sewer sizes and allows for the study and testing of different sensors, cleaning devices, and containment devices with close observations in a controlled environment that wouldn't be possible in the sanitary collection system. CWS has conducted various experiments using this flume to study the factors that affect longevity, film buildup, and maintenance frequency for various probes. The lessons learned through CWS's first few years of unsuccessful pilot studies were presented at PNCWA in 2019. In this talk, CWS will discuss how it finally became successful at developing and implementing a network of water quality sensors in the sanitary collection system, and where it is going from here.

Brief Biography and/or Qualifications

Scott Mansell is a Senior Engineer in the Research and Innovation Department at Clean Water Services in Hillsboro, Oregon. Scott's work in the research program focuses on studying and solving problems using data collection and analysis, modeling, and contaminants of emerging concern. He manages the effort for developing, testing, and implementing continuous, telemetered water quality sensors and autosamplers for the R&I department in the sanitary collection system as well as the creeks and rivers in the watershed. He also leads the projects tracking down

industrial and other sources that impact treatment processes at the treatment plants to support the source control program. Scott earned a PhD in Environmental Engineering from UC Berkeley in 2012, and has worked in both the private and public sector in the environmental engineering field since then. He joined CWS in 2017

8:00am - 10:15am	**Session 26A: Reuse**

8:00am - 9:00am

ID: 272 / Session 26A: 1

Main Technical Program

Topics: Recycled Water & Resource Recovery

Keywords: centralized reuse, onsite reuse, water reuse, reuse planning, potable reuse, case studies

Guiding Regional Reuse Options – A Distributed Systems Approach

Melanie Holmer, Jocelyn Lu

California Urban Water Agencies (CUWA); mholmer@brwncald.com

Water reuse can be achieved through both centralized and onsite systems for non-potable and potable uses. With several reuse options available, utilities can apply a **distributed systems approach**, defined as a regionally optimized combination of water reuse, to produce an effective "fit-for-community" reuse strategy. The California Urban Water Agencies (CUWA), made up of 11 major water utilities in California, conducted research to understand the compatible system characteristics for reuse strategies. CUWA has led the development of a fact sheet that informs that distributed systems approach, which detail considerations around policy, community, environment, economics, operations, and treatment.

Case studies were conducted to understand the decision-making process of utilities that are evaluating water reuse. For example, San Francisco Public Utilities Commission (SFPUC) optimized their regional reuse through a distributed systems approach. The west side of SF is home to large irrigation customers like the Golden Gate park. To capitalize on economies of scale, SFPUC is building a centralized recycled water plant to serve them. The east side of SF is more densely developed with fewer contiguous areas that could benefit from centralized infrastructure. In 2015, SF passed an ordinance requiring new development with footprints > 25,000 square feet to meet their own non-potable reuse needs through onsite reuse. With much of the City's development boom captured under the ordinance, SFPUC found that recycled water demands were largely addressed on the east side.

This work also details the importance of expanding green building certification rating systems, like LEED, to include all sustainable reuse options. A building can employ multiple strategies to increase their water efficiency, and developers tend to opt for onsite reuse. However, LEED offers water efficiency credits for any type of alternative water source, including centralized reuse, and clarification of the rating criteria can improve awareness of this opportunity.

This work is intended to start a conversation with utilities, policy makers, and developers on what is considered sustainable in a given community. This presentation will provide an overview of the favorable system characteristics for each reuse strategy and summarize the key takeaways for stakeholders.

Brief Biography and/or Qualifications

Melanie Holmer is Brown and Caldwell's National Water Reuse Leader and has 22 years of experience in the strategic planning, design, and construction of major water, wastewater, and water reuse projects for a total treatment capacity of over 1 billion gallons per day. Melanie focuses on advanced treatment technologies, regulatory and policy development, and research to support diverse water supply strategies. Melanie serves on the Board of Trustees for WateReuse California and also serves as staff for California Urban Water Agencies.

9:00am - 10:00am

ID: 253 / Session 26A: 2

Main Technical Program

Topics: Treatment Innovation and the Future, Recycled Water & Resource Recovery

Keywords: Water reuse, distributed, decentralized, treatment, innovation

Formalizing the Role of Urban Water Agencies in Distributed Water Infrastructure

Alexander Fairhart[1], Lynn Broaddus[2]

[1]Isle Inc.; [2]Broadview Collaborative; alex.fairhart@isleutilities.com, alex.fairhart@isleutilities.com

This submission continues a conversation from the latest edition of WE&T here.

https://www.waterenvironmenttechnology-digital.com/waterenvironmenttechnology/february_2021/MobilePagedReplica.action?utm_source=newsletter&utm_medium=email&utm_campaign=TXWEAT210128002&utm_content=gtxcel&pm=2&folio=64#pg68

Distributed water infrastructure projects, also called decentralized, onsite or hybrid, are emerging across the Pacific Northwest. Development of these systems is driven by private sector interest, but also government agency

sustainability initiatives. These systems, designed for household, building or district scale, aim compact the efforts of traditional municipal waterworks to avoid the need for collection and conveyance. Major cities across the Pacific Northwest have projects underway that reuse rainwater and wastewater, and even generate fresh water from alternative sources.

Distributed water infrastructure brings a new paradigm to water system development and planning. The knowledge of local water agencies and professionals is often underutilized among the current stakeholder groups of developers, sustainable building groups, technology vendors and public health departments. The public interest would be better served by further collaboration between Pacific Northwest water agencies and the groups developing these projects. In the few cases where municipalities have taken a bold view of the future and adopted legislation for these systems, collaboration is mandated, and cross-benefits readily found.

Water utility professionals are well-suited for the review and approval of new distributed technologies, with the importance of reliability and safety being elevated beyond standard water infrastructure. Several case studies will be reviewed where such collaboration has been facilitated and prioritized by water agencies, to the benefit of new infrastructure developers, technology vendors, serviced ratepayers, and the public health. By taking an active role on behalf of the public, water agencies ensure a seat at the table in this infrastructure development of the future.

Brief Biography and/or Qualifications

Alex Fairhart is a coordinator and technology analyst with Isle Utilities, a water technology consultancy. He has previous experience at a Pacific Northwest wastewater utility and the Water Research Foundation.

Lynn Broaddus is the president of Broadview Collaborative, and currently serves as President on the WEF Board of Trustees.

Full biography and qualification are available upon request.

10:00am - 11:00am

ID: 274 / Session 26A: 3

Main Technical Program

Topics: Stormwater, Recycled Water & Resource Recovery, Resiliency, Planning, Climate Science

Keywords: Water Reuse, Stormwater, Recycled Water, Gray Water

Strategically Balancing Effectiveness and Implementation of Water Reuse Options to Manage Water Consumption

Christopher Stoll[1], Karen Galt[2], Joelle Hammerstad[2]

[1]Kennedy Jenks; [2]City of Seattle, Seattle Parks and Recreation; chrisstoll@kennedyjenks.com, karen.galt@seattle.gov, joelle.hammerstad@seattle.gov

Seattle Parks and Recreation (SPR) operates and maintains around 485 parks over 6,414 acres across the City of Seattle including swimming pools, wading pools, golf courses, spray parks, community centers, and other recreational facilities. SPR was started in 1884 and has continued to increase the open space and facilities available to the public since then. As part of ongoing operations and maintenance, SPR has seen their cost for potable water increase because of three reasons: 1) increase in potable water prices and 2) longer and more intense irrigation seasons due to more frequency drought conditions, and 3) rapid population growth in Seattle since 2010. As SPR desires to continue to use local resources sustainably and reduce long-term operations cost, this Study had three main objectives to help achieve these desires: 1) to assess the effectiveness of SPR's existing water reuse and conservation systems and 2)to evaluate other reuse and conservation systems that SPR could implement, and 3) to determine a high-level implementation plan for the reuse and conservation systems examined to decrease long-term operations and maintenance cost. This Study analyzed and scored various systems for water reuse and conservation (including recycled water, grey water, stormwater and pool water) based on the systems' effectiveness (ability to meet the Study objectives such as decreasing water use and decreasing reliance on potable water) and ease of implementation (level of effort needed to implement a specific system). Based on the analysis and evaluation, the water reuse and conservation systems were broken into categories to assist with focusing efforts for implementation.

Brief Biography and/or Qualifications

Chris Stoll is a Project Manager and Project Engineer with Kennedy Jenks. Chris has over 10 years of experience managing, designing and planning sewer and water projects. Chris has also been involved in planning recycled water

projects and developing innovative solutions for “One Water” management strategies. Chris is a licensed professional engineer (in WA and OR), a project management professional and an Envision certified sustainability professional.

Karen Galt is a registered Landscape Architect in Washington and is Seattle Parks and Recreation’s Water Management Coordinator. Her work includes analysis and reporting on Department water use, review of park development or renovation plans for water efficiency and on-site stormwater management tracking, inspection and commissioning of new or heavily repaired irrigation systems, staff training on irrigation best management practices, supporting planning for system upgrades and other planning efforts to identify and implement climate change adaptation tools such as weather-based irrigation controls and water reuse opportunities.

Joelle Hammerstad is the Sustainable Operations Manager for Seattle Parks and Recreation. She is passionate about implementing strategies that mitigate climate change. She also cares deeply about helping communities adapt to a changing environment. Understanding that water is a precious resource, and aspiring to support her organization in being a responsible consumer of water, Joelle is always looking for creative ways to implement water re-use technologies, projects and programs.

10:30am - 12:00pm	**Session 21B: Collection & Conveyance: Rehabilitation - Livestream**

10:30am - 11:15am

ID: 219 / Session 21B: 1

Main Technical Program

Topics: Collection and Conveyance

Keywords: Rehabiliation, conveyance, wastewater, non-circular, trenchless

Rehabilitation Analysis Of The 100-Year Old Whatcom Creek Trunk Main

Erik Waligorski, Austin Wong

Carollo Engineers, Seattle, WA; ewaligorski@carollo.com, awong@carollo.com

The City of Bellingham's Whatcom Creek Trunk Main was installed in 1909 and consists of large diameter, up to 3-foot wide by 6-foot tall, egg-shaped concrete pipe running along Whatcom Creek and into downtown Bellingham. The existing 6,500 foot-long trunk main includes several sections of pipe which are visible in the creek's bed and completely exposed during the dry season. Maintenance completed by the City showed structural pipe deficiencies which compelled the City to look at the replacement or rehabilitation of the existing sewer.

Carollo Engineers was hired by the City to complete an alternatives analysis to compare viable replacement or rehabilitation options, which included open cut replacement, cured-in-place pipe (CIPP), sliplining, and epoxy coating. Each alternative was evaluated on criteria which could impact the design and construction of the preferred alternative, including hydraulic capacity, constructability, community and environmental impact, bypassing requirements, and construction costs.

To accomplish the alternatives analysis, a laser profile was performed to provide accurate dimensions, estimates of sedimentation, identification of major structural defects not previously identified, and any infiltration which could impact construction.

Each of the rehabilitation methods identified would also require the pipe to be at least partially bypassed to allow for machinery and workers to perform the pre-cleaning and rehabilitation. A bypass pumping analysis was performed using the historical rain and sewer flow data to size an appropriate temporary bypassing system.

This presentation will look at the construction of the original sewer trunk main and how the design of critical sewer interceptors has changed over time, the data and criteria required to complete the alternatives analysis, and the selected alternative. Attendees will learn what risk management aspects needed to be addressed as part of this analysis including, sewer bypass, construction footprint constraints, traffic impacts, and design requirements for non-circular pipeline rehabilitation.

Brief Biography and/or Qualifications

Erik is a Principal Infrastructure Engineer with Carollo in their Seattle office. His 25 years of experience includes the planning, design, and construction of various water and wastewater projects, with specialized expertise in the rehabilitation and replacement of pipelines using trenchless technologies.

Austin is a Lead Engineer with Carollo in their Seattle office. His 10 years of experience includes planning and design of various wastewater and water projects.

11:15am - 12:00pm

ID: 187 / Session 21B: 2

Main Technical Program

Topics: Collection and Conveyance

Keywords: Wastewater, sewer, pipe capacity, sanitary sewer overflow (SSO), combined sewer overflow (CSO), hydraulic modeling, hydrologic modeling, SWMM, wet weather issues.

Planning for Seattle's Future – The Wastewater System Analysis Episode

Kevin Cook[1], Andrew Henson[1], Annalisa McDaniel[2]

[1]Murraysmith, United States of America; [2]Seattle Public Utilities; Kevin.Cook@murraysmith.us, Andrew.Henson@murraysmith.us

Seattle Public Utilities (SPU) is currently undertaking an ambitious effort to integrate their wastewater and drainage systems planning efforts, bridging the needs of the wastewater and stormwater systems to achieve greatest environmental and community benefit. Continual growth and development have made providing adequate capacity a

challenge throughout Seattle's history, since it requires addressing challenges such as an aging system, growing population, densification, and climate change.

SPU serves a population of approximately 747,300 spread over 84 sq-miles and operates a complex network comprised of 1,423 miles of sewers, 68 pump stations, and 86 CSO outfalls. A system-wide capacity analysis was conducted using the latest hydraulic/hydrologic (H/H) model; the results were used to identify and prioritize risk areas using input from multiple stakeholders within SPU.

A primary objective of the Wastewater System Analysis (WWSA) was to identify and understand wastewater capacity needs. Performance Thresholds were selected to achieve performance goals of providing adequate capacity in the public wastewater system, minimizing the risk of sewer backups into private property and public right-of-way. Performance parameters of 1-ft pipe surcharge, maintenance hole flooding, and hydraulic capacity limitation of above 100% of existing pipe were used under one, two, and five-year, 24-hour design storms to evaluate system performance.

The modeling results were used in conjunction with community outreach results to identify and prioritize risk areas. 384 risk areas were delineated and categorized into critical, high, medium, medium-low, and low categories. The project team investigated and categorized critical priority risk areas further to identify capacity issues, providing a framework for programmatic solutions like Inflow and Infiltration (I/I) reduction, pipe and pump station replacement, operational and connected sewer agency constraints, and any combination of issues. This presentation will provide a sound approach to future planning efforts by incorporating technical and non-technical challenges in an expanding urban environment.

Brief Biography and/or Qualifications

Kevin Cook, PE, Murraysmith, Civil Engineer

Kevin is a project engineer at Murraysmith with a strong background in environmental engineering with special emphasis on water resources and stormwater management. He has been involved with several stormwater and wastewater projects across multiple hydraulic/hydrologic modeling platforms.

Andrew Henson, PE, Senior Engineer

Andrew brings to the team over 15 years of professional experience and a background in civil engineering planning, modeling, design, and permitting. He has recently worked on several large projects in roles such as lead modeler and assistant project manager. These projects have included tasks involving planning level analysis, regulatory compliance, climate change impacts, inter-agency coordination, and green stormwater infrastructure, and options analysis

10:30am - 12:00pm	**Session 22B: Resource Recovery**

10:30am - 11:15am

ID: 282 / Session 22B: 1

Main Technical Program

Topics: Recycled Water & Resource Recovery

Keywords: Reuse, Recovery, Biosolids, Planning

Applied Planning for Pocatello's Biosolids Reuse and Recovery

Nick Smith[1], Skyler Allen[2]

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The City of Pocatello, ID has been recovering, land applying and reusing its Class B treated biosolids for decades on nearby agricultural lands. The biosolids treatment and handling system consists of mesophilic anaerobic digestion of thickened primary and secondary sludge, followed by lagoon storage and spring/summer liquid sludge hauling to both City owned and leased land. In the last few years, local growth and associated loading to the Water Pollution Control Facility (WPFC) have increased to the point where the lagoon is often overloaded in late winter through early summer. This situation creates challenges to the operations of the WPCF as the biosolids recirculate back into the liquid stream. This solids overload results in costly and hectic lagoon dewatering efforts, sub-optimal treatment performance and increases the risk of NPDES permit violations. Faced with this challenge, coupled with the desire for long term biosolids planning, the City selected the Stantec/Keller team to address this problem as part of the 2021 Facility Plan update. To properly address the biosolids issue, the team implemented a decision-making process for both solids handling and solids reuse or disposal. The first evaluation included a decision to either expand the biosolids lagoon system or move toward solids dewatering. The second decision determined whether to continue the existing land application of liquid sludge, move to dewatered sludge land application, enhance the biosolids to a Class A through composting, or shift toward landfill application. The results are in, the decisions have been made and the City is moving forward with making the recommended improvements to provide the best solution and end use for this valuable City resource.

Brief Biography and/or Qualifications

Mr. Nick Smith is a registered Idaho civil engineer and principal project manager with Stantec out of the Boise Idaho office. Nick is experienced in planning for wastewater and water systems, focusing on solids handling and treatment systems.

Mr. Skyler Allen is a registered Idaho civil senior engineer with the City of Pocatello, overseeing projects and improvements over the City's major infrastructure including the Water Pollution Control Facility.

11:15am - 12:00pm

ID: 155 / Session 22B: 2

Main Technical Program

Topics: Treatment Innovation and the Future, Recycled Water & Resource Recovery

Keywords: Data-Centers, Industrial, Reuse

Novel Alternative Management of Data Center Industrial Wastewater

Brett Converse[1], Shae Talley[1], Scott Coleman[2]

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Data centers offer economic drivers attractive to communities able to meet utility demands. These industries have large electrical demands to power associated computer equipment which are converted to heat and must be evacuated. Data centers using evaporative cooling require large amounts of water which is evaporated or discharged as industrial wastewater when constituent concentration or temperature prohibits continued use in cooling towers. The volume of water used, the volume of water evaporated, the volume of water discharged, and constituent concentration therein will depend on the quality of source water, climatological conditions and internal management. Water and wastewater service providers must understand the demands of data centers and plan for meeting those demands prior to agreeing to serve. In 2013, the first data center was constructed within city limits at the City of Umatilla, Oregon. After the data center became operational, industrial wastewater was discharged to the City's wastewater treatment plant when the ambient temperature began to climb in the springtime. When the temperature reached over 100 degrees, the City experienced a 65 percent increase in wastewater flow and corresponding dilution of most influent constituent concentrations. As the industrial development continued, the City had concerns over managing projected flows from future data center expansions and began planning to meet service demand. After investigating alternatives,

the City decided to pursue discharging the industrial wastewater directly to a water of the state via a national pollution discharge elimination system (NPDES) permit. The presentation will focus on the City's experience collecting, treating, permitting and disposing of the data center industrial wastewater and associated benefits: additional irrigation water, lower fees and sustainability.

Brief Biography and/or Qualifications

Scott Coleman is the Public Works Director for the City of Umatilla. The bulk of his twenty plus year career has been overseeing of operation and maintenance along with project design and project management. Most of his time has been spent with municipalities such as the City and Irrigation District.

Shae Talley has spent her career providing state and local agencies with municipal and transportation engineering services. She is the City of Umatilla's contract Engineer of Record and served as a Project Engineer and/or Project Manager for various phases of the City's Industrial Wastewater Management project.

Dr. Converse has extensive experience in the design, planning, optimization and permitting of water and wastewater treatment and conveyance systems. He has designed physical, chemical and biological unit processes to treat domestic and industrial wastewater. His fields of expertise include treatment alternative analysis, odor control, biological treatment, optimization, permitting, reuse and high-strength-waste co-digestion and co-generation.

10:30am - 12:00pm

Session 23B: Construction & Alternate Delivery - Livestream

10:30am - 11:15am

ID: 213 / Session 23B: 1

Main Technical Program

Topics: Construction & Alternate Delivery, Collection and Conveyance

Keywords: WRF Outfall Pipeline; Environmental Permitting; Construction Manager/General Contractor

Outfall Fallout – Using the CM/GC Process for A WRF Outfall Replacement

Chris Horgan[1], Jon Baune[1], Craig Borrenpohl[2], Andrew Arbini[2], Curtis Neibaur[3]

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Have you considered involving a Construction Manager/General Contractor (CM/GC) for your next water resources project? The CM/GC contracting method is a fairly new mechanism available for use by Idaho municipalities compared to the traditional design-bid-build process. This approach can be useful and successful when project complexities necessitate the involvement of a contractor early in the project process.

This presentation will discuss the use of the CM/GC process by the City of Post Falls, Idaho (City) for replacement of their Water Reclamation Facility (WRF) outfall in the Spokane River. Representatives from the City (Owner), J-U-B Engineers, Inc. (J-U-B, Engineer of Record), and McMillen Jacobs Associates (McMillen, CM/GC) will provide a project history and discuss how various project risks evolved a traditional design-bid-build approach to a CM/GC process. The CM/GC procurement approach will then be discussed, followed by the various roles and responsibilities of the City, J-U-B, and McMillen during project design, environmental permitting, bidding, and construction. A panel discussion on lessons learned and future best practices with all three entities will follow the formal presentation.

The goal of this presentation is to discuss the City's project-specific experience with the Idaho CM/GC process, including why they chose the CM/GC process over traditional design-bid-build and lessons learned for each phase of the process (procurement, design, construction), and then provide a forum for discussion with the City, J-U-B, and McMillen about each party's general experience with the project and the CM/GC process. This presentation will provide insight for municipalities and engineers on why they might consider an alternate approach to design-bid-build and how they might successfully use the CM/GC process on their next project.

Brief Biography and/or Qualifications

Jon is a project manager and lead project engineer for J-U-B ENGINEERS, Inc. in their Coeur d'Alene, Idaho office. He earned his B.S. in Civil Engineering from Gonzaga University and has over 15 years of experience in the water resources industry. He specializes in water and wastewater system master planning, hydraulic computer modeling analysis, system evaluation, design, and construction.

Chris is a lead project engineer and project manager for J-U-B ENGINEERS, Inc. in their Coeur d'Alene, Idaho office. He earned his B.S. and M.S. in Civil Engineering from the University of Idaho and has over 11 years of experience with water resources-related planning, funding procurement, design, and construction.

Craig is the City of Post Falls Utilities Manager responsible for supervisory and administrative oversight of the City's potable, surface, and reclaimed water systems including distribution, collection and treatment. He earned his B.S. in Civil Engineering from Montana State University and Master of Public Administration from Idaho State University and has 11 years of experience in the municipal water industry.

Andrew is the City of Post Falls Utilities Project Manager and oversees capital improvement projects for the City's wastewater and water division. He earned his B.S. in Construction Management from Eastern Washington University and has 10 years of experience in the construction industry.

Curtis is the lead estimator and director of preconstruction services for McMillen Jacobs Associates' water resources division. He earned his B.S. in Construction Management from Boise State University and has 13 years of experience in the construction industry. He has over 10 years of planning, estimating, and scheduling for heavy civil construction projects, with a focus on work in the hydroelectric, dams, fisheries, and water resources markets

10:30am - 12:00pm

Session 24B: Utility Planning & Asset Management - Livestream

10:30am - 11:15am

ID: 270 / Session 24B: 1

Main Technical Program

Topics: Utility & Assessment Management

Keywords: CSO, combined sewer, equity, planning, community engagement

Co-Creating a Combined Sewer Plan – A Tool that Reports Infrastructure Costs and Benefits in Real Time to Facilitate Community Based Planning

Brent Robinson[1], Alice Lancaster[2], Erik Davido[3]

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Seattle Public Utilities is reimagining the planning process for combined sewer overflows (CSO) and stormwater improvements through the Longfellow Starts Here (LSH) project by endeavoring to make planning accessible and meaningful to the community served by this project. Whereas traditional options analysis has centered on technical feasibility and cost minimization approaches with sparse community engagement on leading options, the LSH team is shifting the planning approach to begin with community and co-create an infrastructure vision through simplified planning tools that demystify drainage and wastewater infrastructure. One tool, the Drainage and Wastewater High Level Planning Tool, is a Microsoft Excel based calculator that reports the cost and water quality performance of various user defined infrastructure scenarios in real time. Specifically, the user selects a suite of CSO reduction and water quality treatment options and the tool reports the planning-level cost, CSO volume reduction and pollutant reduction to Longfellow Creek. The intent of this tool is to facilitate simple, iterative planning so that community can collaborate with SPU to “co-create” the project and engage in dialogue around trade-offs and benefits of various options. The LSH team hopes this tool, through meaningful community engagement, will promote unconstrained creativity and help to elevate optimal strategies by removing the historical bottlenecks in infrastructure planning from modeling and cost analysis given that these calculations are performed automatically by the tool. This presentation will provide a summary of the scenario planning tool’s intended uses, an overview of the back-end calculations and assumptions, and a real time test drive of the tool to showcase its performance.

Brief Biography and/or Qualifications

Brent Robinson, P.E. - Strategic Advisor @ Seattle Public Utilities

Alice Lancaster, P.E. - Principle Engineer @ Herrera Environmental Consultants

Erik Davido, P.E. - President @ Davido Consulting Group, Inc.

11:15am - 12:00pm

ID: 230 / Session 24B: 2

Main Technical Program

Topics: Facility Operations & Maintenance, Utility & Assessment Management, Risk Assessments and Emergency Response

Keywords: Asset Management, Condition Assessment, Piping, GIS tools

Asset Management Shifts Utility Management from Reactive to Proactive

Katie Spilker[1], Steven Dutschke[1], Mia Sabanovic[2]

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The City of Portland Bureau of Environmental Services (BES) Columbia Blvd Wastewater Treatment Plant (CBWTP) was first constructed in 1952 and continued to expand in later years. Many process pipes and plumbing systems are original to the plant’s construction and have often been the forgotten brethren of the CBWTP. The majority of the pipes have not been inspected internally during their lifetime or assessed for their condition and remaining useful life (RUL) . The CBWTP has experienced an increase in pipe breaks in recent years causing process areas to be taken down and creating a detrimental impact on plants operations and a sharp increase in financial expenditures. Frequent breaks and leaks also impact operations and maintenance resources as piping systems are continuously patched to ensure reliable operations of the treatment plant.

BES Condition Assessment team has engaged with Kennedy Jenks consultants to prioritize, inspect, and assess plant process piping helping move BES towards proactive management of its pipe assets. The primary goal of this project

is to identify BES's risk exposure due to these aging pipe assets to enable tailored and sustainable long-term replacement/rehabilitation strategies.

This presentation will outline the vision and drivers for this project, along with sharing success stories and how other utilities can adopt similar programs. Attendees will learn about developing a truly integrated asset management solution, from identifying pipe assets, managing these process piping assets in CMMS, bringing GIS tools within the plant fences, developing risk and prioritization tools, using advanced condition assessment technology and conducting this with careful coordination with a busy plant's scheduling restraints. Finally, the presentation will focus on creating a cultural of change in managing assets, one that proactively inspects piping systems and avoids unforeseen breaks and leaks through effective risk communication long after the team members have moved on.

Brief Biography and/or Qualifications

Steven Dutschke is a reliability and data intelligence engineer at Kennedy Jenks. Steven has spent the last 10 years working to improve operations and maintenance programs through the application of analytics and asset management solutions in the water and oil and gas industries in Australia, Canada and the United States.

Mia Sabanovic, P.E. is an Engineer III at the Portland Bureau of Environmental Services (BES). She has over 15 years of civil engineering experience in public utility sector. She has been actively engaged in Asset Management Program in the City of Portland for the past 10 years. Mia leads a dynamic group of analysts and planners at the Colombia Blvd Wastewater Treatment Plant in the pursuit of improved management of BES assets through the application of programmatic maintenance and condition assessment.

10:30am - 12:00pm	**Session 25B: Regulatory Challenges: Thermal Compliance**

ID: 284 / Session 25B: 1

Main Technical Program

Topics: Regulatory Challenges

Keywords: temperature, variance, regulatory challenge

A Clean Water Act Approved Strategy for Temperature Compliance: City of Boise Clean Water Act 316(a) Thermal Variance Demonstration Project, V2.

Kate Harris[1], Thomas Dupuis[2]

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Temperature effluent limits are challenging to meet and several alternative compliance strategies have been litigated. Section 316(a) of the Clean Water Act provides that the EPA (and delegated state agencies) may authorize alternate thermal conditions in NPDES permits where the effluent limitation is more stringent than necessary to assure the protection and propagation of a balanced, indigenous community (BIC) of shellfish, fish, and wildlife in and on the receiving waterbody. The City of Boise applied for a 316(a) thermal variance and completed a demonstration project. The initial demonstration strategy and results were presented at a previous PNCWA meeting. The strategy for the demonstration project was modified in coordination with Idaho DEQ as administration of the NPDES permitting program was transferred to the state. The results of the modified demonstration project will be presented.

The city conducted a Type II Demonstration: a predictive demonstration based on literature, laboratory, and field studies conducted to evaluate that proposed alternate thermal effluent limitations (ATELs) will provide adequate protection and propagation of the BIC, as characterized by Representative Important Species (RIS). Near field (mixing zone) and far field analyses were performed separately but considered collectively. The potential for adverse effects was evaluated in terms of temperatures in the context of RIS specific biothermal attributes from the scientific literature, local expertise, and Idaho field data. Results demonstrated that the city's ATEL's would assure the protection and propagation of the RIS and maintenance of the BIC in the Lower Boise River. The city's thermal load does not, and will not, cause lethal or sublethal effects that would affect the protection and propagation of the RIS populations; i.e., not interfering with the RIS's completion of life history functions of reproduction, spawning, growth, and migration. The city's IPDES permit is anticipated in fall 2021, therefore the presentation will also include a description of the permitting process and outline implementation planning.

Brief Biography and/or Qualifications

Kate Harris is the Water Quality Programs Manager within the Environmental Division at the City of Boise. When she is not working, she enjoys exploring Idaho with her family.

Tom Dupuis has over 40 years of Clean Water Act technical and regulatory experience, including NPDES permitting, TMDLs, water quality modeling and assessment, and stormwater management. He has bachelor's and master's degrees from Marquette University and has worked for research, state agency and consulting organizations.

ID: 161 / Session 25B: 2

Main Technical Program

Topics: Utility & Assessment Management, Regulatory Challenges, Risk Assessments and Emergency Response

Keywords: temperature compliance, thermal loads, optimization, temperature modeling, reuse

Taking a Watershed-Based Approach to Developing and Optimizing a Thermal Compliance Strategy

Scott Mansell, John Dummer, Bob Baumgartner, Rajeev Kapur, Ken Williamson

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The Tualatin River is a small river that receives wastewater discharges from over 600,000 residents and many large industries.The river and its tributaries contain salmonids which are impacted by water temperature increases caused by anthropogenic activities. Due to the relatively large discharges of wastewater to the relatively small river, the discharges can have a large effect on the temperature of the river that must be mitigated to protect aquatic life. Even more significant population and economic growth is projected in the watershed over the next 50 years. While Clean Water Services currently mitigates the thermal loads from its discharges through a Themal Management Plan that includes reuse, cogeneration, flow augmentation, and riparian shade projects, the projected growth of the population in the watershed and the expected effects of climate change require that an updated Temperature Compliance Strategy (TCS) be developed that will meet the temperature challenges into the future. However, there are a large number of potential actions that could be taken at the treatment plants and in the watershed to help decrease the temperature of

the river and mitigate the effects of the thermal loads from the treatment plant discharges. Each of these actions has different strengths and weakness as well as variable temporal and spatial effectiveness which can often be affected by the other actions being taken. Optimizing which actions to take and when to take them is a difficult process. CWS has developed an updated Thermal Compliance Strategy that includes a suite of actions to be taken over time between 2025 and 2075. A tool was developed that can analyze a large array of potential actions in numerous combinations and predict their effectiveness, costs, benefits, and impacts. The tool relies on complex hydrodynamic and water quality models, data collection, economic analyses, and engineering analyses to compare and contrast the different actions over time, alone and in combination. Using the tool, CWS optimized the suite of actions and the timing of their implementation to maximize benefits to the river while minimizing cost and other impacts. This holistic method provides a much more effective TCS than effluent cooling alone.

Brief Biography and/or Qualifications

Scott Mansell is a Senior Engineer in the Research and Innovation Department at Clean Water Services. His team's work in the research program centers mainly on modeling, data collection and analysis, and contaminants of emerging concern. Scott has conducted many water quality and temperature modeling studies during his 4 years at CWS, as well as his 5 years in private consulting prior to coming to CWS. Scott holds a PhD in environmental engineering from UC Berkeley and is a registered Professional Engineer in the state of Oregon.

10:30am - 12:00pm	**Session 26B: Wastewater Process: Solids**

10:30am - 11:30am

ID: 171 / Session 26B: 1

Main Technical Program

Topics: Treatment Innovation and the Future, Facility Operations & Maintenance, Wastewater Treatment Process

Keywords: Co-digestion, FOG, Anaerobic Digestion, Dewaterability

Effect of Fat, Oil and Grease (FOG) on Digested Sludge Dewaterability

Ornella Sosa-Hernandez, Peter Schauer

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Clean Water Services investigated the impact that co-digestion with Fat, Oil and Grease (FOG) has on the dewaterability of digested sludge. Over the past 4 years, a deterioration of the dewatering performance has been observed while the volume of FOG that is handled has increased at the Durham Advanced Waste Water Treatment Facility (AWWTF). In addition to a possible decline in centrifuge performance from equipment age, the FOG load and its variable composition had been suspected to cause dewatering issues as the cake solids dryness and solids capture have steadily decreased despite little change to the polymer dosing.

The anaerobic digesters at the Durham AWWTF have independent FOG feed lines allowing for different loadings to either digester. During this 4-month evaluation, more FOG was fed to one of the two anaerobic digesters while both received equivalent indigenous sludge loading which is composed of thickened primary and secondary sludge. The digester feed, FOG stream and digested sludge were characterized by measuring parameters such as proteins, lipids and carbohydrates, orthophosphate, and cations concentrations. Dewaterability was assessed through analysis conducted by Dr. Matthew Higgins at Bucknell University.

This presentation will include an analysis approach that can help recommend FOG management strategies whereas the lessons learned from this evaluation are:

- FOG addition had no negative impact on digested sludge dewaterability.
- The polymer demand was more affected by indigenous sludge VS loads than FOG loading.
- The presence of charged compounds in the digestate such as phosphate and cations impacted some of the dewatering characteristics.
- Although VS loads above 0.25 lbs/ft^3/d and up to 50% FOG were fed for a short period of time, digestion stability was maintained. The time to perceive instability and the impact to other parameters such as alkalinity should be investigated.

Brief Biography and/or Qualifications

Ornella Sosa-Hernandez is an Operations Analyst in the Technology Development and Research group at Clean Water Services. She received her Ph.D. of Science and Engineering from the Monterrey Institute of Technology and Higher Education in Mexico specializing in Environmental Systems after obtaining a Bachelor of Science in Biotechnology Engineering.

11:30am - 12:15pm

ID: 239 / Session 26B: 2

Main Technical Program

Topics: Wastewater 101, Treatment Innovation and the Future, Regulatory Challenges

Keywords: biosolids

The Future of Biosolids Handling

Tanner Hartsock

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Sustainable biosolids handling strategies are becoming increasingly difficult to develop. For land applications, the most common biosolid disposal technique, wastewater facilities (WRRFs) must produce either Class A or Class B biosolids. Even if these requirements are met, some WRRFs are faced with local pressure, forcing them to alter the course of their biosolids handling program. Biosolids regulations have seen little change since the first regulations were established in 1993, and mounting pressure on the Environmental Protection Agency make future changes both likely and imminent. Additionally, contaminants such as per-polyfluoroalkyl substances (PFAS) are sure to complicate regulations moving forward. Even landfill applications are uncertain: recently, the state of California banned the use of biosolids as an alternative landfill cover. Now more than ever, WRRFs are considering innovative, even novel technologies for managing their biosolids. Bioaugmentation can be used to degrade volatile biosolids and should be

viewed as a viable approach to reduce the amount of biosolids at WRRFs. Research has shown that microbes capable of producing amylase enzymes can hydrolyze cellulose, a primary component of wastewater sludge, and convert it to glucose, a form of soluble carbonaceous biochemical oxygen demand (cBOD). This soluble glucose is readily available as a food source to both the added microbiology and the existing sludge biomass, reducing sludge volumes by up to 40%. Probiotic additions are common in lagoon systems, reducing costs associated with dredging, dewatering and hauling and recently, biological sludge reduction at mechanical wastewater facilities has received attention as an alternative means to reduce costs associated with dewatering and hauling. As regulations become more stringent, the time to consider new technologies for biosolids reduction is now.

Brief Biography and/or Qualifications

Tanner is the BioLynceus representative covering the Pacific Northwest region. Tanner graduated from the University of Iowa in 2019 with a master's in geology. He is passionate about the natural world and hopes to help preserve it for future generations. His goal is to help pioneer the use of microbial remediation programs for current and future environmental challenges, specifically those concerning water and soil.