



José Bicudo, Ph.D., P.Eng.

National Technical Specialist - Water Resource Recovery

José has 30 years of national and international experience in academic, municipal and consulting roles. His project experience extends across Portugal, the United States and Canada and includes many aspects of wastewater management such as system planning, facility design and operations, technology demonstration, effluent receiving environment assessments, biosolids management and resource recovery. José has been focusing on biosolids processes in the last 10 years.

Education

- Ph.D., Environmental Engineering, University of Newcastle upon Tyne (UK), 1988
- B.Sc., Environmental Engineering, Mauá School of Engineering (SP, Brazil), 1984

Employment History

- 2019 - Date: Associated Engineering
- 2015 - 2019: Region of Waterloo
- 2013 - 2015: Associated Engineering
- 2007 - 2013: Region of Waterloo, Kitchener, ON
- 2004 - 2007: CH2M Hill, Kitchener, ON
- 2001 - 2004: University of Kentucky, Lexington, KY
- 1998 - 2000: University of Minnesota, St. Paul, MN
- 1997 - 1998: North Carolina State University, Raleigh, NC
- 1990 - 1996: National Laboratory of Civil Engineering, Hidrocontrato, and Engidro, Lisbon, Portugal
- 1988 - 1989: University of Sao Paulo, Sao Carlos, Brazil

Professional Societies

- Engineers and Geoscientist British Columbia
- Professional Engineers Ontario
- Association of Professional Engineers and Geoscientists of Alberta
- Water Environment Federation (WEF)
- BC Water and Waste Association (BCWWA)

RELEVANT BIOSOLIDS EXPERIENCE

- **Organics Processing Facility / Digester #4 Project, City of Chilliwack, BC:** Senior Reviewer for the source separated organics co-digestion process aspects of the project, which includes a new SSO pre-processing facility and a new wastewater treatment facility digester. AE is the owners engineer for design-build project implementation. On-going work.
- **Disco Road Organics Process Facility Treatment Optimization, Veolia and City of Toronto, Toronto, ON:** Senior Process Engineer providing QA reviews for the assessment and optimization of the centrate treatment facility at the Disco Road Organics Process Facility. The work includes assessment of current treatment performance, identification of plant limitations and redundancy needs, process modelling to evaluate different treatment strategies and configurations, and conceptual and pre-design of bioreactor cooling system. On-going work.
- **Waterloo and Galt WWTP – Operational Biosolids Storage, Region of Waterloo, ON:** Technical lead for the pre-design and detailed design of the operational biosolids storage tanks to provide emergency and temporary storage of digested biosolids at the Waterloo and Galt WWTPs. This is an on-going project.
- **Abbotsford-Mission Water and Sewer Commission Joint Wastewater Biosolids Management Master Plan, Abbotsford, BC:** Technical lead for the Biosolids Master Plan that will provide guidance to Abbotsford-Mission over the next 25 years, responding to a complex and evolving regulatory environment, increasing First Nations influence, stakeholder and public factors affecting social license and continual development of biosolids treatment technologies. This is an on-going project.
- **City of Kelowna Interim Biosolids Plan, Kelowna, BC:** Technical lead for the feasibility assessment of advanced anaerobic digestion alternatives and identification of end-use options, recommendation of upgrades, identification of short- and long-term capital plan. This is an on-going project.
- **Ayr WWTP Aerobic Digester Upgrades, Region of Waterloo, ON:** Technical and process lead responsible for the optimization of process controls, preliminary and detailed design of upgrades to the existing aerobic digester at the Ayr WWTP. On-going work.

- **Jasper WWTP Dewatering Centrifuge Upgrades, Aquaterra, Jasper, AB:** Senior Process Engineer providing QA reviews for the design and installation of a new dewatering centrifuge at the Jasper WWTP. On-going work.
- **Waterloo WWTP – Digester Mixing System, Region of Waterloo, ON:** Senior Process Engineer providing QA reviews for the design of a new digester hydraulic mixing system at the Waterloo WWTP. On-going work.
- **Estimates of Carbon Footprint due to Biosolids Processes, various WWTPs, Region of Waterloo, ON:** Senior Process Engineer responsible for estimating and updating the carbon footprint of various biosolids processes (thickening, digestion, dewatering, storage, transportation, land application) using the Biosolids Emissions Assessment Model (BEAM) from the Canadian Council of Minister of the Environment (CCME). Completion: 2019
- **Kitchener, Waterloo and Galt WWTP - Dewatering Optimization, Region of Waterloo, ON:** Senior Process Engineer responsible for operational data gathering, development and implementation of laboratory methodology to evaluate and optimize the performance of centrifuge dewatering at the three dewatering facilities in the Region of Waterloo. Both laboratory and full-scale tests were performed on a periodical basis (2016 - 2019) to continually improve the process.
- **Kitchener WWTP - Design of Combined Heat and Power (CHP) Facility, Region of Waterloo, ON:** Wastewater Operations representative as Senior Process Engineer responsible for operational data gathering and technical review of deliverables. This project has the potential to generate about 1 MW of energy through the use of biogas from the digestion of sludge generated at the Kitchener WWTP. The CHP Facility was commissioned in 2021.
- **Biosolids Strategy, Region of Waterloo, ON:** Wastewater Operations representative as Senior Process Engineer responsible for technical review of deliverables. The Region's Biosolids Strategy focused on determining the most suitable biosolids management approach for the Region. It took a critical look at today's practices, considered available technologies and developed a sustainable way to manage biosolids within the Region to the year 2051. The recommended Strategy was finalized in June 2018.
- **Hespeler WWTP - Replacement of Aerobic Digestion Diffusers, Region of Waterloo, ON:** Senior Process Engineer responsible for procurement and technical review of proposals for the replacement of the aerobic digester diffusers. New OVIVO MS diffusers were installed in 2017 and have been operating successfully since then.
- **Waterloo WWTP, Calcite Precipitation in Dewatering System, Region of Waterloo, ON:** Senior Process Engineer responsible for a study to identify the major constituents of the chemical deposits/precipitate; quantify its amount; determine the cause and location of deposit/precipitate and develop conceptual solutions for mitigation. A one-year pilot with HydroFlow™ technology to reduce calcite precipitation was also conducted as part of the study with some success. This work was conducted in 2018 and 2019.
- **Kitchener WWTP - Commissioning of Digester Upgrades, Region of Waterloo, ON:** Senior Process Engineer responsible for operational data gathering and technical review during 14 and 45-day performance of upgraded mesophilic anaerobic digesters with new heating, mixing (linear motion mixers) and gas systems. Work included coordination of dye tracing tests and sampling for mixing performance assessment with the contractor and plant operators, and review and approval of reports. The digester upgrades were commissioned in 2016.
- **Ashbridges Bay WWTP - Pelletizer Condition Assessment, City of Toronto, ON:** Senior Process Engineer responsible for project management and process assessment, as well as coordination of electrical, mechanical and structural assessment of the existing tray dryer and associated truck loading facility. The assessment was finalized in 2015.
- **Duffin Creek WWTP - Sludge blending/storage and odour control facility assessment, Region of Durham, ON:** Senior Process Engineer responsible for the assessment of a sludge blending/storage and associated odour control facility that exploded accidentally due to a combination of

environmental and human factors. These factors were identified and described in a confidential report to the client based on a detailed process, electrical and mechanical investigation. This work was conducted in 2013-2015.

- **Fort Frances WWTP - Pre-design of Dewatering Facility, Fort Frances, ON:** Senior Process Engineer responsible for QA/QC reviews of the pre-design of mechanical dewatering of aerobically digested biosolids. The work included comparative technical and economical evaluation of different dewatering technologies, including screw press, rotary press and centrifuge, followed by the pre-design of the selected technology, rotary press. This facility was commissioned in 2016.
- **St. Thomas WPCP - Digesters Implementation Plan Class EA Amendment, St. Thomas, ON:** Senior Process Engineer responsible for the preparation of a Functional Design Report that was based on current and future design flows noted in the Class EA. Has overseen the development of various digester implementation options, including the processing of biogas for vehicle fuel, and made recommendations to the City for the preferred option. This work was completed in 2015.
- **St. Thomas WPCP - Inspection and Rehabilitation of Anaerobic Digesters, St. Thomas, ON:** Senior Process Engineer responsible for the assessment and evaluation of the current conditions of Digester No. 3 that was damaged due to pipe plugging against the CAN/CSA B149.6-11 "Code for Digester Gas and Landfill Gas Installations". Deficiencies identified were summarized in a tech memo prepared for the City including risk assessment and upgrades required to achieve code compliance and to bring the digester into operation. This work was completed in 2014.
- **Kitchener WWTP Upgrades - Detailed Design of Anaerobic Digester Upgrades, AECOM and Region of Waterloo, ON:** Senior Process Reviewer on behalf of both AECOM (lead Consultant) and the Region of Waterloo for upgrades to the anaerobic digestion system. Upgrades include new linear motion mixers, new covers (including a sludge holding tank with a membrane cover), new digester control building with new pumping and heating systems (boilers and heat exchangers). Also helped as senior process engineer on a 60% detailed design value engineering workshop. This work was completed in 2013.
- **Kitchener WWTP Upgrades - Design of the Manitou Dr Dewatering Facility, Region of Waterloo, ON:** The existing Manitou Dr Sludge Transfer Facility was upgraded to become a dewatering facility with centrifuges. José scoped the work, led the pre-design component as project manager and process specialist and served as a senior process reviewer during the detailed design. The facility was completed in 2012.
- **Biosolids Master Plan Update, Region of Waterloo, ON:** The detailed decision-making process followed Phases 1 and 2 of the Municipal Class EA process. Life-cycle assessment, a technique endorsed by EPA, was used in order to determine long-term impacts on the natural environment in terms of abiotic depletion of resources, climate change, land use, eutrophication and acidification. A major recommendation of the master plan was to install a centralized heat drying facility to process dewatered biosolids from the Kitchener, Galt, and Waterloo WWTPs. The facility would use waste heat from local industry or from the existing cogeneration facility located at the Region's landfill. José scoped the work, led the master plan process as project manager, and provided senior reviews on behalf of the Region. The master plan update was completed in 2011.
- **Aurora Organic Dairy - Sustainability Master Plan, Golden, CO:** Associate Project Manager and Technical Lead for a team that spanned four regions, three business groups, and two companies (IDC and CH2M HILL INC). Coordinated and developed a sustainability master plan for the Aurora Organic Dairy (AOD) to guide the 5,000-cow dairy based in Golden, Colorado, in meeting its environmental and community stewardship goals. AOD's Sustainability Director stated the plan achieved AOD's goals of being more tangible and tactical than previous Sustainability Plans he had seen before developed by others.
- **Fort Frances WWTP - Pre-design of Dewatering Facility, Fort Frances, ON:** Senior Process Engineer responsible for QA/QC reviews of the

pre-design of mechanical dewatering of aerobically digested biosolids. The work included comparative technical and economical evaluation of different dewatering technologies, including screw press, rotary press and centrifuge, followed by the pre-design of the selected technology, rotary press. This facility was commissioned in 2016.

- **Preston WWTP - Digester Upgrades, Region of Waterloo, ON:** Recommendations were made to replace and upgrade the following systems: heating (new boilers, heat exchangers, and associated pumps), mixing (new internal draft tubes), and gas (new gas booster and safety equipment). Other upgrades to the facility include new MCCs, digester roof modifications, new sludge unloading facility with spills containment and flow metering; new ventilation and HVAC systems. José scoped the work, led the pre-design as project manager on behalf of the Region, and served as a process reviewer during preliminary and detailed design. Digester upgrades were completed in 2013.
- **Kitchener WWTP - Pre-design of the Biosolids Dewatering Facility, Region of Waterloo, ON:** This dewatering facility has capacity to process 970 m³/d of biosolids in 2041 with three centrifuges and includes a two-floor building connected through an above ground gallery to a previously existing truck transfer station. The facility is equipped with biofilters for odour control and was commissioned in March 2012. Scoped the work, led the pre-design as project manager on behalf of the Region, and served as a process reviewer during preliminary and detailed design.
- **Galt WWTP - Digester Upgrades, Region of Waterloo, ON:** Additional primary digester capacity was required to reduce the plant's volatile solids loading rate to within typical design parameters for high-rate mesophilic primary digesters. This project included the detailed design for the conversion of the existing secondary digester to a primary digester. The major components associated with this conversion included replacement of the floating steel digester cover, installation of digester mixing equipment (draft tubes), installation of a hot water/sludge heat exchanger with associated pumps and piping, installation of digester gas collection/safety equipment, installation of electrical supply and control system, and refurbishment of a sludge holding tank. This project was completed in 2011. Scoped the work, led the pre-design as project manager on behalf of the Region, and served as a process reviewer during preliminary and detailed design.
- **Guelph WWTP - Digester Capacity Expansion, City of Guelph, ON:** Project Engineer responsible for the pre-design and detailed design of the new digester. The work included increased primary digestion capacity with installation of one new primary digester of the same size, shape, and mixing technology (draft tube mixers) as to the existing three primary digesters, new gas cleaning system for the removal of siloxanes, and provision of all auxiliary components suitable for operation with the expanded digestion capacity.
- **Oakville South-West WWTP - Anaerobic Digestion Upgrades, Region of Halton, ON:** Process Engineer responsible for the pre-design and detailed design of the digester upgrades. This project included design of anaerobic digester hydraulic mixing and recirculation systems (including pumps and piping), heating system (including heat exchangers, boilers, and hot water pumps), raw sludge pumping, gas system (piping, gas booster, waste gas burner), upgrade and expansion of the existing Digester Control Building to accommodate new hydraulic mixing equipment and meet NFPA requirements and Canadian Gas Code (CAN/CGA-B105).
- **Guelph WWTP - Dewatering Upgrades, City of Guelph, ON:** Project Engineer responsible for the detailed design of new belt filter presses. The work consisted in the preparation of construction documents (drawings and specifications), tender assistance, and design services provided for the installation and commissioning of the belt filter presses.
- **Barrie WPCC - Pre-Design of Upgrades, City of Barrie, ON:** Project Engineer responsible for the technical and economic comparison of alternatives to quantify the impacts related to the discharge of WTP residuals to the Barrie WPCC.

PROFESSIONAL COMMITTEES

- 2020 – date: Water Environment Federation (WEF) Residuals and Biosolids Committee
- 2013 - 2019: Federation of Canadian Municipalities, Green Municipal Fund Peer Reviewer
- 2013 – 2019: Water Environment Association of Ontario (WEAO), Residuals and Biosolids Committee (Committee Chair for the 2018-2019 period).
- 2017 - 2019: Region of Waterloo's Water Services Research and Innovation Committee, Chair
- 2017 - 2018: National Science and Engineering Research Council - Strategic Partnerships Grants Project Review Panel Member
- 2016 - 2018: Federation of Canadian Municipalities, Green Municipal Fund Advisory Group on Wastewater Capacity Building Programming
- 2014 - 2017: Water Environment Association of Ontario (WEAO), Member of the Board of Directors.

SELECTED PUBLICATIONS

- Bicudo, J.R., Gerber, J., Celmer-Repin, D., Ormecí, B., Shirvani, H. And Osinga, I. (2020). Carbon footprint of biosolids processes – a practical case study. *WEAO Influent*, Summer 2020, pp. 46-49.
- Bicudo, J.R., Parker, W.J., Higgins, M.J., Morris, S., Gerber, J., Crowley, B. and Celmer-Repin, D. 2019. Impact of anaerobically digested biosolids characteristics and handling conditions on dewatering performance at multiple facilities. *Water Environment Research*, Vol 92, pp. 347-358.
- Parker, W., Celmer-Repin, D., Bicudo, J. and Law, P. (2020). Assessment of the use of mainstream iron addition for phosphorus control on H₂S content of biogas from anaerobic digestion of sludges. *Water Environment Research* 92:338-346, doi:10.1002/wer.1161.
- Bicudo, J.R., Klassen, A., Dorozynski, P., Parker, W.J., Smith, D.S. and Mank, J. (2019). Managing chemical scaling in dewatering systems with Hydropath technology. *48th Annual WEAO Technical Symposium and OPCEA Exhibition*, April 14-16, Toronto, ON.
- Bicudo, J.R., Morris, S., Klassen, A., Parker, W., and Higgins, M. 2018. A chilling effect – Environmental factors that affect dewatering of anaerobically digested biosolids. *WEF Water Environment & Technology*, Vol. 30, No. 11, pp. 30-33.
- Bicudo, J.R., Dixon, D.J., Adams, S., Bradley, M., Sirwaitis, R., Armistead, J., Hallman, B., and Baldwin, S. (2017). Mixing performance of a linear motion mixer at the Kitchener WWTP. *46th Annual WEAO Technical Symposium and OPCEA Exhibition*, April 2-4, Ottawa, ON.
- Bicudo, J.R., Armistead, J., Thomas, K., Ip, I., Coleman, P. and Mawani, Z. (2016). Low energy mixing to optimize anaerobic digestion at the Kitchener WWTP. *WEAO Influent*, Winter 2016, Vol. 11, pp. 34-37.
- Bicudo, J.R., Celmer-Repin, D., Brown, T. and Bellamy, T. (2016). Anaerobically digested liquid to cake – Managing biosolids without long-term storage. *WEF Residuals and Biosolids – Biosolids as a Resource*, April 3 – 6, Milwaukee, WI.
- Bicudo, J.R., Liu, N., Steel, P., McCready, C., and Stafford, L. (2015). Biogas as vehicle fuel – Does it make sense for small municipalities? *WEF Water and Energy – Opportunities for Energy and Resource Recovery in the Changing World*, June 8 -10, Washington, DC.
- Bicudo, J.R., Seaman, L., Brown, T., Ross, D., Briggs, T., Saint, W. and Mehmood, K. (2014). A unique retrofit to treat centrate with RAS reaeration at the Kitchener WWTP. *WEF Residuals and Biosolids – Sustainability made Simple: Facilitating Resource Recovery*, May 18-21, Austin, TX.
- Bicudo, J.R., White, A., Burrowes, P. Schmitter, J., Mahood, T., Brown, T. and Serrati, D. (2012). The true environmental cost of treatment – A biosolids master plan incorporates a life-cycle assessment for better understanding of impacts to the environment. *WEF Water Environment & Technology*, Vol. 24, No. 3, pp. 32-36.
- Bicudo, J.R. and Burrowes, P. (2011). Developing an environmentally sustainable biosolids master plan. *Canadian Municipal Water News & Review*, Fall 2011, pp. 8-10.

C. Michael Bullard, PE

FULL NAME:	C. Michael Bullard	JOB TITLE:	Vice President
DESIGNATIONS: Examples – P.E., Ph.D., AIA, DEE, etc.	PE		
Years Experience With Hazen and Sawyer:	2000-Present 1986-1989 Total H&S– 25 years Total Overall – 36 years	Years Experience With Other Firms List Firms & Dates	Eastman Chemical Company 1991-2000 – 9 years The Chester Engineers 1989-1991 – 2 years
Principal Areas of Expertise:	Residuals and biosolids management Digester gas utilization and energy production Wastewater treatment facility design Wastewater operations process optimization		
Professional Affiliations or Memberships:	Water Environment Federation Residuals and Biosolids Committee (Active) Specialty Conference Planning Group (2012-Present) Technical Practice Committee MOP-11 – 4th Edition (Reviewer) MOP-11 – 5th Edition (Chapter Author) WEFTEC Program Committee Facility Operations Symposia: 2002-08 (Past Chair) Residuals and Biosolids Symposia – 2008 - 2015		
Technical Publications/Papers/ Presentations :	See attached listing		
Other Items of Importance:	George B. Gascoigne Medal (1998), Water Environment Federation Willem Rudolfs Medal (2002) Water Environment Federation		
ACADEMIC CREDENTIALS			
Education: BSCE North Carolina State University, 1984 MCE North Carolina State University, 1986	Active registrations/licensures Professional Engineer, P.E. (First registered June 1989 - NC) North Carolina 15761 Tennessee 23460 Virginia 36668 South Carolina 21879 New York 086081-1		

C. Michael Bullard, PE

PROFESSIONAL RECORD – EMPLOYMENT HISTORY / JOB TITLE HISTORY

Period: 2000 to Present

Employer: Hazen and Sawyer

Positions Held / Job Title:

Vice President/Shareholder (2012-Present)

Senior Associate/Shareholder (2008-2012)

Senior Associate (2003-2012)

Associate (2001-03)

Senior Principal Engineer (2000-01)

Period: 1991 To 2000

Employer: Eastman Chemical Company

Positions Held / Job Title:

Senior Civil Engineer (1996-2000)

Advanced Civil Engineer (1993-1996)

Civil Engineer (1991-1993)

Period: 1989 To 1991

Employer: The Chester Engineers

Positions Held / Job Title:

Senior Engineer/Project Manager

Period: 1986 To 1989

Employer: Hazen and Sawyer, P.C.

Positions Held / Job Title:

Assistant Engineer (1986-1989)

C. Michael Bullard, PE

PROFESSIONAL RECORD – GENERAL EXPERIENCE DESCRIPTION

Mr. Bullard has over 35-years of experience as an engineer in the design, operation, maintenance and process optimization of municipal and industrial water and wastewater treatment facilities. Mr. Bullard is Hazen and Sawyer's National Residuals and Biosolids Practice Leader and has extensive experience in the full range of residuals and biosolids thickening, digestion and biogas utilization and recovery, dewatering, and advanced residuals treatment systems from a planning, design, and operational perspective.

Prior to rejoining Hazen and Sawyer in 2000, Mr. Bullard served in a variety of positions with Eastman Chemical Company in the wastewater treatment field. While at Eastman Chemical Company Mr. Bullard served as the plant manager for the 30-mgd industrial wastewater treatment plant located in Kingsport, Tennessee which is one of the largest activated sludge treatment plants in the US chemical process industry. Additionally, while at Eastman, Mr. Bullard served as Leader for Eastman's wastewater treatment Process Improvement Team which provided wastewater treatment process development, improvement, optimization and design consulting services for Eastman's global wastewater treatment operations. His experience in day-to-day operational management and process control for a large treatment facility and his experience in operations and process troubleshooting and optimization provide a unique perspective and are leveraged in development and deployment of operationally functional and flexible design solutions.

Mr. Bullard's work in innovative wastewater treatment process improvement has been nationally recognized. He is the recipient of the Water Environment Federation's 1998 George Bradley Gascoigne Medal for significant contributions to wastewater treatment plant operations and the 2002 Willem Rudolfs Medal for outstanding contributions in industrial waste control.

Mr. Bullard is active in the Water Environment Federation. He has served as both a chapter reviewer and chapter author for WEF's MOP-11. He is formerly the WEFTEC Program Committee Facility Operations Symposium Chair and has served on the WEFTEC Program Committee's Residuals and Biosolids Symposia Subcommittee and the WEF Residuals and Biosolids Committee. Additionally, Mr. Bullard has published extensively in the area of wastewater treatment process control, process improvement and optimization, and solids dewatering.

C. Michael Bullard, PE

TECHNICAL PAPERS AND PRESENTATIONS

1. Abu-Orf, M. and **Bullard, C. M.**, Driving the Upgrade Ramp: Biosolids decision making in light of possible regulatory changes and industry trends, Water Environment and Technology (WE&T), Water Environment Federation, December 2020.
2. **Bullard, C. M.**, Hardy, S., Taylor, S. and Jalbert, M., Apollo Root Cause Analysis for Extending BFP Belt Life, Proceedings 2020 Water Environment Federation Residuals and Biosolids Conference, Minneapolis, MN, March 2020.
3. Borgmann, R. S. and **Bullard, C. M.**, Thickening and Dewatering Strategies for Small Plants - Minimizing Capital Investment by Leveraging Installed Infrastructure Proceedings 2020 Water Environment Federation Residuals and Biosolids Conference, Minneapolis, MN, March 2020.
4. Abu-Orf, M, **Bullard, C. M.**, and Dursun, D., Thermo-Chemical Hydrolysis with and without Digestion – Does it Make Economic Sense when Compared to Other Technologies, Proceedings 2020 Water Environment Federation Residuals and Biosolids Conference, Minneapolis, MN, March 2020.
5. Hanna, A, **Bullard, C. M.**, Selock, K., Dubeck, S, Van Horne, M. P., and Ugelvich, J., Finding the “Right Fit” Digestion Solution for WSSC’s THP Project in Balancing Design Requirements, Proceedings 2020 Water Environment Federation Residuals and Biosolids Conference, Minneapolis, MN, March 2020.
6. **Bullard, C. M.**, Foisy, M., Wiman, D., Wagoner, D., Bickerstaff, B., and Bridwell, M., Its Alive: Bringing the Rehabilitated Columbia Metro WWTP Anaerobic Digesters Back to Life, Proceedings 2019 Water Environment Federation Residuals and Biosolids Conference, Ft. Lauderdale, FL, May 2019.
7. Borgmann, R. S., **Bullard, C. M.**, Struve, J.N., and Wiman, D., Leveraging Existing Assets First (LEAF): Developing a Progressive Biosolids Management Approach Through Intentional Infrastructure Repurposing, Proceedings 2019 Water Environment Federation Residuals and Biosolids Conference, Ft. Lauderdale, FL, May 2019.
8. **Bullard, C. M.**, Foisy, M., Wiman, D., Wagoner, D., Bickerstaff, B., and Bridwell, M., Its Alive: Bringing the Rehabilitated Columbia Metro WWTP Anaerobic Digesters Back to Life, 25th Annual South Carolina Environmental Conference, Myrtle Beach, SC, March 2019.
9. Knight, G., **Bullard, C. M.**, Bailey, E., Hanna, A., Long, D., and Lynch, T.J., *Finding the Best Solution for Cooling on Thermal Hydrolysis Projects*, Proceedings 2018 Water Environment Federation Residuals and Biosolids Conference, Phoenix, AZ, May 2018.
10. Pfeffer, K., **Bullard, C. M.**, Chiavaroli, M., Guzman, Karloren, Lisk, B. R., Porter, J., *Selecting an Advanced Anaerobic Digestion Configuration and Biogas Management Strategy for the City of Tampa*, Proceedings 2018 Water Environment Federation Residuals and Biosolids Conference, Phoenix, AZ, May 2018.
11. **Bullard, C. M.**, Hanna, A. L., Knight, G., Lackey, K., Buckley, B., Schaefer, P., Lynch, T.J., and Brower, A., *Reinventing Your Biosolids Management Program and Unlocking Resource Recovery with Thermal Hydrolysis – They City of Raleigh’s Journey*, Proceedings 2017 Water Environment Federation Residuals and Biosolids Conference, Seattle, WA, April 2017.

C. Michael Bullard, PE

TECHNICAL PAPERS AND PRESENTATIONS

12. Knight, G., **Bullard, C. M.**, Lackey, K., Polo, C. Kemp, J., Brower, A., and Lynch, T.J., *A Greener Future for the City of Raleigh – Turning Biosolids Into Vehicle Fuel*, Proceedings 2017 Water Environment Federation Residuals and Biosolids Conference, Seattle, WA, April 2017.
13. **Bullard, C. M.**, Latimer, R. L., and Khunjar, W. O., *Considerations in Applying Thermal Hydrolysis for Advanced Residuals Stabilization*, Proceedings South Carolina Environmental Conference, Myrtle Beach, SC, March 2017.
14. **Bullard, C. M.**, Latimer, R. L., and Khunjar, W. O., *Applying Thermal Hydrolysis in a Nutrient Sensitive World*, Proceedings Georgia Water Professional Conference, Savannah, GA, July 2016.
15. Pfeffer, K., Galav, V., **Bullard, C. M.**, Koroshec, J., and Klug, C., *Turning up the Heat – Advanced Digestion to Meet Disposal Constraints*, Proceedings of the Water Environment Federation Residuals and Biosolids Specialty Conference, Milwaukee, WI, April 2016.
16. Hardy, S., Brown, B., Nguyen, V., McCallum, E., Latimer, R., **Bullard, C.M.**, Harris, R., Lan, JC, and Richards, T., *Holistic Nutrient Recovery at the F. Wayne Hill WRC: WASSTRIP Design and Full-Scale Start-up*, Proceedings of the Water Environment Federation Residuals and Biosolids Specialty Conference, Milwaukee, WI, April 2016.
17. Hardy, S., Brown, B., Nguyen, V., McCallum, E., Latimer, R., **Bullard, C.M.**, Harris, R., Hancock, E, Boss, E., and Lan, JC, *Holistic Approach to Residuals Handling at F. Wayne Hill WRC: Did the Upgrades Work*, Proceedings of the Water Environment Federation Residuals and Biosolids Specialty Conference, Milwaukee, WI, April 2016.
18. Khunjar, W. O., Latimer, R., Bilyk, K., Worley-Morse, T., Taylor, R., **Bullard, C. M.**, Pitt, P., Mann, M., Drummey, P., and Gibson, J., *Understanding the Impacts of Thermal Hydrolysis Products on ENR WRRFs*, Proceedings of the Water Environment Federation Residuals and Biosolids Specialty Conference, Washington, DC, April 2015.
19. Khunjar, W. O., Latimer, R., Bilyk, K., Pitt, P., Taylor, R., **Bullard, C. M.**, Mann, M., and Drummey, P., *Understanding the Impacts of Refractory Thermal Hydrolysis Products on ENR WRRFs*, Proceedings of the Water Environment Federation Technical Exposition and Conference (WEFTEC), New Orleans, LA, September 2014.
20. Porter, J., Schmidt, D., and **Bullard, C. M.**, *Howard F. Curren AWTP Biosolids Dewatering Technology Evaluation*, Proceedings of the Water Environment Federation Technical Exposition and Conference (WEFTEC), New Orleans, LA, September 2014.
21. Wang, L., Hossen, E. H., Aziz, T. N., Ducoste, J., **Bullard, C. M.**, and de los Reyes, F. L., *Developing Resilient Anaerobic Co-Digesting Microbial Communities*, Proceedings of the Water Environment Federation Technical Exposition and Conference (WEFTEC), Chicago, IL, October 2013.
22. Long, J. H., **Bullard, C. M.**, Crump, F., and Shamel, C, *Sometimes Average Isn't Good Enough: Understanding the Impact of Variability on Energy Recovery from Digester Gas*, Proceedings of the Water Environment Federation Residuals and Biosolids Specialty Conference, Nashville, TN, May 2013.
23. Van Horne, M. P., **Bullard, C. M.**, and Linder, Y., *To Haul or Not to Haul? Capacity and Class A Biosolids processing at the Haifa, Israel Wastewater Treatment Plant*, Proceedings of the Water Environment Federation Residuals and Biosolids Specialty Conference, Nashville, TN, May 2013.
24. **Bullard, C. M.**, Lisk, B. R, and Hardy, S. A., *On-site Energy Production: using Digester Gas in Combined Heat and Power Systems*, Indiana Water Environment Association 76th Annual Meeting, Indianapolis, IN, November, 2012.

C. Michael Bullard, PE

TECHNICAL PAPERS AND PRESENTATIONS

25. **Bullard, C. M.**, Latimer, R. L., and Cubbage, L. H., *Resource Recovery Opportunities from Anaerobically Digested Sludge Dewatering Sidestreams*, Northeast Residuals and Biosolids Conference, Amherst, MA, October 2012.
26. Cubbage, L. H., **Bullard, C. M.**, Long, J. H., and Whitaker, J., *Process Assessment to Performance Testing: Transitioning from Plate and Frame to High Solids Centrifuge Dewatering*, Proceedings of the 2012 Water Environment Federation Technical Exposition and Conference (WEFTEC-2012), New Orleans, LA, October 2012.
27. **Bullard, C. M.**, Sorah, W., Coetzee, J., Brown, L., Cox, G., and Ensor, N., *Evaluating Biosolids Management Alternatives in Northeast Tennessee: A Cooperative Masterplanning Effort*, Proceedings of the 2012 Water Environment Federation Technical Exposition and Conference (WEFTEC-2012), New Orleans, LA, October.
28. Long, J. H. and **Bullard, C. M.**, *WAS Pretreatment to Boost Volatile Solids Reduction and Digester Gas Production – Market and Technology Assessment*, Proceedings of the 2012 Water Environment Federation Technical Exposition and Conference (WEFTEC-2012), New Orleans, LA, October 2012.
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31. **Bullard, C. M.** and Van Horne, M. A., *Coming Full Circle: Moving Wastewater Treatment Plants Toward Energy Neutrality*, 2012 Kentucky-Tennessee Water Professionals Conference, Memphis, TN, July 2012.
32. Rohrbacher, J. A., Lisk, B. R., Szoch, C., **Bullard, C. M.**, Whitaker, J., Wichser, R. C., and Frederick, T., *Optimizing Biogas Utilization Provides Energy Savings and Increased Nutrient Removal Reliability*, Water Environment and Technology, April 2012.
33. **Bullard, C. M.**, Sorah, W., Coetzee, J., Brown, L., Cox, G., and Ensor, N., *Evaluating Biosolids Management Alternatives in Northeast Tennessee: A Cooperative Masterplanning Effort*, Proceedings of the 2012 WEF Residuals and Biosolids Specialty Conference, Raleigh, NC, March 2012.
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35. Rohrbacher, J. A., Lisk, B. R., **Bullard, C. M.**, Whitaker, J., Wichser, R. C., and Frederick, T., *Digester Gas Energy Recovery – Deciding Between Driving Blowers or Making Electricity*, Proceedings of the 2012 WEF Residuals and Biosolids Specialty Conference, Raleigh, NC, March 2012.
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37. Lisk, B. R., and **Bullard, C. M.**, *Maximizing the Economic Benefit from CHP Systems through Electric Utility Billing Coordination*, New England Water Environment Association Annual Conference, Boston, MA, January 2012.

C. Michael Bullard, PE

TECHNICAL PAPERS AND PRESENTATIONS

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40. Van Horne, M, Grandstaff, J., Chapman, M., Stone, A. L., **Bullard, C. M.**, Peplinski, D, Long, H., *From Grease to Green: FOG Receiving, Co-Digestion and Combined Heat and Power Generation at the Henrico County, VA Water Reclamation Facility*, 2011 Chesapeake Water Environment Association “TRICON 2011” Meeting, Ocean City, MD, August 2011.
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43. Lisk, B. R., Dodson, J. J., and **Bullard, C. M.**, *Coordinating Utility Billing Rate to Maximize the Benefit from On-Site Energy Generation and Combined Heat and Power Systems*, Proceedings of the 2011 Water Environment Federation (WEF) Energy and Water Conference, Chicago, IL, August 2011.
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45. **Bullard, C. M.**, Lisk, B. R., and Hardy, S. A., *Achieving Economic and Environmental Sustainability Objectives through On-Site Energy Production from Digester Gas*, Ohio Water Environment Association Annual Conference, Sandusky, OH, June 2011.
46. **Bullard, C. M.**, Lisk, B. R., and Hardy, S. A., *Biogas Utilization for On-Site Energy Production*, Pennsylvania Water Environment Association Annual Conference, Lancaster, PA, June 2011.
47. **Bullard, C. M.**, Fishman, M. A., Lisk, B. R., and Hardy, S. A., *Putting Digester Gas to Work: Economic and Environmental Sustainability Via on-Site Energy Production*, 2010 NC AWWA-WEA 90th Annual Conference, Winston-Salem, NC, November 2010.
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49. Hardy, S. A., Jalla, S., and **Bullard, C. M.**, *Solving the Many Variables in a Digester Gas Cogeneration System*, Chesapeake Water Environment Federation Annual Conference, Ocean City, MD, September 2010.

C. Michael Bullard, PE

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53. Abrams, J. S., Earle, J. K., and **Bullard, C. M.**, *Pilot Scale Evaluation of Electro-Osmotic Enhanced Dewatering at the Plum Island Wastewater Treatment Plant*, Proceedings WEF Residuals and Biosolids Specialty Conference, Savannah, GA, May 2010.
54. **Bullard, C. M.**, *Digester Gas Utilization: Sustainable Options for On-Site Energy Production*, Virginia Water Environment Association, 2010 Education Seminar, Richmond, VA, May 2010 (invited speaker).
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58. **Bullard, C. M.**, Vogt, K. L., Lundin, C., *Seasonal and Lifecycle Cost Considerations in Evaluating Beneficial Utilization of Digester Gas*, Proceedings 82nd Annual Conference of the Water Environment Federation (WEFTEC 2009), Orlando, FL, October 2009.
59. **Bullard, C. M.**, Lee, S. W., Cheatham, J. B., Dressell, D., Bond, R., and Shepherd, E., *Energy (and Cost) Implications Associated with Dewatering Technology Selection for Thermal Drying Applications*, Proceedings WEF Residuals and Biosolids Specialty Conference, Portland, OR, May 2009.
60. **Bullard, C. M.**, *Sustainability in Wastewater Treatment Processes via Digester Gas Utilization*, NC WEA/AWWA Sustainability Seminar, Charlotte, NC, September 2008 (invited speaker).
61. Willis, J., **Bullard, C. M.**, Donovan, J., Schultz, S., and Shaw, T., *JEA's Path out of Biosolids Purgatory through Anaerobic Digestion and Drying Enhancements*, Proceedings WEF Residuals and Biosolids Specialty Conference, Philadelphia, PA, March 2008.
62. Schmidt, D. B., **Bullard, C. M.**, Edeback, J., Wegis, H., *Handling Residuals Management in a Changing World: Lee County Utilities Regional Biosolids Management Plan*, Proceedings WEF Residuals and Biosolids Specialty Conference, Philadelphia, PA, March 2008.

C. Michael Bullard, PE

TECHNICAL PAPERS AND PRESENTATIONS

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65. **Bullard, C. M.**, *Design, Permitting, and Start-up Considerations for a Residuals Dewatering and Thermal Drying Facility*, Virginia AWWA/WEA Joint Annual Meeting, Hampton Roads, VA, September 2007.
66. Barber, J. B, Musick, T. E., and **Bullard, C.M.**, *Less Waste or More Treatment Capacity*, Industrial Wastewater, Water Environment Federation, December 2006/January/2007, Volume 5, Number 6, pp. 10-12.
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69. **Bullard, C. M.** and Bonne', R.P., *Biosolids Dryings; Design, Technology, & Economic Considerations*, North Carolina AWWA/WEA Spring Conference, New Bern, NC, April 2006
70. **Bullard, C. M.**, Blount, P.B., and Curtis, G.S., *Charting the Future for Biosolids Management using Lifecycle Costs*, Proceedings 78th Annual Conference of the Water Environment Federation, (WEFTEC 05), Washington, D.C., November 2005
71. **Bullard, C. M.** and Barber, J. B., *Reducing Dewatering Maintenance Costs using Reliability Centered Maintenance*, Proceedings Annual Conference of the North Carolina American Water Works Association and Water Environment Association (NC AWWW/WEA), Winston-Salem, North Carolina, November 2003.
72. **Bullard, C. M.**, *Accommodating Process Variation in the Design and Sizing of Thermal Drying Facilities*, Proceedings 75th Annual Conference of the Water Environment Federation, Chicago, IL, October 2002.
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74. Barber, J. B. and **Bullard, C. M.**, *Drop that Load: Waste Minimization at a Large Chemical Manufacturer*, WEF Industrial Wastewater Newsletter, May/June 2002.
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C. Michael Bullard, PE

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78. **Bullard, C. M.**, *Evaluating Clarifier Robustness Using Monte' Carlo Simulation*, Proceedings 74th Annual Conference of the Water Environment Federation, Atlanta, Georgia, October 2001.
79. Barber, J. B. and **Bullard, C. M.**, *Minimizing Wastewater Load and Sludge Production at a Chemical Manufacturing Facility*, Proceedings: WEF Industrial Wastes Technical Conference, Water Environment Federation, Charleston, SC, August 2001
80. **Bullard, C. M.**, *Improving Belt Filter Press Performance Using Reliability Centered Maintenance*, Proceedings 73rd Annual Conference of the Water Environment Federation, Anaheim, California, October 2000.
81. **Bullard, C. M.**, and Barber, J. B., *Accounting for Environmental Variability with a Modified Activated Sludge Wasting Strategy*, Proceedings 72nd Annual Conference of the Water Environment Federation, New Orleans, Louisiana, October 1999.
82. **Bullard, C. M.**, Barber, J. B., and Vannice, R. W., *Bench and Pilot Scale Anaerobic Liquid Treatment Evaluations for an OCPSF Wastewater*, Proceedings 72nd Annual Conference of the Water Environment Federation, New Orleans, Louisiana, October 1999.
83. **Bullard, C. M.**, *Waste Minimization Success at a Large OCPSF Manufacturing Facility*, Proceedings: WEF/Indiana WPCF/Purdue University Industrial Wastes Technical Conference, Water Environment Federation, Indianapolis, Indiana, June 1999.
84. **Bullard, C. M.** and Barber, J. B., *Sludge Dewaterability Influences on the Full-Scale Evaluation and Selection of Sludge Conditioning Agents*, Proceedings 71st Annual Conference of the Water Environment Federation, Orlando, Florida, October 1998.
85. Barber, J. B., **Bullard, C. M.**, *"Thinking Outside the Box" to Improve Sludge Dewatering Performance*, Proceedings Industrial Wastewater Conference, Water Environment Federation, Nashville, Tennessee, March 1998.
86. Barber, J. B., **Bullard, C. M.** and Meyers, A. J., *Nitrogen Supplementation Strategy for Variable-Strength Industrial Wastewater*, Proceedings 70th Annual Conference of the Water Environment Federation, Chicago, Illinois, October 1997.
87. Barber, J. B., **Bullard, C. M.**, and Charles, M. A., *Centrifuge Test Predicts Solids Dewaterability*, Industrial Wastewater, Water Environment Federation, March/April 1997, pp. 31-36.
88. Operation of Municipal Wastewater Treatment Plants, 5th Edition, Chapter 16, Training, Water Environment Federation, Alexandria, VA, USA, 1996
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90. **Bullard, C. M.** and Barber, J. B., *Effect of Sludge Dewatering Potential on Belt Filter Press Capacity and Performance*, Proceedings 69th Annual Conference of the Water Environment Federation, Dallas, Texas, October 1996.

C. Michael Bullard, PE

TECHNICAL PAPERS AND PRESENTATIONS

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92. Barber, J. B.; **Bullard, C. M.**; and Charles, M. A., *Activated Sludge Process Control based on Sludge Dewatering Potential*, Proceedings 68th Annual Conference of the Water Environment Federation, Miami, Florida, October 1995.
93. Barber, J. B., and **Bullard, C. M.**, *Compensating for Limited Aeration Capacity with Anoxic Pretreatment*, Proceedings 67th Annual Conference of the Water Environment Federation, Chicago, Illinois, October 1994.
94. **Bullard, C. M.**, and Barber, J. B., *Improved Operational Performance Using an Extended Sludge Reaeration Process*, Proceedings 67th Annual Conference of the Water Environment Federation, Chicago, Illinois, October 1994.



Rashi Gupta, PE

Rashi Gupta, a vice president and project manager with Carollo Engineers, has specialized in delivering sustainable solutions for biosolids management and wastewater treatment throughout her career. Ms. Gupta is Carollo's National Solids Process Technology Lead, which allows her to remain current on leading technologies and changes within the biosolids management field.

Her responsibilities as project manager and process specialist on solids-related projects across the country have taken her from the initial planning phase through design to start-up after construction. She also leads applied research projects for solids processes to assess the best ways to integrate innovation into facilities. From this experience, Ms. Gupta has become a national expert in all things related to solids – from thickening and dewatering to digestion and subsequent practices to beneficially use biogas and biosolids. A summary of her experience includes:

Education

MS Environmental and Water Resources Engineering, University of Texas, Austin, 2001

BS Civil and Environmental Engineering, University of California, Davis, 1999

Licenses

Civil Engineer, California
Professional Engineer, Kentucky

Professional Affiliations

California Water Environment Association (CWEA)

Santa Ana River Basin Section of CWEA (SARBS):

- Past-President, Board of Directors

Southern California Alliance of Publicly Owned Treatment Works

Water Environment Federation

- Member, Residuals and Biosolids Committee
- Past Chair, Solids Separation Sub-Committee
- Member, Bioenergy Sub-Committee

Biosolids Processing and Management

→ Subject matter expert for King County, Washington, Planning Analysis for West Point Digestion Capacity project.

Conventional and innovative solids processing options are being evaluated against numerous criteria to determine the best approaches for King County's long-term solids management at the West Point plant. Ms. Gupta is providing guidance on the solids processes under consideration and technical review of the evaluations and planning document deliverables.

→ Technical advisor for the Post Point Resource Recovery Plant's Primary Sludge Tank Replacement Design for the City of Bellingham, Washington. The existing primary sludge tank is reaching the end of its useful life and needs to be replaced. Carollo will design the new tanks that will replace this single tank and modifications for the piping and pumping systems to and from the new tanks. Responsibilities include assessment of existing system and review of alternatives developed by project team.

→ Project manager for the City of Oxnard, California, Food Waste Preprocessing and Implementation of Co-Digestion for the Anaerobic Digesters project. This project, which is funded in part through a grant obtained by the City from the EPA, includes evaluation of food waste projections, solids system capacity analyses, food waste preprocessing technologies, cost/benefit analyses, and bench scale food waste digestion. The bench scale work includes operation of

four lab scale digesters with varying feed-stock to assess digestibility, loading rates, biogas production, and impacts on dewaterability and odor generation. Ms. Gupta is managing this work.

→ Solids systems lead for the Clean Water Services, Oregon, Durham Advanced Wastewater Treatment Facility East Basin 2019 Master Plan. Ms. Gupta is leading the existing solids system capacity analysis and evaluation of solids treatment alternatives. The alternatives considered include innovative technologies like hydrothermal liquefaction, gasification, and pyrolysis as well as thermo-chemical hydrolysis and high solids digestion with recuperative thickening. The capacity analysis includes existing solids thickening, digestion, co-digestion, dewatering, fermentation, WASSTRIP/Ostara, and biogas utilization processes.

→ Project engineer for the City of Sioux Falls, South Dakota, Wastewater Treatment Expansion Project. She is responsible for preliminary and final design of a comprehensive overhaul of the plant's existing solids handling system. The preliminary design includes the addition of WAS thickening with rotary drum thickeners and associated systems within an existing solids handling building, a new digested sludge storage tank, a new solids dewatering facility with screw presses, and covered cake storage. The design also includes provisions for direct truck-loading.

→ Alternatives analysis task lead for the 2020 Energy Management Master Plan at

Awards

Induction into Select Society of Sanitary Sludge Shovelers (5S) by the California Water Environment Association

Spotlight Volunteer Award from the Santa Ana River Basin Section of CWEA

Other

Accomplishments

National Science Foundation Fellow - University of Texas, Austin

Regents Scholar - University of California, Davis

Recipient of University of California, Davis M.S. Ghauri Medal for the College of Engineering

Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

the Nine Springs Wastewater Treatment Plant operated by the Madison Metropolitan Sewerage District, Wisconsin. This project includes assessment of the plant's existing energy baseline within its solids processes, and evaluation of alternatives to reduce energy consumption, increase energy production, and increase resource recovery. Ms. Gupta completed a review of the plant's complex heat loops, heat demands, and heat supply systems and recommended improvements for a more reliable, simpler heating system. Ms. Gupta led the team responsible for conducting alternatives analyses.

→ Technical advisor for the Sludge Thickening and Dewatering Building projects at the 285 mgd Central District WWTP and 112.5 mgd South District WWTP operated by the Miami-Dade Water and Sewer Department, Florida. She worked with the team to develop facility layouts/design concepts and continued through project duration, provided technical reviews and checks for the design of the thickening and dewatering facilities polymer, cake conveyance and truck loading for both treatment plants. Each treatment plant will be provided new thickening and dewatering buildings with four 30-inch bowl dewatering centrifuges, dry polymer make-down, cake pumping systems and truck loading silos. The Central District WWTP will include thickening with eight gravity belt thickeners whereas the South District WWTP will include six 30-inch bowl thickening centrifuges. Each facility will also include new odor control, centrate management, electrical and controls systems.

→ Project engineer for the City of Burlingame, California, Digester Equipment Building and Digester No. 2 Predesign Project. This project included evaluation of replacing two existing digesters with a new digester and a new sludge storage tank. Sizing of the new digester and sludge storage tank was based on a review of the plant's past 5 years of process data to estimate effective volume needed to a design capacity of 4 mgd. Various site layouts were then developed to fit

the new digesters and an associated digester equipment building around another digester and gravity thickener.

→ Process specialist for the City of Burlingame, California, Digester Equipment Building and Digester No. 2 preliminary design. The preliminary design includes a new 55-ft diameter digester, rehabilitation of an existing pump mixing systems for both digesters, and a new digester equipment building to house new sludge recirculation and heating systems and a new electrical room. Ms. Gupta is leading the design effort.

→ Technical advisor for the Primary Sludge Thickening Improvements project at the 150 mgd Flamingo Water Resource Center operated by the Clark County Water Reclamation District, Nevada. She is providing technical reviews and checks for the design of the primary sludge pumping, screening, and gravity thickening facilities. The design includes installation of 20 thin primary sludge pumps, 7 sludge screens, four 80-ft diameter gravity thickeners, and 8 thickened primary sludge pumps.

→ Technical advisor for the Sacramento Regional County Sanitation District, California, Biosolids Recycling Alternatives Study and Management Plan Update. Carollo was selected to provide a long-term biosolids management plan for reuse and recycle of biosolids while reducing Sacramento's risks and costs. In addition to conventional economic and non-economic analyses, project included a market analysis to help the District identify biosolids products that would be acceptable to the market.

→ Project manager for the Blower Building Condition Assessment at the JB Latham Treatment Plant for the South Orange County Wastewater Authority, California. This project included condition assessment of the building, mechanical, and electrical systems, and performance assessments of the plant's existing blowers, primary influent pumps, RAS pumps, WAS pumps, and primary sludge pumps. Ms. Gupta managed the project.

→ Project manager for the Hydraulic Study at the JB Latham Treatment Plant for the

Awards

Induction into Select Society of Sanitary Sludge Shovelers (5S) by the California Water Environment Association

Spotlight Volunteer Award from the Santa Ana River Basin Section of CWEA

Other

Accomplishments

National Science Foundation Fellow - University of Texas, Austin

Regents Scholar - University of California, Davis

Recipient of University of California, Davis M.S. Ghausi Medal for the College of Engineering

Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

South Orange County Wastewater Authority, California. This project includes the development and calibration of a full plant hydraulic model, and hydraulic modeling to assess plant capacity under varying hydraulic scenarios. Ms. Gupta managed the project.

→ Co-principal investigator for the Characterization and Contamination Testing of Source Separated Organic (SSO) Feedstocks and Slurries for Co-Digestion at Resource Recovery Facilities project for the Water Research Foundation (WRF). The project includes multiple tasks to ultimately provide industry guidance on sampling and analytical methods to characterize food waste, standardized monitoring protocols, minimum feedstock quality standards, impacts of feedstock on digestion and biogas utilization processes, and recommended SSO feedstock pre- and post-treatment practices.

→ Project manager for the Chiquita WRP Digester Heat Loop Improvements project for the Santa Margarita Water District, California. She developed conceptual level modifications to the digestion heat loop to address heating deficiencies and mitigate corrosion related failure of the heat loop system.

→ Task lead for the Tahoe-Truckee Sanitation Agency's Master Sewer Plan, Truckee, California. She is responsible for addressing operational and capacity issues within the solids processing system, which includes gravity thickeners, thermophilic digestion, dewatering of chemical sludge with a plate and frame press, dewatering of biological sludge with centrifuges, and ancillary chemical conditioning systems.

→ Project manager for the Union Sanitary District's WAS Thickener Replacement Project at the Alvarado Wastewater Treatment Plant in Union City, California. The project includes evaluation of thickening technologies, and preliminary and final design for a retrofitted thickening facility with new polymer, thickened sludge conveyance, HVAC, electrical and other ancillary systems. Ms. Gupta is managing the project.

→ Process engineer for Union Sanitary District's (USD) Primary Digester No. 8 Feasibility Study which evaluated the feasibility of constructing a new Primary Digester No. 8 in multiple areas of the plant and evaluated repurposing opportunities for Primary Digesters No. 1 through 3.

→ Technical advisor for the Union Sanitary District, California, Primary Digester No. 2 Rehabilitation Project. Assisted with evaluation and replacement of heat exchanger, recirculating pump, gas thermal flow meter, and digester gas and sludge transfer piping.

→ Project engineer and task lead for the Treasure Island Wastewater Treatment Plant and Recycled Water Facility Project for the San Francisco Public Utilities Commission, California. Her responsibilities include the conceptual design of new solids blending, thickening, and truck loading facilities for this greenfield plant. The conceptual design documents will be used by a design/build team for delivery of the final constructed facility.

→ Project manager for the Solids Management Study for the City of Los Angeles, California, Terminal Island Water Reclamation Facility. The study includes an assessment of existing solids processing capacity and capacity available for co-digestion of food waste. The processes evaluated include thickening, thermophilic digestion, centrifuge dewatering, and dewatered cake loading systems. Biosolids management and digester gas utilization options were studied to determine feasibility of the various options for the plant.

→ Project manager for the Flare Study at the JB Latham Treatment Plant for the South Orange County Wastewater Authority, California. This project included an evaluation of expected SCAQMD permitting requirements and recent code requirements on new flares and digester gas storage systems that SOCWA may need to install at the JBLTP. Ms. Gupta managed the project.

→ Technical advisor for the South Orange County Wastewater Authority (SOCWA), California, Innovative Biosolids Technologies project. The project included identification of promising innovations in biosolids

Awards

Induction into Select Society of Sanitary Sludge Shovelers (5S) by the California Water Environment Association

Spotlight Volunteer Award from the Santa Ana River Basin Section of CWEA

Other

Accomplishments

National Science Foundation Fellow - University of Texas, Austin

Regents Scholar - University of California, Davis

Recipient of University of California, Davis M.S. Ghausi Medal for the College of Engineering

Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

management, development of an RFP for related solutions providers, and evaluation of proposals received relative to criteria important to SOCWA.

→ Subject matter expert for the Biosolids Capital Conversion Projects project for the JEA, Florida, Buckman Wastewater Treatment Facility, Florida. She assisted in the development of a centrifuge pilot plan, checked the 30% design for the post-aerobic digestion system, and is working with the team on layouts and final design development for the thickening, dewatering, and fully redundant 86 DT/day (430 WT/d) thermal drum drying facilities for this regional solids treatment plant.

→ Technical lead for the Biosolids Facility project for the City of Kansas City, Missouri, Blue River Wastewater Treatment Plant. She Worked with the owner's advisor design team to develop a 30% design for the sludge screening, centrifuge thickening and dewatering facilities, polymer system, hydrolyzed sludge and cake conveyance and storage, and digestion improvements as part of an overall incorporation of thermal hydrolysis at the plant. Additional areas under Rashi's purview included polymer, sludge conveyance, and coordination with other disciplines for necessary support facilities.

→ Project engineer for the Solids Thickening Project for the Encina Wastewater Authority in Carlsbad, California. Her responsibilities include the preliminary and final design of the RDT-based solids thickening facilities in an existing dewatering building. She is also leading the design of the polymer and thickened sludge conveyance, and coordinating with other disciplines for necessary support facilities.

→ Task lead for the Phase IIB Improvements project for the City of Fargo, North Dakota. Her responsibilities include the final design of the centrifuge-based solids thickening facilities in a new building. She is also leading the design of the polymer, thickened sludge conveyance, and bridge crane systems, and coordinating with other disciplines for necessary support facilities.

→ Project manager for the California State Water Resources Control Board, California, Co-Digestion Capacity Analysis. This project includes a statewide analysis of food waste quantities, anaerobic digestion capacity needs/availability, investment needs, impacts on greenhouse gas production, lessons learned through case studies, and measures that can be taken to successfully implement co-digestion of food waste across California.

→ Project manager for the Plant Solids System/Capacity Assessment (Phase 1) project at the Union Sanitary District, California, Alvarado Wastewater Treatment Plant. This project included a capacity assessment of all solids treatment processes, optimization of existing processes, and planning-level recommendations for additional solids processes required to reach the plant's permitted capacity. The project also included evaluations of technologies to achieve Class A biosolids, investigation of options to achieve energy neutrality, and determination of potential regulatory changes that could affect the plant.

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→ Project engineer for the Biosolids Master Plan for the Fresno Clovis Wastewater Reclamation Facilities in Fresno, California. This project includes a capacity assessment of solids treatment processes, evaluations of technologies to achieve a diverse portfolio of biosolids, investigation of local markets for different classes of biosolids, and determination of potential regulatory changes that could affect the plant. Ms. Gupta is responsible for solids system capacity assessment and evaluations of solids processing technologies.

→ Project engineer for the Plant 3 Upgrades Project for the City of Lubbock, Texas, Southeast Water Reclamation Plant. This project includes replacement of existing secondary clarifiers, new RAS and scum pump stations, and upgrades to the existing aeration piping. Ms. Gupta is responsible for design of the pump stations.

→ Process specialist for the Solids Handling Improvement Project at the Bend Water

Rashi Gupta, PE

Awards

Induction into Select Society of Sanitary Sludge Shovelers (5S) by the California Water Environment Association

Spotlight Volunteer Award from the Santa Ana River Basin Section of CWEA

Other

Accomplishments

National Science Foundation Fellow - University of Texas, Austin

Regents Scholar - University of California, Davis

Recipient of University of California, Davis M.S. Ghausi Medal for the College of Engineering

Quotes

See "Client Feedback" at end of resume

Reclamation Facility for the City of Bend, Oregon. The project includes the rehabilitation of existing thickening and dewatering facilities to install new equipment for increased capacity and reliability. Preliminary design included an assessment of dewaterability through external sludge testing, investigation of potential optimization measures to improve process efficiency, and an evaluation of screw presses, centrifuges, and belt filter presses for installation in an existing solids handling building. Final design was based on the results of that evaluation and includes centrifuges and upgrades to the polymer, ventilation, cake load-out, automation, and electrical facilities.

→ Design manager for the Cogeneration and Solids Improvements at Willow Lake WPCF for the City of Salem, Oregon. The project includes the rehabilitation of existing thickening and dewatering facilities to install new equipment for increased capacity and reliability. The final project, which includes rotary drum thickeners, centrifuges, and emulsion polymer systems, was based on an earlier project phase that included evaluation of various technologies.

→ Technical lead for the Solids Handling Improvements Project for the Rock Creek AWWTF for Clean Water Services, Oregon. The project included evaluation, selection, and procurement of dewatering centrifuges, design of modifications for installation of the new dewatering centrifuges in an existing belt filter press building, new polymer system, HVAC modifications, and odor control.

→ Subject matter expert for the RP-1 Liquid and Solids Capacity Recovery Project for the Inland Empire Utilities Agency in Chino, California. Her responsibilities include oversight of the preliminary and final design of the multi-phase digestion system and new solids thickening facilities. Preliminary design included evaluation of various digester mixing and heating systems, and final design includes incorporation of the new system elements into the plant's existing heat loops.

→ Subject matter expert for King County, Washington, Planning Analysis for West

Point Digestion Capacity project. The project includes planning level analyses for solids processing and management options due to a lack of digestion capacity and site footprint constraints. Conventional and innovative solids processing options are being evaluated against numerous criteria to determine the best approaches for King County's long-term solids management at the West Point plant.

→ Project manager for the Dewatering and Digester System Assessment Project at the JB Latham Treatment Plant for the South Orange County Wastewater Authority, California. This project includes capacity and condition assessment of the existing digester heating and dewatering processes. Ms. Gupta is managing the project.

→ Project manager for the Dewatering System Assessment Project at the Regional Treatment Plant for the South Orange County Wastewater Authority, California. This project includes capacity and condition assessment of the existing dewatering equipment and processes. Ms. Gupta is managing the project.

→ Project manager for the South Orange County Wastewater Authority (SOCWA), California, JB Latham Facility Improvements Package "B". Planning, design, and engineering services during construction (ESDC) for various plant upgrades and basin rehabilitation. The planning of this project used process and hydraulic modeling to assess the plant's capacity under a variety of operating scenarios, assessed various effluent management options, evaluated the condition of existing infrastructure onsite, and made recommendations for facility improvements to address capacity and condition-related constraints. Those recommended improvements were then designed and implemented in the design and ESDC project phases. Improvements included rehabilitation of primary and secondary sedimentation basins, dissolved air flotation thickeners, thickened sludge pumping, digester mixing, digester heating, effluent pump station and valves, and associated electrical and controls systems.

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Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

→ Project manager for the Plant Solids System/Capacity Assessment (Phase 1) project at the Alvarado Wastewater Treatment Plant for the Union Sanitary District, California. This project includes a loadings-based capacity assessment of all solids and liquid treatment processes, optimization of existing processes to improve operations and increase capacity, and planning-level recommendations for additional solids processes required to reach the plant's permitted capacity of 33 mgd. The project also includes evaluations of technologies to achieve Class A biosolids, investigation of options to achieve energy neutrality, and determination of potential regulatory changes that could affect the plant. Some of the focus areas of the project include codigestion, high solids digestion with recuperative thickening, chemically-enhanced primary treatment, solids drying, low-temperature thermal hydrolysis, and high-temperature thermal hydrolysis. Ms. Gupta is responsible for project management, solids optimization and capacity assessment, analyses of digestion options, and overall technical oversight.

→ Project manager for the Plant Solids System/Capacity Assessment (Phase 2) project at the Alvarado Wastewater Treatment Plant for the Union Sanitary District, California. This project includes a loadings-based capacity assessment of all liquid treatment processes, optimization of existing processes to improve operations and increase capacity, and planning-level recommendations for additional liquid processes required to reach the plant's permitted capacity of 33 mgd. Ms. Gupta is responsible for project management and overall technical oversight.

→ Project manager for the CLARTS Impacts Study for the City of Los Angeles, California, Hyperion Treatment Plant. The study focused on the impacts at the 450-mgd plant of organic waste conveyed from the CLARTS facility to the plant by sewer. The study included an assessment of existing solids processing capacity, including centrifuge thickening, thermophilic digestion system, sludge screening, centrifuge dewatering, and dewatered cake loading systems.

The impacts of increased load from the organic waste on the existing solids systems and ancillary processes were determined and recommendations made to mitigate those impacts. The study included an assessment of existing solids processing capacity, including centrifuge thickening, thermophilic digestion system, sludge screening, centrifuge dewatering, and dewatered cake loading systems. The impacts of increased load from the organic waste on the existing solids systems and ancillary processes will also be determined and recommendations to mitigate those impacts will be made.

→ Project engineer for the Improvements to Anaerobic Digesters Nos. 1-3, Omnivore Cost Evaluation study, and final design at the City of South San Francisco, California, Water Quality Control Plant. The original project included the replacement of two existing digesters with new digesters and rehabilitation of a third existing digester to meet seismic requirements and improve system reliability. The preliminary design phase of this project included an evaluation of digester mixing technologies, digester roof, and heating system options as well as finalization of the required rehabilitation necessary for the single digester being upgraded. The Omnivore study included a cost-based evaluation of the Anaergia Omnivore process compared with conventional digestion. The study included both capital and life-cycle costs, and the results were sufficiently attractive for the City to change the original design intent of the project to include a preliminary design of an Omnivore system. Ms. Gupta conducted the evaluation and developed the subsequent report for the City. The final project includes design for the replacement of two existing digesters with one new high solids ("Omnivore") digester and rehabilitation of a third existing digester to meet seismic requirements and improve system reliability. Replacement of existing mixing system with a linear motion mixer was provided for the retrofitted digester. Modifications to the digester heating and sludge transfer systems are also included as part of overall system

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Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

improvements. She is responsible for the final design of the Omnivore and conventional digestion system at the plant.

→ Project engineer for the City of Lubbock, Texas, Southeast Water Reclamation Plant Solids Handling Improvements Project. Designed staged replacement of three existing gravity belt thickeners, four belt filter presses, and associated dry polymer systems with three new rotary drum thickeners, three 30" dewatering centrifuges, and emulsion polymer feed systems while retaining the plant's ability to thicken and dewater the solids produced during construction. The \$34M project, which provides reliable dewatering capacity of 9,000 lb/hr, also included a new cake storage and truck loading bay, new odor control, rehabilitated sludge storage tanks, and new E&C systems. Her work inside an existing solids handling building included staged replacement of three existing gravity belt thickeners, four belt filter presses, and associated dry polymer systems with three new rotary drum thickeners, three dewatering centrifuges, and emulsion polymer feed systems while retaining the plant's ability to thicken and dewater the solids produced during construction. Improvements to the solids handling system also included replacement of an existing truck-loading system located within the building with an external, drive-through truck-loading bay. In addition to her responsibilities for the design of the solids handling facilities, she also coordinated the replacement of the existing building ventilation system and the addition of a new odor control facility dedicated to the solids handling system. The modifications will provide a reliable solids handling capacity sufficient for 29-mgd average annual flow.

→ Project engineer for the San Jacinto Regional Water Reclamation Facility Title 22 Tertiary and Plant 2 Facilities Expansion for the Eastern Municipal Water District, California. The project expanded plant capacity to 14-mgd average annual flow through the expansion of the digestion and solids handling facilities as well as the replacement of the existing headworks, addition of a new liquid treatment train, and expansion of the

tertiary treatment facilities. Her primary design responsibilities included two new 80-ft diameter digesters with Rotamix mixing systems, chopper pump-based sludge recirculation and heating systems, heating and feed system modifications for three existing digesters, a new sludge storage tank, a boiler facility and primary heating system for the digesters, primary sludge and scum pump stations, a digested sludge transfer pump station, and a waste activated sludge thickening facility with rotary drum thickeners. As part of preliminary design, she also analyzed the modifications required for an existing sludge pasteurization system to meet Class A biosolids requirements.

→ Project team member for the Co-Digestion of Organic Waste: Addressing Operational Side Effects report for the Water Environment and Reuse Foundation (WERF) and the New York State Energy Research and Development Authority (NYSERDA). The Final Report, published in 2017, included a comprehensive review of operational impacts and considerations associated with co-digestion of organic waste. Ms. Gupta wrote about lessons learned and the practical challenges overcome by successful facilities. She also reviewed and edited the report.

→ Solids process engineer for the Anaerobic Digester No. 4 and FOG Receiving Facility Project for the Dublin San Ramon Services District in Dublin, California. This project included design of a new 70-ft diameter digester and FOG receiving facility at a severely constrained site. The digester design included roof-mounted draft tube mixing and a sludge heating recirculation system. The FOG receiving facility was designed with cone-bottom FOG tank, FOG recirculation with a chopper pump, tube-in-tube heat exchanger, rotary lobe positive displacement digester feed pump, and other O&M friendly features. The FOG system was designed to allow feed to any of the four digesters onsite to maximize operational flexibility and process stability.

→ Project manager for the CLARTS RFP Development Project for the City of Los Angeles, California. The City is developing an RFP for the organics processing system to

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Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

be installed at the CLARTS facility. Carollo is providing technical review of the RFP and managing the project's team members.

→ Project engineer for the Co-Digestion and Digester Gas Utilization Feasibility Study for the Inland Empire Utilities Agency, California. This study included estimation of external feedstock available in the Agency's service area and projections of associated digester gas production. Ms. Gupta conducted the evaluation and developed the subsequent report for the City.

→ Technical reviewer for the Delta Diablo Regional Sanitation District, California, Food Waste Receiving Facilities Assessment. This project supported the District's East County Bioenergy Project, which will include food waste collection and processing by a private waste management partner and co-digestion of food waste slurry and FOG at the District's wastewater treatment plant. The assessment included a study of best management practices, operational side effects, odor control, and O&M needs for food waste receiving facilities. Ms. Gupta advised the project team and reviewed the study.

→ Project engineer for the Facilities Master Plan for the Central Marin Sanitation Agency, California. Ms. Gupta is responsible for an assessment of current digester capacity, estimation of additional FOG and food waste that could be accommodated at the facility, projections of additional digester gas production, planning level modifications to add capacity at the existing FOG/Food Waste Receiving Facility, and recommendations for modifications to the current dewatering system.

→ Project manager for the Perris Valley Regional Water Reclamation Facility Dual-Fuel Boiler Installation Project for the Eastern Municipal Water District, California. Her responsibilities included management of a quick-paced project to install a new dual-fuel boiler and digester gas pressurization system during the construction of two other projects onsite. The new boiler and gas system were installed under a canopy to minimize project cost and maintain an accelerated schedule. The project required coordination with permitting agencies to ensure

compliance with stringent emissions requirements. Due to project schedule, the project was delivered in a hybrid design-build approach that shared many of the features of the design-assist model.

→ Project manager for the San Jacinto Valley Regional Water Reclamation Facility Interim Solids Handling Project for the Eastern Municipal Water District, California. Her responsibilities included management of a critical, fast-tracked project; evaluation of the existing biosolids systems; and design and start-up of an interim sludge heating system to increase reliability of existing digesters. The project also included analysis of capacity-limiting cake conveyance equipment within the existing belt filter press and centrifuge-based dewatering system and implementation of changes to increase system reliability ahead of an overall plant expansion. Before system start-up, she assisted with development of an operations and maintenance manual and provision of operator training on the system.

→ Project engineer for the 2015 Regional Water Reclamation Facilities Master Plan Update for the Eastern Municipal Water District, California. Carollo was retained to update the comprehensive Capital Improvements Plan we developed fifteen years ago for each of the District's four reclamation facilities. The update includes a review of existing capacity, impacts of regulatory changes, and recommendations for future projects to address those regulatory changes as well as the increasing loads experienced at each facility. The plan covers both liquid and solids treatment processes and Ms. Gupta is responsible for the solids system work.

→ Project manager for the Southside Water Reclamation Facility FOG Receiving Station Study for the Albuquerque Bernalillo County Water Utility Authority, New Mexico. Ms. Gupta managed the project, which initially included a comprehensive survey of existing FOG receiving facilities to determine operational histories, types of equipment and materials used, and lessons learned. A second project task included development of documentation for the Utility to use to

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Other

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Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

assess the quality and quantity of FOG available in their vicinity. Finally, operational requirements associated with FOG receiving stations were evaluated and documented to help the Utility understand required staffing, tasks, and maintenance frequency for FOG systems.

→ Assistant project manager for the Michelson Water Recycling Plant Biosolids and Energy Recovery Facilities Master Plan and Preliminary Design for the Irvine Ranch Water District, California. Rashi was responsible for project management, interdisciplinary coordination, and preliminary design of the digestion system. During planning, she evaluated the feasibility of diverting volatile fatty acids as carbon substrate for the secondary treatment system. As part of the master plan, she assisted with the evaluation of various digestion technologies and several biogas management alternatives. The preliminary design of the 28-mgd "greenfield" project included an evaluation of several conventional and advanced sidestream treatment processes to minimize the impacts of the solids systems on the existing liquid treatment processes. The preliminary design for the facility included phased digestion, centrifuge thickening and dewatering, solids storage, centrate treatment, biogas treatment and utilization systems, and digester heating.

→ Project manager for the Emulsion Polymer System Modifications project at the Orange County Sanitation District's Plant No. 1 in California. This fast-tracked project included the addition of new emulsion polymer storage, mixing, containment, and connections to existing polymer feed units to improve the District's dewatered cake dryness and reduce hauling costs. Ms. Gupta led the design effort and managed the project.

→ Project manager of the Dewatering Optimization Project for the Eastern Municipal Water District (EMWD) in California. In addition to managing the project, Ms. Gupta conducted audits of the centrifuge dewatering systems at each of the four facilities operated by EMWD to determine baseline dewatering performance, capacity, and operating costs. She also conducted centrifuge

training and developed optimization protocols to help the facilities standardize operations and data collection.

→ Project manager and facility support engineer for the Biogas Enhancement Project Modifications at the Sacramento Regional Wastewater Treatment Plant for Sacramento Regional County Sanitation District, California. Project includes a fats, oils, and grease (FOG) facility that provides FOG processing capacity of 50,000 gallons per day to increase the generation of digester gas. She assessed corrosion and abrasion resistance of various system components and material alternatives to enhance facility life and operability. Based on evaluation results and District preferences, she designed modifications to the FOG facility to reduce operational attention required for the facility.

→ Project engineer for the Palm Springs Wastewater Treatment Plant Upgrade operated by Veolia Water NA for the City of Palm Springs, California. This project includes much-needed upgrades to both the liquid and solids treatment systems necessary to maintain the plant's treatment capacity and reduce odors. Ms. Gupta is responsible for the work associated with the solids treatment systems including rehabilitation of two gravity thickeners and one anaerobic digester as well the evaluation of a new mechanical sludge dewatering facility. The preliminary design included an evaluation of sludge dewatering technologies including belt filter presses, screw presses, and centrifuges. Final design for the facilities is based on the decisions made during the preliminary design phase.

→ Design engineer and construction support for the Perris Valley Regional Water Reclamation Facility Plant 3 Facilities Expansion to 22 mgd for the Eastern Municipal Water District, California. This project included the addition of a new liquid treatment train and completely new anaerobic digestion systems to handle solids from both liquid trains. A new centrifuge, associated polymer, and electrical systems were installed in the existing dewatering facility to increase dewatering capacity and improve performance. Ms. Gupta was a lead engi-

Rashi Gupta, PE

Awards

Induction into Select Society of Sanitary Sludge Shovelers (5S) by the California Water Environment Association

Spotlight Volunteer Award from the Santa Ana River Basin Section of CWEA

Other

Accomplishments

National Science Foundation Fellow - University of Texas, Austin

Regents Scholar - University of California, Davis

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Quotes

See "Client Feedback" at end of resume

neer for the solids processes and set the design criteria for those systems. Her design responsibilities also included new primary sludge and scum pump stations, a waste activated sludge thickening facility with rotary drum thickeners, two return activated sludge/waste activated sludge pump stations, a digested sludge transfer pump station, and tertiary filter backwash and concentrate return water pump stations. She also provided construction support services through submittal review and responses to contractor requests for information.

→ Project engineer for the Sludge Thickening and Digester Upgrades Project at the South Cross Bayou Water Reclamation Facility for the Pinellas County Utilities, Clearwater, Florida. The project included preliminary design services for conversion from conventional to acid-phased digestion and upgrades to the County's sludge thickening system. She was responsible for analysis of the existing digester heating system, investigation of the existing fats/oil/grease (FOG) collection and digester feed system, evaluation of sludge thickening alternatives, and development of preliminary design drawings and technical memoranda for required modifications.

→ Project engineer for the City of Las Vegas, Nevada, Water Pollution Control Facility Centrifuge Cooling System Project. She was responsible for assessing the cooling provisions for eight existing centrifuge lubrication systems and recommending improvements to increase their life. She inspected existing shell-and-tube heat exchangers and cooling water characteristics to determine suitability, and studied other options for exchanger type, materials of construction, water source, and cooling via air or chiller water. A memorandum summarizing findings and recommendations was submitted to the City.

→ Project engineer for the El Dorado Irrigation District's Evaluation of the Deer Creek WWTP Biosolids Operations Project in El Dorado Hills, California. Ms. Gupta conducted site visits and an audit of the overall solids system to determine if existing belt filter press performance could be improved. The evaluation covered gravity thickening,

aerobic digestion, sludge transfer, dewatering, polymer, lime addition, and conveyance systems.

→ Project engineer during the construction phase of the Digester No. 1 Rehabilitation Project for the City of Palm Springs/Veolia Water NA in Palm Springs, California. Her responsibilities included development and review of field changes during construction, assistance with the startup of the digester heating system, and advising operations staff on various questions about the digestion system during initial operations. She conducted field inspections to assess construction progress and developed design documents to address piping conflicts with unknown underground utilities. In addition, she suggested specific modifications to the digester heating loop that were incorporated during construction to better control the digester heating system.

→ Project engineer and construction support for the Soscol Water Recycling Facility for the Napa Sanitation District, California. She studied the performance and capacity of the existing aeration system and developed recommendations for aeration system upgrades to improve secondary treatment performance. During a separate project phase, she provided construction management services and reviewed submittals for innovative digester gas storage system modifications.

→ Project manager for Orange County Sanitation District, California, Process Engineering Training program. She is managing the provision of Carollo's training services for the District's trickling filter/solids contact, oxygen activated sludge, digestion, and dewatering systems. She is personally responsible for training District engineering personnel on digestion and dewatering processes.

→ Project manager for the Biosolids Regulations and Requirements training project for the Eastern Municipal Water District, California. Ms. Gupta developed and provided training on the 40 CFR Part 503 (Standards for the Use or Disposal of Sewage Sludge) regulations for each of the District's four reclamation facilities. The training focused

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Other

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Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

on the federal and state regulatory and operational requirements for consistent production of Class B sludge for land application.

→ Project engineer for the Comprehensive Wastewater Master Plan for the City of Riverside, California. Carollo was retained to develop a master plan for all wastewater facilities owned and operated by the City. The master plan included projections of the impacts of regulatory changes, and recommendations for future projects to address those regulatory changes as well as the increasing loads experienced at the City's treatment facility. The plan covered both liquid and solids treatment processes and Ms. Gupta was responsible for the solids system work.

→ Project engineer for the Facilities Master Plan 2017 for the Orange County Sanitation District, California. Carollo was retained to develop a facilities master plan for all wastewater facilities owned and operated by the District. The master plan included documentation of existing facilities, determination of operation issues that must be addressed, and recommendations for future projects to address those issues. The plan covered both liquid and solids treatment processes and Ms. Gupta was responsible for the solids system work.

→ Project engineer for the AquaCritox Demonstration Facility at the Orange County Sanitation District's Plant No. 2. Carollo was retained by SCFI Group LTD to develop conceptual level documents describing how a full scale demonstration facility for the SCFI supercritical water oxidation system would be integrated into the existing plant. Ms. Gupta assisted with facility layout, piping connections, and the conceptual level cost estimate for the facility.

→ Technical advisor and reviewer for the Five Year CIP Projects and Digester Cover Replacement Project for the Sewerage Agency of Southern Marin, California. Her responsibilities included collaboration with Agency personnel to highlight impacts of potential regulatory changes on the plant's solids processes, review of digester cover

evaluation, and advising project team on digester heating system design parameters.

→ Technical advisor and reviewer for the digester modifications, mixing system evaluation, Omnivore analysis, centrifuge selection process and associated specifications for the Rock Creek Solids Handling Improvements Project for Clean Water Services (CWS), Oregon. For the dewatering system, her responsibilities included collaboration with CWS personnel to highlight differences between centrifuges, advising on centrifuge selection parameters, and finalization of centrifuge specifications for the project. Ms. Gupta's responsibilities for the digestion system included review of required modifications for existing digesters to increase capacity, advising on potential causes for digester foaming, analyzing results of mixing system tests, development of improvements for sludge transfer, and review of an analysis of the Omnivore system to increase digester capacity at the facility.

→ Technical advisor for the Willow Lake WPCF - Solid Waste Storage Facility and 5-Year CIP Guideline Phase 2 projects for the City of Salem, Oregon. Assisted team with facility layouts, equipment selection, and evaluations of various sludge thickening and dewatering options for the facility. Collaborated with project team and plant staff at workshop to finalize planning level recommendations for solids system modifications.

→ Technical reviewer for the Rock Creek AWWTF Digester 1&2 Modifications Project for Clean Water Services (CWS), Oregon. Ms. Gupta's responsibilities included review of mixer specifications and modifications required to install Omnivore system mixers on an existing tank.

→ Technical reviewer for the dewatering centrifuge evaluation, selection, and final design for the City of Garland, Texas, Biosolids Rehabilitation and Odor Abatement Project. Her initial responsibilities included review of the design team's evaluation of dewatering options based on results from centrifuge pilot tests. The dewatering centrifuges will be installed in an existing dewatering building that will be retrofitted for the selected units. Ms. Gupta analyzed the

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Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

proposed modifications and provided suggestions to improve process reliability and constructability during final design.

→ Technical advisor and reviewer for the Southside Water Reclamation Facility Rotating Drum Thickener Facility Design Project for the Albuquerque Bernalillo County Water Utility Authority, New Mexico. During preliminary design, her responsibilities included review of the design team's evaluation of rotary drum thickeners, advising plant staff on equipment selection, and review of the facility layout for new rotary drum thickeners and associated equipment. During the final design phase of the project, Ms. Gupta will provide final checks on system design.

→ Technical advisor and reviewer for the centrifuge selection process and associated specifications for the Dewatering and Strain Press Final Design Project for the City of Fort Collins, Colorado. Her responsibilities included collaboration with City personnel to highlight differences between centrifuges, advising on centrifuge selection parameters, and finalization of centrifuge specifications for the project.

→ Technical reviewer for the sludge thickening evaluation, selection, and final design for the Gravity Belt Thickener Project for the Rock River Water Reclamation District, Illinois. Her responsibilities included review of the design team's evaluation of thickening options, advising plant staff on equipment selection, and review of the facility layout for new gravity belt thickeners and associated equipment.

→ Technical advisor for the Primary Digester No. 3 Rehabilitation project for the Union Sanitary District, California. Assisted team with evaluation of digester foaming mitigation measures and design details necessary for rehabilitation and repair of an existing digester.

→ Technical advisor for the Process Master Plan for the Encina Wastewater Authority, California. Assisted team with evaluation of the Omnivore process for increased digester capacity at the plant and reviewed master plan for technical accuracy.

→ Technical advisor and quality control for the High Strength Waste Project for the City of Petaluma, California. This project included design of a new high strength waste (HSW) receiving station, modifications to an existing acid phase digester complex to provide storage of digestion feedstock, and a digester feed pump station. The HSW receiving facility included pumps and macerators designed to be O&M friendly. The existing tanks were modified to allow easy removal of grit and contaminants and connected to a robust odor control system. Existing digester mixing and sludge heating systems were re-purposed for HSW. Digester feed pumps with large turndown capability were provided to maximize operational flexibility and digester stability.

→ Technical advisor for the El Estero Wastewater FY 2017 Improvements Project for the City of Santa Barbara, California. Assisted team with facility layouts for primary sludge and sludge transfer pumping systems, equipment selection, and evaluations of various options to reduce pipe clogging in sludge lines at the facility. Collaborated with project team and plant staff at workshops to finalize solids system modifications.

→ Technical advisor for the WWTP Critical Improvements Project for the City of Richmond, California. Assisted team with evaluation of sludge thickening and dewatering options for the facility.

→ Technical advisor for the City of Oak Harbor, Washington, Clean Water Facility Design. The project includes dewatering and dryer technology evaluation, preliminary, and final design for the City's new solids handling processes to replace current sludge lagoons. She has advised the design team and client on available technologies and key differences between manufacturers. Final design for the system will be based on the results of the evaluations.

→ Technical advisor for the Post Point Biosolids Planning and Plant Expansion project for the City of Bellingham, Washington. She advised the team on evaluation of digestion processes including temperature-phased anaerobic digestion.

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Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

→ Technical reviewer for sludge storage, pumping, and dewatering system design as part of the Spring Street Sewage Treatment Plant Upgrades project for the City of Klamath Falls, Oregon. Ms. Gupta reviewed the design team's sizing criteria and design for a screw press-based dewatering system, sludge storage tanks, tank mixing, and system pumps.

→ Technical reviewer for the Dallas Water Utilities Solids Handling Improvements at the Central and Southside Wastewater Treatment Plants in Dallas, Texas. The project included a projection of solids loading at the plant, evaluation of existing facilities, and recommendations for improvements to increase process stability, reduce unintended fermentation, and maximize digester gas production. She reviewed the analytical results, process recommendations, and overall evaluation.

→ Technical reviewer for the City of Oxnard, California, Public Works Integrated Master Plan. The project included an evaluation of biosolids management options and treatment processes to produce Class A biosolids to address uncertainty about future regulatory requirements. She reviewed the evaluation and provided input on process feasibility, historical performance, and future outlook.

→ Technical reviewer for the Southside Water Reclamation Facility Solids Dewatering Facility Project for the Albuquerque Bernalillo County Water Utility Authority, New Mexico. For one part of the project, she reviewed the design concepts for rehabilitating the existing dewatering facility and options for risk mitigation through provision of temporary dewatering and sludge storage during construction. This project phase includes replacement of existing dewatering centrifuges with new units and the addition of redundant cake conveyance systems. She is also the technical advisor for the addition of a 2-MG sludge holding tank that will be mixed with linear motion mixers and tied into the plant's existing sludge handling system.

→ Technical reviewer for the dewatering centrifuge evaluation, selection, and final

design for the City of Garland, Texas, Biosolids Rehabilitation and Odor Abatement Project. Her initial responsibilities included review of the design team's evaluation of dewatering options based on results from centrifuge pilot tests. The dewatering centrifuges will be installed in an existing dewatering building that will be retrofitted for the selected units. Ms. Gupta analyzed the proposed modifications and provided suggestions to improve process reliability and constructability during final design.

→ Technical reviewer for design of the dewatering system of the City of Nampa, Idaho, Solids Handling Project. Her responsibilities included value engineering of a preliminary design completed by others and advising the Carollo/Keller design team during final design of a new solids handling facility and truck loading bay. The dewatering system will include centrifuges, polymer systems, and shaftless screw conveyors that will operate 24 hours per day. The solids handling facility will also house thickeners, thickening polymer system, an electrical room, and a bridge crane for equipment maintenance.

→ Technical reviewer for the dewatering technology evaluation and final design of the Dewatering Equipment Replacement project for the City of Simi Valley, California. Ms. Gupta reviewed the design team's evaluation of screw presses, centrifuges, rotary fan presses, and belt filter presses and advised the project team and plant staff of the most appropriate technology for specific project conditions. Final design for the system includes replacement of the existing belt filter presses with new belt filter presses, polymer system, and conveyors.

→ Technical reviewer for the dewatering technology evaluation and final design of the City of Orlando, Florida, Conserv II Biosolids Dewatering System Improvements Project. Her responsibilities included review of the design team's evaluation of screw presses, centrifuges, and belt filter presses for a facility that produces only secondary sludge. Final design for the system is based on the results of the dewatering evaluation and includes replacement of the existing belt filter presses with new belt filter presses.

Rashi Gupta, PE

Awards

Induction into Select Society of Sanitary Sludge Shovelers (5S) by the California Water Environment Association

Spotlight Volunteer Award from the Santa Ana River Basin Section of CWEA

Other

Accomplishments

National Science Foundation Fellow - University of Texas, Austin

Regents Scholar - University of California, Davis

Recipient of University of California, Davis M.S. Ghauri Medal for the College of Engineering

Quotes

See "Client Feedback" at end of resume

→ Technical reviewer for the preliminary and final design of the Tohopekaliga Water Authority, Florida, Biosolids Dewatering Centrifuge Project. Her responsibilities included review of the preliminary and final design of centrifuge dewatering systems at two facilities owned and operated by the Authority. One facility will be provided with a new dewatering building that will house new centrifuges, polymer systems, and conveyance to a new truck loading bay. The other facility includes existing belt filter presses and polymer systems in a severely constrained canopy-covered structure. These existing belt filter presses are being replaced with centrifuges and dedicated polymer systems. Dewatered cake will be discharged to an existing conveyor and truck loading facility.

→ Technical reviewer for the preliminary and final design of the City of Orlando, Florida, Iron Bridge WRF Dewatering Improvements Project. Her responsibilities included review of the preliminary and final design of belt filter press dewatering systems at the facility. The existing facility, which included gravity belt thickeners and belt filter presses, was modified to replace the thickeners with new 3-belt presses that could provide both dewatering and thickening functions.

→ Technical reviewer for the dewatering facility design included in the Ammonia Treatment and Biosolids Dewatering Improvements Project for the City of Longmont, Colorado. Her responsibilities included review of the basis of design, preliminary design concepts, and system layout for the new dewatering facility. The project includes centrifuge dewatering, a dry polymer storage and make-down system, and a dewatered cake truck loading facility.

→ Technical reviewer for the Truckee Meadows Water Reclamation Facility ECM 6- Dewatering Project for the City of Reno, Nevada. Ms. Gupta provided the technical check for the dewatering facility design which included two new centrifuges, associated polymer make down systems, and dedicated piston-style cake pumps.

→ Solids facilities technical lead for the City of Sunnyvale, California Water Pollution

Control Plant Master Plan and Primary Treatment Facility Design project. Her responsibilities include leading the project team's master planning efforts for the sludge thickening, digestion, dewatering, and cake loading facilities. The master plan for the solids processes includes facility layouts, preliminary equipment sizing, and preliminary control procedures.

→ Technical reviewer for the City of Lubbock, Texas, Digesters 8 and 9 Improvements Project at the Southeast Water Reclamation Plant. She performed the final design check and review for the work, which included comprehensive rehabilitation of two 120-ft diameter digesters. Both digester domes and the systems providing digester heating, sludge recirculation, and mixing were all replaced during the project.

→ Technical reviewer for the Sanitary District No. 5 of Marin, California, Main Plant Rehabilitation Project. The project included a comprehensive rehabilitation of the headworks, primary sedimentation basins, aeration systems, secondary clarifiers, chlorine contact basin, chemical systems, sludge thickening system and anaerobic digesters. She performed the final design check and review for the sludge thickening modifications, which consisted of the replacement of existing dissolved flotation thickener with rotary drum thickening, and installation of new WAS and TWAS pumping.

→ Technical advisor for the City of Petaluma, California, Solids Process Upgrades at the Ellis Creek Water Recycling Facility (Facility) project. The project increases solids handling capacity and operational constraints by improving the Facility's sludge screening, thickening, digestion, and dewatered cake conveyance and hauling systems. Ancillary processes like digester heating and digester mixing are also included in the project. Ms. Gupta is advising the design team on the digestion and conveyance systems, and will review the final design of the improvements.

→ Project manager for the JB Latham Treatment Plant Blower Building 1 Crack Repair Design project for the South Orange County Wastewater Authority, California. Managed project which included inspection

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National Science Foundation Fellow - University of Texas, Austin

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Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

of structural cracks and deficiencies within existing building and fast-tracked repair details, drawings, and specifications necessary for emergency repairs.

→ Project manager for the JB Latham Treatment Plant Consolidated Headworks Feasibility Study project for the South Orange County Wastewater Authority, California. Managed project which included preliminary sizing, layouts, and cost estimates for a new headworks facility at the plant to assess the feasibility of such a system at this very constrained site.

→ Technical advisor for the Digester Improvements project for the City of Orem, Utah. Evaluated digester heating problems and mitigation measures for hydrogen sulfide formation in digester gas. Advised City of low-cost methods to improve operational issues without substantial capital expenditure.

→ Technical advisor for the Southside Water Reclamation Facility Electrical System Master Plan for the Albuquerque Bernalillo County Water Utility Authority, New Mexico. She evaluated potential digester gas production for future conditions to allow the Water Authority to assess feasibility of co-generation at the plant.

→ Project manager for the RAS Interim Control Improvements project at the Alvarado Wastewater Treatment Plant for the Union Sanitary District, California. The plant faces poor sludge settleability that has impacts on effluent quality and solids processes. This project includes development of documents necessary to improve the RAS system control on an interim basis before large capital projects are completed. Ms. Gupta is responsible for project management and overall technical oversight.

Construction Management

→ Project engineer during the construction phase of the Digester No. 1 Rehabilitation Project for the City of Palm Springs/Veolia Water NA, California. Her responsibilities included development and review of field changes during construction, assistance with the start-up of the digester heating system, and advising operations staff on various

questions about the digestion system during initial operations. She conducted field inspections to assess construction progress and developed design documents to address piping conflicts with unknown underground utilities. In addition, she suggested specific modifications to the digester heating loop that were incorporated during construction to better control the digester heating system.

→ Construction support and civil engineer for the San Jacinto Valley Regional Water Reclamation Facility, Interim Solids Handling Project for the Eastern Municipal Water District, California. She was responsible for construction management services, system start-up, submittal review, and response to contractor requests for information.

→ Construction support for the Water Quality Control Plant Secondary System Upgrades project for the City of Riverside, California. She provided construction management services and reviewed shop drawings for materials and equipment used in the construction of this project, which included the replacement of the biological treatment aeration diffusers, blowers, controls, piping, and ancillary equipment.

Economic Analysis

→ Project engineer for the economic analysis of the Digester Heating System Upgrades project for water reclamation facilities in San Jacinto, Moreno Valley, and Temecula for the Eastern Municipal Water District, California. She conducted cost analyses and quantity takeoffs for each facility.

→ Project engineer for the economic analysis for the Temecula Valley Regional Water Reclamation Facility Expansion to 18 mgd for the Eastern Municipal Water District, California. She assisted with the preparation of a comprehensive cost analysis through quantity takeoffs and construction estimates for the facility.

Operations and Maintenance

→ Assisted with the development of an operations and maintenance manual for the Interim Solids Handling System at the San Jacinto Valley Regional Water Reclamation

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Rashi Gupta, PE

Facility for the Eastern Municipal Water District, California. Her duties included development of operational procedures for the manual and provision of operator training on the system.

→ Assisted with the development of an operations and maintenance manual for the Sanderson Avenue Lift Station for Eastern Municipal Water District, California. Her duties included editing, ensuring that the client's comments were addressed, and helping to finalize the manual.

Wastewater Treatment

→ Project engineer responsible for preparation of bid-phase documents for a new 9.9-mgd wastewater treatment facility in Darsait, Sultanate of Oman. The project includes influent pumping, headworks, fine screening, and membrane bioreactors (MBRs) followed by tertiary effluent pumping and solids handling facilities.

→ Design engineer responsible for preparation of bid phase documents for the new 8-mgd Regional Water Reclamation Facility for Spokane County, Washington. The project included headworks and biological aerated filtration (BAF) followed by tertiary membranes and solids handling facilities to meet the most stringent effluent phosphorous limits in the country (0.05 ppm).

→ Design engineer for the Perris Valley Regional Water Reclamation Facility Tertiary Facilities Expansion for the Eastern Municipal Water District, California. The project included design and construction management services for the expansion of disinfection and filtration facilities to achieve 22 mgd tertiary treatment capacity and provide reclaimed water meeting Title 22 requirements. Her responsibilities included the completion of preliminary design technical memoranda for required modifications to the disinfection and tertiary filtration facilities.

→ Design engineer for the Wastewater Treatment Plant Upgrade for the City of Camarillo, California. The project included design of a facility expansion, which included the addition of advanced secondary treatment and filtration to meet increased

water quality standards. Her responsibilities included analysis of the hydraulics of both plants at the facility and generation of a complete hydraulic profile during the preliminary design phase of the project.

→ Project engineer for the Perris Valley Regional Water Reclamation Facility Project Development Report for the Eastern Municipal Water District, California. The project included development of a comprehensive planning-level report to outline recommendations and the necessary upgrades and modifications for the facility to reach 22 mgd capacity. Her responsibilities included evaluation and development of recommendations for fine-bubble aeration systems and tertiary filtration alternatives through economic and non-economic analysis.

Water Quality

→ Project engineer for the Advanced Water Treatment for Estuarine Water Supplies for Improving Water Quality project for the Contra Costa Water District, California, and the Water Research Foundation. She assisted in the development of a comprehensive Quality Assurance Project Plan by coordinating and reviewing analytical methods and quality assurance protocol.

Previous Experience

→ Conducted research and wrote a master's thesis on the removal of BTEX compounds from water produced during oil and gas extraction through sorption to surfactant-modified zeolite.

→ Analyzed effectiveness of recycling programs developed by the Solid Waste Planning Department of the Los Angeles County Sanitation Districts in California.

→ Assisted doctoral student with research on ultraviolet inactivation of coliform found in wastewater. Simple microbiological techniques were used to ascertain the effectiveness of the disinfection process at the University of California Davis Wastewater Treatment Plant in Davis, California.

Publications/Presentations

→ Swanback, S., A. Evans, H. Gerges, R. Gupta, A. Tartaglione. "Design of Municipal Wastewater Treatment Plants: Chapter 21 -

Awards

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Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

Solids Thickening" Water Environment Federation Manual of Practice No. 8, 2018.

→ Gupta, R., Charbonnet, E., Deslauriers, S., "Food Waste Co-Digestion in California – The Role of WRRFs and Investment Needs to Maximize Co-Digestion in Support of SB 1383", Proceedings of California Water Environment Association and California Association of Sanitation Agencies Joint Specialty Webinar, September 9, 2020.

→ Gupta, R., Deslauriers, S., Charbonnet, E., Ransom, C., Williams, R., "Comprehensive Assessment of Co-Digestion Capacity, Costs, Impacts, and Operational History in California", Proceedings of WEFTEC 2020, 93rd Annual Conference of the Water Environment Federation, Virtual, October 5-9, 2020.

→ Gupta, R., Park, B., Robertson, J., Truax, T., Miccolis, C., Sprick, M., Miner, J., McCormick, J., "Dewatering Technology Selection for the '2nd Most Difficult-to-Dewater Sludge in the World'", Proceedings of WEFTEC 2020, 93rd Annual Conference of the Water Environment Federation, Virtual, October 5-9, 2020.

→ Gherini, B., Eve, K., Bosick, C., R. Gupta, "Getting to Zero with Co-Digestion: Defining the Road to Energy Neutrality", Proceedings of the WEF Residuals and Biosolids Conference, 2018, Phoenix, AZ, May 15-18, 2018.

→ Appleton, A., Rauch-Williams, T., Gupta, R., Greene, M., S. Grimbert, "Addressing Operating Side Effects of Co-Digestion of Organic Wastes", Proceedings of the WEF Residuals and Biosolids Conference, 2018, Phoenix, AZ, May 15-18, 2018.

→ Gupta, R., S. Walker, M. Brehm, B. Stevenson, K. Tagney, M. Verosik, "Reducing Dewatering Costs Through an Optimization Program", Proceedings of the WEFTEC 2017, 90th Annual Conference of the Water Environment Federation, Chicago, IL, October 4.

→ Gupta, R., D. Meacham, P. Parkins, T. Peacock, A. Montoya. "Lifting the FOG from FOG Receiving" Proceedings of the WEF Residuals and Biosolids Conference, 2017, Seattle, WA, April 11.

→ Gupta, R. "Organics Management and Energy Recovery: The Future of Solids Processing", Proceedings of the Water Environment Association of Utah Mid-Year Conference 2017, West Valley City, UT, November 14.

→ Gupta, R. "Reducing Dewatering Costs: Case Studies of Successful Optimization", Proceedings of the California Water Environment Association Annual Conference 2017, Palm Springs, CA, April 26-29.

→ Gupta, R. "Fats, Oils, and Grease Receiving Stations - Practical Considerations and Lessons Learned" Proceedings of the Water Environment Federation Navigating the World of FOG Conference, Tempe, AZ, April 6-8.

→ Gupta, R., S. Walker. "Optimization for Centrifuge Dewatering" Proceedings of the WEFTEC 2016, 89th Annual Conference of the Water Environment Federation, New Orleans, LA, September 24-28.

→ Gupta, R. "Innovations in Anaerobic Digestion" Proceedings of the California Water Environment Association Annual Conference 2016, Santa Clara, CA, April 26-29.

→ Pretorius, C. F., R. Gupta, E.L. Jorgensen, D. Howell, J. Ahmadpour, G. Buenagua, D. Mathes, J. Rosenfield, "Increasing Digester Gas Production Using Residual Syrup" Proceedings of the Water Environment Federation, Residuals and Biosolids Conference, Raleigh, NC, March 2012.

→ Gupta, R. "Effects of Competitive Sorption and Salinity on the Sorption of BTEX Compounds in Produced Water onto Surfactant-Modified Zeolite." Masters Thesis, University of Texas, Austin. 2001.

Quotes

→ "Rashi's expertise, responsiveness and thoroughness has helped us develop a digester design that allows us to implement state-of-the-art, energy-saving technologies while still protecting the robustness of our anaerobic digestion systems. This project is a large undertaking for our team, but Rashi has always been available to listen to our concerns and addressed them quickly and in a collaborative manner. We are pleased

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Quotes

See "Client Feedback" at end of resume

Rashi Gupta, PE

to have worked with Rashi on this project and would be happy to work with her again on future work."

-Brian Schumacker, Plant Superintendent, South San Francisco-San Bruno Water Quality Control Plant, South San Francisco, CA

→ "Rashi has been working with EMWD for over 10 years. In that time she has designed our digesters and thickening facilities, trained our operators on solids processes and regulations, and continues to help us with optimization of our dewatering processes. She listens to our concerns and follows through. When we have a solids-related question or need, we don't hesitate to call Rashi."

-Jeff Wall, P.E., Assistant General Manager, Operations & Maintenance, Eastern Municipal Water District, CA

→ "We were very pleased with Rashi's excellent performance and quality designs on our solids handling facility which included new Centrifuges, Rotary Drum Thickeners and Polymer systems. She is very thorough, follows up with every detail, finds answers to our questions and gets back to us in a timely manner".

-Kyle McCoy, Operations Coordinator, Southeast Water Reclamation Plant, City of Lubbock, TX

Anthony Tartaglione, P.E., BCEE

Senior Associate

Mr. Tartaglione is a senior associate that provides and develops comprehensive planning documents for municipal wastewater treatment plants and construction documents including plans and specifications for the designed expansion, rehabilitation and repair, upgrades, and improvements of water resource recovery facilities. Anthony provides process mechanical calculations, energy and mass balances calculations, unit process system analysis and selections, specification development, CAD design drawing development, code interpretation, multidiscipline coordination, meetings with client stakeholders, water quality and NFPA code compliance, coordination with vendors, contractors and subconsultants, engineering services during construction including review of submittals, shop drawings and responses to RFIs from contractors. He has a commitment to excellence and enthusiasm to create opportunities from challenges including resource recovery and recognition of "wastewater" as "resource-water". Anthony is a contributing author to Water Environmental Federation publications including 1) *Design of Water Resource Recovery Facilities. Manual of Practice No. 8, 6th Ed., Water Environmental Federation Publication, 2017*; 2) *Energy in Water Resource Recovery Facilities, Manual of Practice No. 32, 2nd Ed., Water Environmental Federation Publication, 2021* and 3) *Wastewater Treatment Fundamentals III, 1st Ed., Water Environmental Federation Publication, 2022*.

PROJECT EXPERIENCE

San Bernardino Municipal Water Department | Spec 1728R Digester "B" Replacement Project, San Bernardino Water Reclamation Plant (SBWRP) – San Bernardino, CA

Engineering Manager. The Project consists of professional engineering services for the study, planning and design of the Solids Treatment process upgrades and digestion and thickening (D&T) electrical and I&C improvements. A detailed market assessment of products for potential outlets in the region will be used for the development of the Biosolids Strategic Plan (Plan) for SBWRP. As part of the planning and design the existing digestion system and the D&T electrical and I&C systems are evaluated including the replacement of the existing out of service Digester "B". The Solids Treatment process upgrades will be based upon the recommended replacement alternative from the Biosolids Strategic Plan and the existing systems evaluation.

City of Houston Almeda Sims WWTP | Disaster Mitigation for Wastewater Facilities Induced by Hurricane Harvey, Package 3 – Almeda Sims Area, Houston, TX

Lead Process Mechanical Engineer. Providing professional engineering services for the subject consolidation package as part of the Hurricane Harvey disaster recovery and mitigation program, particularly looking at the expansion of the Almeda Sims WWTP from 60 mgd to 180 mgd to accommodate flows and loads from consolidated plants. As Lead Process Mechanical Engineer, was responsible for new headworks with coarse followed by fine screening, aerated grit basins, screenings and grit handling systems, and odor control treatment with biotrickling filters.



OFFICE LOCATION

Portland, OR

EDUCATION

- MSc, Chemical Engineering, Colorado State University, Ft. Collins, Colorado, 2000
- BSc, Environment Engineering, Rensselaer Polytechnic Institute, Troy, New York, 1997

PROFESSIONAL REGISTRATION

Civil

PE – 2014, CA, 82471
PE – 2015, FL, 80044
PE – 2020, ID, 19466
PE – 2015, MD, 47044
PE – 2014, ND, 9409
PE – 2015, NY, 095366
PE – 2016, OR, 92042
PE – 2020, TX, 138930

Chemical

PE – 2003, CA, 6119
PE – 2020, ID, 19466
PE – 2016, OR, 92042

Board Certified Environmental Engineer (BCEE) – American Academy of Environmental Engineers & Scientists

Wastewater System Operator. Treatment IV Restricted Wastewater Operator, State of Utah

Department of Energy (DOE) Qualified Pumping Systems Specialist, Atlanta, Georgia, 2010

PROFESSIONAL ASSOCIATIONS

- Water Environment Federation (WEF)
- Pacific Northwest Clean Water Association (PNCWA); Technical Program Committee; 2021 Co-Chair Biosolids Committee
- American Academy of Environmental Engineers & Scientists

YEAR CAREER STARTED

1997

YEAR STARTED WITH B&V

2018

Clean Water Services | The Forest Grove Solids Treatment Alternatives Project, FGWWTF; Washington County, OR

Project Manager. Managed a Black & Veatch team performing the review and evaluation of solids treatment technologies including pyrolysis, gasification, oxidation, hydrothermal processing, heat drying and composting to be selected for preliminary design development that accounts for future growth, diversifies treatment and disposal, reduces potential impact on future regulations including PFAS, and affords the District an opportunity to free up treatment capacity at Rock Creek WWTF (Rock Creek) and the existing return sludge (RS) pipelines between Rock Creek and Hillsboro WWTF and Forest WWTF for increased pumping reuse water capacity to reduce the effluent discharge temperature load to the receiving waters.

San José-Santa Clara Regional Wastewater Facility | Digested Sludge Dewatering Facility Design Build Project, San José, CA

Lead Process Mechanical Engineer San Jose Clara Regional Wastewater Facility provides tertiary treatment of an average dry weather flow design of 167 mgd, which is the largest in the western United States. The new 182 dry tons per day Dewatering Facility includes new dewatering buildings that houses a mechanical Digested Sludge (DS) centrifuge dewatering system; polymer storage, blending and dosage facilities; dewatered cake conveyance and storage facilities; truck loading bays with weighing scales; and, a maintenance shop and various support facilities and systems. It also includes a process control room, Motor Control Center, transformers, switchgear, heating/ventilating/air conditioning systems, break room, kitchen, conference room, showers, lockers, bathrooms, and a parts storage area. Within the fence line of the RWF, the Project includes transfer pumps and pipelines to convey DS from existing digesters to storage facilities; a new DS storage facility facilitates the conveying, pumping, and tankage; new DS pumping systems and pipelines to convey DS from DS storage to the new dewatering building; new centrate pumping systems and pipelines to convey centrate from the dewatering process to RWF; and, various new and modified ancillary facilities and systems.

San José-Santa Clara Regional Wastewater Facility | Cogeneration Facility Project – Owner’s Advisor – San José, CA

Lead Process Mechanical Engineer. Responsible for providing owner’s advisor services including technical oversight during the construction a new 14 MWe cogeneration facility consisting of four 3.5 MWe reciprocating gas engine generators with fuel blending, heat recovery, exhaust gas treatment, and digester gas treatment system including unit processes for hydrogen sulfide removal with iron sponge media, moisture removal through multi-stage cooling and reheating, activated carbon for siloxane removal, and particle removal. This work included the review of startup, testing and commissioning submittals including the approval of factory acceptance test (FAT) plans, process and control narratives, loop descriptions, and commissioning acceptance test plans.

City of Oceanside | Integrated Organic Waste to Energy/Biosolids Master Plan; Oceanside, CA

Lead Process Mechanical Engineer. To help achieve the City’s goal of zero waste and comply with emerging regulations to divert organic waste from landfills, Black & Veatch is preparing a comprehensive biosolids master plan that includes regulatory and permitting analysis, evaluation of the plant (SLRWRF) to produce organic waste to energy and optimization of the existing biosolids management facilities. The plan also includes alternatives evaluation for hauling, conversion of raw organic waste to high quality bioslurry, onsite organic waste treatment and product beneficial use utilizing a market-based approach. Responsibilities include project coordination and budget and schedule management.

City of Hayward | Water Pollution Control Facility Phase II Facilities; Hayward, CA

Lead Process Mechanical Engineer. Prepared alternatives analysis for the City for a new Preliminary Treatment Facility planning for future plant influent flows upwards of 53 mgd and average daily flows of 11.5 mgd.

Central Contra Costa Sanitary District | Solids Handling Improvements Project; Martinez, CA

Lead Process Mechanical Engineer. Planning, predesign and final design phases of the solids improvement project including rehabilitation of the emergency dewatered sludge loadout facility and improvements/upgrades to the thickened sludge facilities.

El Dorado Irrigation District (EID) | El Dorado Hills WWTP DAFT Rehabilitation Project; El Dorado Hills, CA

Engineering Manager and Lead Process Mechanical Engineer. Planning, condition assessment, predesign and final phases of rehabilitation of an existing waste activated sludge (WAS) dissolved air flotation thickener (DAFT) with direct air

saturation pumps. The project included structural concrete repair, complete replacement of DAFT tank mechanisms, thickened WAS pumping upgrades, electrical, instrumentation and controls improvements.

[City of Portland Bureau of Environmental Services | Tyron Creek WWTP Upgrades Project; Lake Oswego, OR](#)

Design Manager. The major elements of the Project included a Headworks Facility, Dry Weather Primary Clarifiers, and odor control systems. The Project also included modifications to the existing Primary Clarifiers 1 through 3 for wet weather operation, modifications to existing on-site pump stations, and plant electrical improvements. The new Headworks Facility included four (4) multi-rake 6 mm screens with sluice conveyance and washer/compactors, two (2) multi-tray vortex type HeadCell units, grit pumping with recessed impeller centrifugal type pumps, and two (2) vortex (cyclone) type classifiers.

[Wastewater – Master Planning; Pilot; Studies & Evaluations](#)

[New York City Environmental Protection Bureau of Engineering Design and Construction | Value Engineering Study for HP-238 Hunts Point WWTP New Anaerobic Digester Facilities; City, ST](#)

Lead Process Engineer. Value engineering study to review the Basis of Design Report (BODR) for the design construction of new Anaerobic Digester Facilities at the Hunts Point WWTP with an average dry weather capacity of 200 mgd. The continuously mixed mesophilic anaerobic digesters are designed for co-digestion of plant sludges and food waste within 4 silo digesters, each with an active volume of 2.5 million gallon.

[Confidential Client | Biological Nutrient Removal Pilot; Northwest](#)

Pilot Operator. Operated and performed troubleshooting and sampling of biological nutrient removal reactor including heavy sequencing batch reactor bench scale test. Organized own schedule to meet dynamic and complicated needs to prepare feed solutions, collect time-sensitive measurements, and perform system checks to ensure consistent operation and data production.

[North Hudson Sewerage Authority | West New York Wastewater Treatment Facility Secondary Clarifier Leak Investigation; West New York, New Jersey](#)

Lead Investigative Engineer. Developed “Leak Investigation” scope of work and managed the field work tasks to identify the source and probable causes of a leak from Secondary Clarifier No. 1 at the West New York Plant that lead to the remediation of an approximate 2 gpm leak or 17,560 gallons per year.

[City of Fort Collins | Drake Water Reclamation Facility Digester Foaming Investigation; CO](#)

Lead Process Engineer. Investigated the causes for foaming events at the Drake Water Reclamation Facility (DWRF). As part of the investigation standard operation procedures (SOPs) were developed with Plant operation and maintenance (O&M) to prevent future foaming events. Also, corrective measures were developed to mitigate events including isolating foam from the storm water collection system.

[Fairfax County | Master Plan for Norman M. Cole, Jr. Pollution Control Plant \(NMCPCP\) – Fairfax County, VA](#)

Design Manager. Development of the facility’s \$700-million 20-year Master Plan, which included 1) Energy Efficiency Study, which included evaluating alternative energy systems, 2) review of current plant liquid and solids process performance and costs; and identified potential future liquids and solids processes to meet future treatment and load scenarios, 3) review and analysis of relevant existing and pending environmental regulatory requirements, 4) development of options for the County to offload future excess flow resulting from the projected growth in the NMCPCP sanitary sewer service area, 5) investigation of all auxiliary plant processes and when appropriate made recommendations to improve plant operation, 6) review of land-use issues within the existing plant property and adjacent properties, and 7) development of a process to prioritize potential projects for Capital Improvement Projects (CIP) (Master Plan projects and Asset Management Projects) and the decision criteria. Solids processes included fats, oil and grease (FOG) collection and handling system, primary sludge (PS) from Primary Clarifiers, WAS from DAFT, dewatering centrifuges, sludge silos, lime stabilization and Multiple-hearth incineration (MHI). Recommended improvements and preliminary design included 1) replace existing MHI with Fluidized Bed Incineration with steam turbine for co-generation, 2) dissolved air flotation thickening (DAFT) co-thickening, and 3) septage and FOG receiving processing system.

[Ocean County Utilities Authority \(OCUA\) | Central Water Pollution Control Facility Improvement Study; Bayville, NJ](#)

Lead Process Mechanical Engineer. Provided an evaluation of the existing assets at the Central Water Pollution Control Facility (CWPCF) to improve operation and maintenance. Focus was on screening, thickening (GBT), anaerobic digestion, co-

generation (reciprocating internal combustion engine for on-site energy use) and dewatering and biosolids residual management. Recommended improvements and preliminary design included 1) septage and fats, oil and grease (FOG) receiving processing system, 2) digestion mixing and capacity improvements with FOG co-digestion, 3) managing struvite generation and buildup, and 4) digester gas recovery and beneficial utilization.

North Hudson Sewerage Authority | Adams Street Wastewater Treatment Plant Secondary Clarification / Filtration System Rehabilitation Engineering Planning Study and Capital Improvement Plan; Hoboken, NY

Lead Process Mechanical Engineer. Condition assessment and evaluation of the condition of the combined dissolved air flotation (DAF) followed by sand filtration process. These are critical secondary and tertiary treatment processes which keep the plant in compliance with its NJDEPS permit. As part of the condition assessment and evaluation a report with cost estimates and conceptual level alternatives for rehabilitation or replacement was provided as a roadmap for the Authority to use in their Capital Improvements Plan for the construction sequencing and phasing of the rehabilitation work.

Wastewater – Treatment Design

Miami-Dade Water and Sewer Department | Wastewater Treatment Master Pump Station 2 Upgrades; Miami, FL

Design Manager and Lead Process Mechanical Engineer. Planning, predesign and final design phases of the 60 million gallon per day (mgd) pump station. This project included process modification of the ventilation, odor control, and effluent flow meter systems. The odor control system included 3-stage wet chemical scrubber followed by carbon adsorption for H₂S and sulfur reducing compounds treatment with a capacity of 16,000 standard cubic feet per minute. Managed the development, engineering and construction of a bypass system and sequencing plan that allowed the pump station to remain active during construction.

North Hudson Sewerage Authority | CSO Screening Facilities / Pump Stations; Hoboken, NJ

Design Manager and Lead Process Mechanical. Engineer for the design of combined sewer overflow (CSO) solids/floatables screening facilities and Pump Stations throughout the Authority's service territory Anthony maintained full responsibility for work planning, oversight and management of staff engineers.

Ocean County Utilities Authority (OCUA) | Central Water Pollution Control Facility Headworks Improvement Project; Bayville, NJ

Project Manager and Lead Process Mechanical Engineer. Evaluated existing assets at the Central Water Pollution Control Facility (CWPCF) to improve operation and maintenance. One component of the plant wide evaluation included headworks screening technology alternative analysis and the preliminary design including constructability of the selected alternative, which included 5/8-inch multi-rake screens with screenings washer/compactor system.

Miami-Dade Water and Sewer Department | Central District Wastewater Treatment Plant (CDWWTP) Headworks Upgrade Project; Miami, FL

Process Mechanical Design Engineer. Addition of fine screening facilities at the CDWWTP Plants 1 and 2. The project included the addition eight (8) perforated plate 6mm fine screens, screenings washer/compactor system and replacement of the existing odor control system.

Cape Coral Southwest | Water Reclamation Facility Headworks Screen Replacement Project; Cape Coral, FL

Project Engineer. Design/CM-at-Risk headworks screen replacement. The existing screens were 6-millimeter (6 mm) rake screens and were experiencing problems treating peak flows. More importantly, screenings were passing through the screens and impacting the downstream processes (mixers in the anaerobic and anoxic basins, fine bubble diffusers in the aeration basins and vacuum suction piping in the secondary clarifiers. In addition, the City documented some overflows during lower than peak flow conditions. Based on the results of the evaluation performed, it was determined that 6 mm step screens were the best option for the City. Other than operating costs, step screens required no structural improvements and could fit in the existing channels. More importantly, the step screens meet the City's goals of improving screening removal efficiencies and hydraulic capabilities. The FDEP permits and supporting documentation were prepared, and once the permit was approved two new step screens were procured and installed.

[North Hudson Sewerage Authority | Adams Street Wastewater Treatment Primary Clarifiers Upgrades Project; Hoboken, NJ](#)

Design Manager and Lead Process Mechanical Engineer. The project involved the planning, predesign and final design phases of the upgrades to the rectangular primary clarifiers at Adams Street WWTP. This work involved structural rehabilitation of the rectangular clarifiers, replacement of the clarify mechanisms and associated electrical, instrumentation and controls upgrades.

[Miami-Dade Water and Sewer Department | North District Wastewater Treatment Plant \(NDWWTP\) Primary Clarifiers Upgrade Project; Miami, FL](#)

Process Design Engineer. The project involved the preliminary and final design of the upgrades to the secondary clarifiers at the 120 mgd NDWWTP. This facility consists of pretreatment (screening and grit removal), primary clarification, high-purity oxygen activated sludge biological treatment, secondary clarifiers and chlorine disinfection. This work involved structural rehabilitation of the circular clarifiers including covers, odor control rehabilitation, replacement of the clarify mechanisms and associated electrical, instrumentation and controls upgrades.

[Miami-Dade Water and Sewer Department | Central District Wastewater Treatment Plant \(CDWWTP\) Oxygen Production Upgrade Project; Miami, FL](#)

Process Mechanical Design Engineer. The project involved the preliminary and final design of the upgrades to the oxygen production facilities at the 143 mgd CDWWTP. This work encompassed a field investigation of the existing equipment to determine whether to replace and/or refurbish the existing physical facilities. Based on the information presented, the sensitivity analysis, the installation of two new 90 ton per day (TPD) vacuum pressure swing adsorption (VPSA) oxygen production units at the CDWWTP is recommended. These units are to be installed in a new building with all ancillary infrastructure to support operations.

[Miami-Dade Water and Sewer Department | Central District Wastewater Treatment Plant \(CDWWTP\) Process Upgrade Project; Miami, FL](#)

Process Design Engineer. Evaluation of incorporating process modifications to operate the high purity oxygen (HPO) activated sludge facilities at the 143 mgd CDWWTP in the step-feed activated sludge mode during wet weather conditions. The work involved process modeling varying alternative operating modes that included plug flow, contact stabilization and step-feed. Based on the various alternative operating scenarios, it was determined that operating the HPO facilities in the contact stabilization mode during wet weather conditions was the most favorable for the current operations.

[City of Fort Collins | Drake Water Reclamation Facility South Process Train Biological Nutrient Removal and Equipment Replacements Project; Fort Collins, CO](#)

Process Mechanical Engineer. Biological nutrient removal upgrade and equipment replacement project at the Drake Water Reclamation Facility's South Process Train (SPT). The upgraded SPT consist of two parallel 4.3 mgd A2O process trains, complete with anaerobic, anoxic, and aerobic zones. The upgraded bioreactor was designed for a future conversion to a 5-stage Bardenpho process. Project components include site piping modifications, replacing coarse bubble diffusers with ceramic, fine bubble diffusers, constructing new bioreactor volume, direct-drive high-speed turbocompressor aeration equipment and controls, floating mixers and surface scum removal.

[Loudoun County Sanitation Authority \(LCSA\) | Broad Run Water Reclamation Facility Project; Loudoun County, VA](#)

Process Mechanical Engineer. Anthony was involved with the final design and construction services of the biological treatment and solids treatment. This advanced wastewater treatment facility was a "green field" facility designed to provide nutrient removal requirements of 3 mg/L for total nitrogen and 0.1 mg/L for total phosphorus. The liquids-treatment portion of the process will be designed for an average daily flow of 11 mgd. The process will consist of preliminary and primary treatment, biological treatment with biological nutrient removal (BNR) in an MBR, granular activated carbon (GAC) treatment, disinfection, and post aeration. Effluent is discharged to Broad Run and ultimately flows to the Potomac River. Primary solids, primary scum, and thickened waste activated solids (WAS) are pumped to the anaerobic digesters for solids stabilization and with enclosed digester gas waste flares. Centrifuges are used to thicken the WAS. The digested solids are dewatered with centrifuges to produce a Class B product suitable for land application.

Miami-Dade Water and Sewer Department | Central District Wastewater Treatment Plant (CDWWTP) Secondary Clarifiers (Plant 2) Upgrade Project; Miami, FL

Design Manager and Lead Process Mechanical Engineer. The project involved the preliminary and final design of the upgrades to the secondary clarifiers at the 143 mgd CDWWTP. This facility consists of two plants, each with aerated grit removal, high-purity oxygen activated sludge biological treatment, secondary clarifiers and chlorine disinfection. This work involved structural rehabilitation of the rectangular clarifiers, replacement of the clarify mechanisms and associated electrical, instrumentation and controls upgrades.

Miami-Dade Water and Sewer Department | Central District Wastewater Treatment Plant (CDWWTP) Return Activated Sludge Pump Stations (Plant 2) Upgrade Project; Miami, FL

Design Manager and Lead Process Mechanical Engineer. The project involved the preliminary and final design of the upgrades to the return activated sludge pump stations at the 143 mgd CDWWTP. This facility consists of two plants, each with aerated grit removal, high-purity oxygen activated sludge biological treatment, secondary clarifiers and chlorine disinfection. This work involved replacement of the return activated sludge (RAS) pump, piping, motor control centers and structural repairs to the RAS wet wells.

Miami-Dade Water and Sewer Department | North District Wastewater Treatment Plant (NDWWTP) Secondary Clarifiers Upgrade Project; Miami, FL

Process Design Engineer. The project involved the preliminary and final design of the upgrades to the secondary clarifiers at the 120 mgd NDWWTP. This facility consists of pretreatment (screening and grit removal), primary clarification, high-purity oxygen activated sludge biological treatment, secondary clarifiers and chlorine disinfection. This work involved structural rehabilitation of the circular clarifiers including covers, replacement of the clarify mechanisms and associated electrical, instrumentation and controls upgrades.

City of Hayward | WPCF Phase 1 Secondary Treatment Improvements; Hayward, CA

Project Engineer. Planning predesign and final design phases of primary treatment and the final clarifiers facility. The design included two new final clarifiers with return secondary sludge (RSS) pump stations. Each final clarifier has a diameter of 120 feet and sidewater depth of 18 feet with a dedicated 6.4 mgd RSS pump station operated in duty / standby mode.

Dublin San Ramon Services District | Secondary Clarifier Design Build; Dublin, CA

Project Engineer. Design build project for upgrades to a secondary clarifier. The project involved the utilizing an existing Contractor onsite performing Effluent Transport Facilities work. This work involved structural rehabilitation of an existing circular clarifier, replacement of the clarify mechanisms and associated electrical, instrumentation and controls upgrades.

Orange County Sanitation District | Plant No. 2 Trickling Filters; Orange County, CA

Project Engineer. Design of chemical facilities for sodium hypochlorite disinfection and sodium hydroxide snail control systems.

Dublin San Ramon Services District | Effluent Transport Facilities; Dublin, CA

Project Engineer. Designed an effluent pumping station in conjunction with the design of a plant wide capacity expansion. The project included evaluating effective effluent pumping alternatives and determining plant hydraulic loading rate at various flow conditions.

City of Ukiah | WWTP Improvements Project; Ukiah, CA

Project Engineer. Responsible for and involved with 1) design of plant reclaimed/reuse water system, 2) disinfection/dechlorination facilities, and 3) anaerobic digester modifications along with upgrades to the digester gas waste flares.

Metro Wastewater Reclamation District | PAR 861 Dissolved Air Flotation Thickening (DAFT) Rehabilitation Project; Denver, CO

Lead Process Mechanical Engineer. Planning predesign and final design phases of a major rehabilitation project on the DAFT process building. The project included modernization or replacement of DAFT equipment, in-plant waste pumping

station, DAFT polymer system, HVAC and odor control, electrical, instrumentation and controls. The saturation vessels were custom designed including nitrogen purge, recycle pumps, recycle feed, and withdrawal. Designed a custom polymer feed ring/manifold at the head of the DAFT process tanks in coordination with the saturated recycle feed to optimize solids contact and flotation. Designed the thickened float scraper/removal system and the thickened sludge discharge beach. Thickened sludge pumping system design incorporated convoluted lobe pumps for ease of operation and maintenance. Designed major modifications to the DAFT underflow discharge system, including an automatic discharge gate and valve. Managed the development, engineering and construction of a bypass system and sequencing plan that allowed the facility to remain active during construction.

City of Hayward | WPCF Phase 1 Secondary Treatment Improvements; Hayward, CA

Lead Process Mechanical Engineer. Planning predesign and final design phases of the solids co-thickening facility. The design included gravity belt thickeners (GBT) and polymer system for co-thickening primary sludge (PS) and waste active sludge (WAS) as part of treatment plant improvements. The project included performing plant mass balances for evaluating alternative thickening processes. Consideration was being given as to whether to co-thicken the primary and secondary sludge or treat each stream separately then blending prior to digestion. Based on experience in co-thickening, co-thickening with GBTs was evaluated and recommended. The Units have been operational since 2007 successfully co-thickening to 5-7% on a continuous basis. This was the first of its kind with proven success, utilizing GBT for co-thickening PS and WAS.

The Metropolitan District | Dissolved Air Flotation Thickening (DAFT) Rehabilitation and Improvements Project; Hartford, CT

Lead Process Mechanical Engineer. Planning predesign and final design phases of a major rehabilitation project on the DAFT process building. The project included modernization or replacement of DAFT equipment, in-plant waste pumping station, DAFT polymer system, HVAC and odor control, electrical, instrumentation and controls, and upgrades to overall building structure and improvements to working environment including adherence to NFPA 820 and other standards of care and codes. Specific activities included engineering for installation- specific recycle saturation and polymer systems. Managed the development, engineering and construction of a bypass system and sequencing plan that allowed the facility to remain active during construction.

City of San Leandro | WPCP Waste Activated Sludge (WAS) Upgrades; San Leandro, CA

Lead Process Mechanical Engineer. Planning, predesign and final design phases of a major upgrade project on the WAS thickening system. The upgrades included 1) relocation of the existing sieve drum concentrator and thickened sludge pump and 2) provide a new rotary drum thickener with thickened sludge pump, WAS pump, and polymer blending unit and polymer feed pump.

Miami-Dade Water and Sewer Department Central District | Thickening/Dewatering Wastewater Treatment Plant; Miami, FL

Quality Control and Technical Oversight. Thickening and dewatering facilities at Central District Wastewater Plant (CDWWTP). The project includes the preparation of the design criteria package for a combined dewatering/thickening building to include the primary sludge (PS) and waste activated sludge (WAS) thickening system, the dewatering system and support systems; and for a dedicated electrical substation building.

Miami-Dade Water and Sewer Department South District | Acid/Gas Phase Digestion Modifications for Wastewater Treatment Plant; Miami, FL

Design Manager and Lead Process Mechanical Engineer. Planning, predesign and final design phases of the acid/gas phase digestion modifications and managed the design team for the execution of the project. This project included rehabilitation, repair and process modification of the Digester Complex at the 122 million gallon per day (mgd) South District Wastewater Plant (SDWWTP) including the replacement of candlestick digester gas waste flares with enclosed digester gas waste flares. Major mechanical components of the anaerobic digestion systems for Clusters 1 and 2 where be replaced as part of this project. Under this project, the existing single-phase mesophilic anaerobic digestion process was modified to acid/gas phase mesophilic anaerobic digestion for effective co-digestion of fat, oil, and grease (FOG) and thickened waste activated sludge (TWAS) for digester gas production enhancements. As part of the project the acid phase digesters where provided with dedicated digester gas waste flares for the continuous flaring of the rich H₂S acid phase gas to protect the digester gas treatment system for CHP.

Miami-Dade Water and Sewer Department Central District | Biogas Treatment Facilities for Wastewater Treatment Plant; Miami, FL

Quality Control and Technical Oversight. New biogas treatment facilities at the CDWWTP to provide suitably clean biogas to CHP. The project evaluated a new biogas treatment system that included alternatives for the removal of moisture, H₂S, and siloxane. The project included the treatment systems and biogas process piping to treat, store and convey nearly 4,100 scfm of biogas. This project will prevent partial loss of power to the plant and temporary equipment shutdown associated with generator failure or unplanned maintenance, and loss of heat to the anaerobic digestion process.

Washington, D.C.'s Water and Sewer Authority | Digestion Facilities Blue Plains Advanced Wastewater Treatment Plant (AWTP); Washington, D.C.

Project Engineer. Design of the new digestion facilities for high-rate mesophilic anaerobic digestion. The facilities included eight (8) 4.5 million gallon, two (2) 2.5 million silos, operations building, and ancillary facilities and equipment including digester gas waste flares. The design was mothballed due high construction costs.

City of Pinole | WWTP Anaerobic Digester Improvements Project; Pinole, CA

Project Engineer. Involved with the planning, predesign and final design phases for anaerobic digestion facility upgrades. The anaerobic digestion facility upgrades included the addition of a fourth digester, new sludge pumping mixing and heating systems, and new thickening system. Project included retro-fitting an existing gravity thickener into an anaerobic digester and a new thickening system using rotary screen thickeners with a polymer system.

Price River Water Improvements District (PRWID) | Digesters Improvements Project; Price, UT

Design Manager. Wastewater treatment plant improvements that consisted of new digester lids, sludge transfer pumps, digester mixers, waste gas burner, and HVAC equipment as well as replacement of the digester gas piping.

Miami-Dade Water and Sewer Department South District | FOG Receiving Station Upgrades for Wastewater Treatment Plant; Miami, FL

Quality Control and Technical Oversight. A fats, oils and grease receiving station upgrades at the 120 mgd South District wastewater treatment plant (SDWWTP) in order to address the current excessive operation and maintenance (O&M) activities that MDWASD personnel have to perform to keep the facility functioning. The upgrades included rock boxes to prevent debris from clogging the mechanical screens; a hot water system; a truck dump/unloading station for trucks that are unable to unload using a hose; a traveling bridge crane to remove accumulated FOG and grit from the facility; a surface skimmer for concentrating floating FOG to sump; and electrical and control equipment to accommodate the upgrades.

Metro Wastewater Reclamation District | PAR 1237 Nutrient Removal Project; Denver, CO

Process Mechanical Engineer. Planning and predesign phases. This project which included completing the preliminary design, final design, and bidding phase services for facilities at the Robert W. Hite Treatment Facility (RWHTF) to achieve full plant biological phosphorus removal to meet the Regulation 85 discharge limits for phosphorus, to improve the nitrogen elimination, and to enhance biological nutrient removal process stability. As lead process mechanical engineer for Phosphorus Sequestration, he was responsible for evaluation process alternatives, process calculations, process control strategies, integration with existing unit processes and preliminary design. As project engineer involved with the planning, design development and project delivery of plans and specifications for the design of enhanced biological phosphorus removal (EBPR) within existing infrastructure, the conversion of existing gravity thickeners to unified fermentation and thickening (UFAT) fermenters for volatile fatty acid (VFA) production, phosphorus recovery to minimize EBPR impacts, and deammonification for nitrogen removal within existing infrastructure. A challenge for plants with anaerobic digestion is the release of phosphorus and ammonia-rich recycles from the sludge dewatering operation.

Alexandria Sanitation Authority (ASA) | Advanced Wastewater Treatment Facility Sidestream Treatment; Alexandria, VA

Process Mechanical Engineer. Design for an ammonia-rich centrate sidestream treatment facility. The sequence batch reactor process reduced total nitrogen loading to the existing biological reactors basins by 20%. Project included performing mass and energy balances of the nitrogen-reducing oxidation exothermic reactions for system design including process control, mechanical equipment sizing & layout, and constructability within an existing structure.

Confidential Client | Biological Nutrient Removal Pilot; Northwest

Process Mechanical Engineer. Anthony served as a project process mechanical engineer in the biological process design of a modular membrane bioreactor system for the high-level treatment of an industrial microelectronics wastewater from microchip fabrication processes for both recycle and direct discharge uses. Critical to the design was coordination of the process with other physical/chemical treatment processes treating a host of complex inorganic wastes. In addition, he was the lead process mechanical engineer of the solids treatment system, which include WAS storage with aeration followed by dewatering with screw presses to a dewatered sludge loadout facility with the use of shaftless screw conveyors and conveyor belts. The systems was designed for future conditions and modularized for application to conditions at multiple sites in the US and overseas.

North Hudson Sewerage Authority | Adams Street Wastewater Treatment Plant Electrical Feeder Replacement Project; Hoboken, NJ

Design Manager and Lead Civil Engineer. Design build project, which included the design and construction of a new feeder system to restore 100% redundancy to the power distribution system impacted during Super Storm Sandy. As the Lead Civil Engineer for planning, predesign and final design phases provided the routing and all site civil work including design of the system to accommodate differential settlement.

City of Hayward | WPCF Phase 1 Secondary Treatment Improvements Construction Services; Hayward, CA

Project Manager and Office Engineer. Assisted the Contractor with construction management to avoid any interference with normal operation of plant equipment and processes. This effort included, but was not limited to submittal reviews, response to Contractor request for information (RFIs), and coordination with Contractor to sequence construction that resulted in an early completion and no interference with normal operation of plant equipment and processes.

Water

City of Minot | Water Treatment Plant Hazard Mitigation Flood Protection Project (WTP HMFPP) Project; Minot, ND

Client Service Manager. Design of floodwalls, tie-back levees, removable flood barriers, storm water drainage improvements, a new raw water intake structure and pump station, demolition of the existing raw water intake and pump station, chemical system upgrades and new surface water UV disinfection system at the Minot Water Treatment Plant.

Price River Water Improvements District (PRWID) | Water Treatment Improvements and Water Distribution Modeling Project; Price, UT

Design Manager. Water treatment plant improvements and hydraulic modeling of the District's distribution system. The water treatment plant improvements include 1) Upgrades to flocculation, sedimentation, and 2) The water distribution model will be used to generate water age estimates for the assessment of Disinfection Byproduct formation within the distribution system and evaluation of remedial options including chlorine booster stations.

Army Corps of Engineers | Remedial Design of Operable Unit 2 Pohatcong Valley Groundwater Contamination Superfund Site; Franklin and Greenwich Townships, NJ

Field Manager. Provided management, guidance and day to day logistics for a field crew to assess and evaluate how water service connections will be established for a total 320 homes. The assessment involves interviewing home owners, documenting existing utilities, piping and well connections, noting any potential conflicts and planning a proposed route with minimal impact to existing conditions.

Water and Sewer

City of Minot | Downtown Infrastructure Improvements Project; Minot, ND

Project Technical Lead and Design Manager. Design of replacement sanitary sewer & service connections, watermain and service connections, storm sewer, concrete pavement streets, street lighting, concrete walks, and streetscape improvements within a 26 block area of downtown. The project design integrated constructability to limit the impact to downtown residents and businesses. Construction engineering, surveying, project management, and record plans were included in the scope of services.

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Remediation

Honeywell | Port of Baltimore, MD

Project Engineer. Facilitated the design/build of a stormwater remediation system through the design and coordination with construction team.

Industrial and Federal Operations | Walnut Creek, CA

Associate Engineer. Participated in design/build, conceptual design, field project management; report, design basis and feasibility study writing of groundwater and soil remediation systems via pump & treat, soil vapor extraction (SVE), air sparging, biological treatment, thermal oxidation and desorption (hot water/steam injection). Also, participated in the planning, design, surface water management, as well as report and design basis writing of supply, transmission, and distribution systems.

PUBLICATIONS / PRESENTATIONS

Wastewater Treatment Fundamentals III, 1st Ed., Water Environmental Federation Publication, 2022.

Energy in Water Resource Recovery Facilities, Manual of Practice No. 32, 2nd Ed., Water Environmental Federation Publication, 2021.

Biosolids 101, Wastewater Treatment Session, *Southern Oregon Water and Wastewater Short School; Medford, Oregon; September 13, 2017*

Time and Money – Managing and Implementing One of the Country's Largest Wastewater Capital Program, Session 20B: Utility Management, *Pacific Northwest Clean Water Association (PNCWA) 2017 Annual Conference; October 25, 2017.*

An "Integrated Design to Purpose Approach" to Optimize Mesophilic Anaerobic Digestion, Session 4B: Wastewater Treatment – Design Considerations, *Pacific Northwest Clean Water Association (PNCWA) 2017 Annual Conference; October 23, 2017.*

Design of Water Resource Recovery Facilities. *Manual of Practice No. 8, 6th Ed., Water Environmental Federation Publication, 2017.*

(WTF) What the Foam. *Water Environmental Federation Publication, 2015.*

The Energy Roadmap Water and Wastewater Utility Guide to More Sustainable Energy Management. *Water Environmental Federation Publication, 2013.*

An Integrated Design Approach to Optimize Photovoltaic Systems. *ASES National Solar Conference, American Solar Energy Society, 2010.*

Dissolved Air Flotation Rehabilitation at Metro Wastewater Reclamation District. *RUMBLES, Rocky Mountain Section of American Water Works Association, Vol. 44, No. 5, 2004.*

Alexander K. Krämer

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QUALIFICATIONS HIGHLIGHTS

Results-oriented Product Manager with more than twenty years of sales and management experience. Proven ability to develop business and expand opportunities within a new and existing client base, achieving sales and revenue targets in municipal and industrial markets. Territory coverage is the United States of America.

- Demonstrated success in new product launches and execution of sales strategies
- Ability to set priorities and meet deadlines
- Proven ability to work in high-stress environments and make complex pricing decisions
- Exercise good judgment and tact, while managing client expectations
- Excellent communication skills; able to work closely with people of diverse backgrounds
- Planning, organizational and scheduling skills
- Manage multiple projects simultaneously
- Strong presentation, facilitation and negotiation skills

EDUCATION – Akademie Handel e.V. Industrie und Handelskammer für München und Oberbayern

Bachelor Professional of Trade and Commerce Munich, Germany 2000

PROFESSIONAL EXPERIENCE

HARVEST TECHNOLOGY

Waxhaw, North Carolina

2022 – present

Harvest Technology provides revolutionary solutions to wastewater processing needs. Harvest's patented products together with its solution offering systems are custom designed to address the wastewater industry's concern on the solids handling side relating to Contaminants of Emerging Concern (CECs).

Sole-Member / CEO

THERMAL PROCESS SYSTEMS

Crown Point, Indiana

2019 – present

Thermal Process Systems works alongside water reclamation facilities to reduce biosolids, odors, and operating costs through a revolutionary ecosystem of biosolids management solutions that deliver high solids destruction with low energy consumption.

Product Manager | ExCalibAer™ | Thermo-System®

Supporting the Regional Sales Managers for the promoting, expanding, maintaining, and implementing all aspects of TPS Biosolids Management Technologies, which includes Anaerobic Digestion and Biosolids Drying.

Responsible for defining a product's strategic vision, managing the product throughout its lifecycle, prioritized product, and customer requirements, and working closely with the client to ensure best practices from product concept to delivery.

CENTRISYS/CNP

Kenosha, Wisconsin

2016 – 2019

International equipment manufacturer of decanter centrifuges for water, wastewater and biosolids treatment as well as a provider of wastewater process solutions and nutrient recovery technologies.

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Regional Sales Manager

Responsible for defining and executing the solids separation, solids drying and nutrient recovery business plan with an adaptive sales strategy for eastern states of the US & Canada; managing staff and internal sales team as well as representative networks; provide leadership towards the achievement maximum profitability and growth in line with company and departmental goals, visions and values; establish plans and strategies to: expand the customer base, contribute to the development, presentation of technologies, create training and educational programs for sales staff and sales representatives.

Instrumental in acquiring a US\$ 1 million contract with a new client within first year of employment.

VEOLIA

Cary, North Carolina

2015 – 2016

Established, international industry leader in providing advanced water and wastewater solutions to industrial and municipal customers. VEOLIA provides water services through public-private partnerships and industrial outsourcing agreements and is comprised of the top water professionals throughout the world.

National Sales Manager

Responsible for the promoting, expanding, maintaining, and implementing all aspects of VEOLIA's Biosolids and Bioenergy technologies, which includes Biosolids drying, thermal hydrolysis, CHP, and Co-digestion.

THERMA-FLITE

Benicia, California

2013 – 2015

Manufacturer of advanced high-temperature dryer solutions for municipal & industrial wastewater treatment

Regional Sales Manager

Responsible for the development and performance of sales activities. Direct internal sales team as well as sales representative networks and provide leadership towards the achievement of maximum profitability and growth in line with the company's and departmental goals, vision and values. Establish plans and strategies to expand the customer base and contribute to the development and presentation of training and education programs for sales staff and sales representatives.

- Create and conduct customer presentations and RFP responses
- Currently managing 4 municipal and 3 industrial funded 2015 projects, averaging \$2MM respectively
- Represent Therma-Flite at tradeshow, conferences and customer visits
- Create sales and marketing plans; forecast/trend annual sales quotas for existing and new markets
- Establish new contractual partnerships, while maintaining established partnerships to maximize profitability and growth in line with the company's goals
- Maintain accurate records of all pricings, sales activity reports and control expenses to meet budget guidelines

Key Achievements

- Industrial Contract 2014
 - Personally procured contract resulting in revenue of \$1.5MM within 6 months of employment
- Municipal Contract 2014
 - Personally procured contract resulting in revenue of \$1.2MM within 10 months of employment
- Established new Representative Networks in the New England, Mid-Atlantic & Gulf Coast Sales Territory

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PARKSON

Ft. Lauderdale, Florida

2010 – 2013

Leading international provider of advanced solutions for water and wastewater treatment

Product Manager | Thermo-System® | Thick Tech™ Rotary Drum Thickener

Responsible for defining a product's strategic vision, managed the product throughout its lifecycle, prioritized product and customer requirements and worked closely with the client to ensure best practices from product concept to delivery

- Instrumental in acquiring a Phase One multi-million dollar contract with Dubai, UAE, generating \$7.5 MM in sales revenue
- Continued to manage ten active accounts averaging \$1.5 MM respectively
- Create sales and marketing plans; forecast annual sales quotas for existing and new products
- Conducted research to develop sustainable business models and case studies prior to project implementation

Thermo – Specialist | Thermo-System®

Responsible for tactical approach to sales strategy, market analysis, market share growth, sales revenue, and client advocacy for sales and implementation of proprietary technology for Thermo-System® products

- Developed product specific selling strategies, analyzed critical business requirements and recommended turn- key solutions to achieve sales and revenue targets. Personally, managed ten active accounts averaging US\$1.5 million respectively
- Worked hands on with the sales, application engineering, marketing and product teams to validate that the new functionality meets the business needs
- Delivered multiple technical sales presentations to demonstrate product features, benefits and lifecycle cost analysis
- As product expert liaison, manage the product through its lifecycle to ensure business requirements are met
- Leverage strong presentation, negotiating and closing skills to optimize sales results
- Co-authored multiple professional and technical papers, many of which have been accepted at annual regional and national conferences

Key Achievements

- North American Contracts 2013
 - Personally procured contracts resulting in revenue of \$5million
- Dubai UAE Contract 2013
 - Phase One contract resulting in revenue of \$7.5 million. Phase Two in pipeline

THERMO-SYSTEM INDUSTRIE- & TROCKNUNGSTECHNIK

Stuttgart, Germany

2008 – 2010

International sole licensor of the Thermo-System Active Solar Dryer™ for Biosolids and waste products

Over 25 years ago, the desire for sustainable solutions for sludge treatment drove the founders with the guidance of University of Hohenheim to develop a sustainable solution in the field of sludge drying.

THERMO-SYSTEM is the market leader and technology pioneer for individual, innovative and sustainable solutions for solar and solar thermal drying of sludge and various other substrates.

Alexander K. Krämer

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Project Designer & Technical Sales Specialist – National and International Accounts

Responsible for designing the Thermo-System for incoming applications

Managed active projects in Germany and England

- Managed the product through its lifecycle, ensuring business requirements were met
- Managed client technical needs and determined appropriate design for the application
- Held company record for sales of Solar Dryers within one year. Achieved 'Rookie of the Year' Award due to generating \$700k

LANGUAGES– English, German, Afrikaans

COMPUTER LITERACY– Microsoft Office Suite, Visio, Power Point, Access, Excel, AutoCAD

PROFESSIONAL AFFILIATIONS – WEF – Water Environment Federation; Florida WEA; NC One Water

VOLUNTTERING – WEF RBC 2023 Co-Chair; WEF RBC Specialty Conference Vice-Chair; FWEA SE Chapter Vice-Chair; SEBA Vice-President; FWEA Biosolids Committee Past Chair

Lisa Challenger

Chief Executive Officer



Ms. Challenger has extensive experience in marketing, permitting, and managing biosolids and residual materials. She plays a key role supporting her clients' needs in developing comprehensive biosolids and organic waste market evaluations, beneficial use plans, biosolids characterizations, obtaining beneficial use permits and product registrations, and evaluating and reporting on permitting, biosolids product quality, and regulatory compliance. She has been instrumental in master planning projects and biosolids market assessments in 24 states and has experience with evaluating biosolids regulations unique to each state. Her array of local and national experience serves as a foundation for understanding a variety of challenges faced by her clients. Lisa played an integral role as lead author in the development of *Phosphorus in Biosolids: How to Protect Water Quality While Advancing Biosolids Use* developed by WEF's Sustainable Residuals Use Subcommittee.

Education

BS, Environmental Resource Management, The Pennsylvania State University 2012

Years of Experience

With Firm: 10

Total: 10

Professional Affiliations

Past Chair, Sustainable Residuals Use Subcommittee, Residuals and Biosolids Committee, Water Environment Association

Chesapeake Water Environment Association

Pennsylvania Water Environment Association

California Association of Sanitation Agencies

Mid-Atlantic Biosolids Association

Selected Experience

City of Clarksville Gas & Water Department, Clarksville, TN. *Market Evaluation for Class A and Class B Products (for Hazen). Project Manager.*

Conducted a preliminary and final market assessment for biosolids products in Tennessee and Kentucky. Clarksville Wastewater Treatment Plant was plagued with limited funding for plant solids processing upgrades that lead to odor complaints from landfill disposal of unstabilized solids. Short-term and long-term alternatives were sought. The market evaluation included regulatory update, product characterization, regional options for selected products, and outside-the-gate costs. Third party contractors were identified and surveyed to manage selected biosolids products. Material Matters developed an RFP and assisted with selection of a TPC to process and manage biosolids as a short-term option.

City of Columbus, Columbus, OH. *Water Treatment Residual Market Assessment (for Hazen). Project Manager.*

Conducted market assessment for lime and alum water treatment residuals (WTR) in the region. Columbus generates over 80,000 dry tons of lime and alum WTR annually and capacity in the existing outlet – an abandoned quarry – was depleted. Characterized products, worked with regulators to create regulatory pathway for beneficial use, and identified innovative options. Developed innovative RFP to attract unique and cost-effective product management workable in Ohio. Assessed potential outlets and surveyed potential customers to define willingness to use either alum or lime WTRs (both liquid and dewatered) and outside-the-gate expenses and revenues. Transportation and storage were critical considerations.

Milwaukee Metropolitan Sewerage District (MMSD), Milwaukee, WI. *Biosolids Advanced Facilities Plan (AFP)(for Applied Technologies). Project Manager.*

Evaluated the MMSD's nationally acclaimed biosolids product, Milorganite®. The MMSD has produced a high-quality, thermally dried product for over 90 years. While the product appears to be a success story, aging infrastructure and regulatory pressures led MMSD to conduct a series of technology and facility evaluations. The AFP complements the 2050 Facilities Plan and included gathering information about the current distribution program, including customer base and national regulatory pressures, and establishing and defining operational risks associated with the current Milorganite® program. Prepared a detailed Risk Register to define, rank, and mitigate risks associated with future Milorganite distribution and sales. Information gathered was used to assess the general impacts the current product and technologies evaluated. The most highly ranked risks were incorporated into the overall technology evaluation.

Anne Arundel County, Annapolis, MD. *Biosolids Market Assessment (for Hazen). Project Manager.*

Performed a market assessment for Class B and Class A/EQ biosolids products in Maryland and the surrounding Mid-Atlantic region for initial planning of a regional biosolids processing facility in Anne Arundel County. The County operates 7 WWTPs, each producing Class B or unstabilized cake or liquid that is transported >100 miles to the final use site. Interviewed regional utilities to assess current management practices and beneficial use program pricing. Identified locally available beneficial use markets and conducted surveys with individual outlet representatives. Material Matters used the regional market findings to provide a final 'product outlook' rating and outside-the-gate

product management cost range for each technology under consideration. The market assessment findings were applied to the County's established goals to identify two products best suited to meet County goals: anaerobically digested, dried granule and biochar.

Goleta Sanitary District, Goleta, CA. Preliminary Biosolids Market Assessment as part of Biosolids and Energy Strategic Plan (for Hazen). Project Manager. Conducted a preliminary assessment of the market demand for various biosolids products to assist in evaluating viable technologies for the GSD biosolids. GSD generated a Class B anaerobically digested cake managed by third-party merchant composter. The project drivers include interest in becoming energy neutral and landfill diversion regulations, which will be taxing composting infrastructure in upcoming years. Conducted regulatory review to identify regulations related to biosolids generation and disposition in CA, characterized products under consideration by GSD, and conducted phone interviews and on-site interviews to identify key market shareholders and their preferred products and preferences. Based on preliminary market assessment, Class A/EQ compost was identified as the best suitable product for direct marketing and sale due to California's unique regulatory preference for compost and due to its ability to substitute for products currently used by local markets.

Little Patuxent Water Reclamation Plant, Howard County, MD. Solids Master Plan, Preliminary Engineering Report (PER), and Distribution and Implementation Plan (for HDR). Project Manager. Performed market analysis for biosolids in Mid-Atlantic region (MD, VA, and PA) as part of the Little Patuxent Water Reclamation Plant (LPWRP) long-term Biosolids Master Plan. Defined locally available markets for beneficial use, established biosolids quality requirements for each market, identified and surveyed potential end users, researched and evaluated potential regulatory changes, and determined "outside-the-gate" costs for each beneficial use alternative. Gathered information about various biosolids dryers to assist client with selecting specific dryer technology. Characterized dozens of heat-dried products to connect market requirements with different dryer types and manufacturers. Organized site visits for LPRWP personnel to POTWs to observe dryer operation and product quality. Conducted follow-up interviews with most promising beneficial use markets and summarized technology / product quality characteristics required by each. After start up and commissioning of the dryer, conducted a final market assessment to connect with interested customers to set customer demonstrations and trials. Prepared a Distribution Plan and assisted Howard County in implementing the Plan.

City of Memphis, Memphis TN. Long-Term Biosolids Market Assessment (for Barge, Waggoner, Sumner, and Cannon). Assistant Project Manager. Performed market assessment for Class A / EQ and Class B biosolids products in Western TN, AR, and MS. Memphis biosolids disposal practices included an on-site monofill for 30+ years. Capacity in the monofill was nearing its end. Identified locally available beneficial use biosolids outlets and conducted surveys with individual customers to develop a practical, cost-effective, beneficial use alternative to replace current disposal method. Developed comprehensive biosolids sampling plan to characterize biosolids throughout the biosolids treatment process and conducted process evaluation to show pathogen reduction and vector attraction reduction were compliant with USEPA technical standards. Conducted regulatory assessment to identify regulatory barriers, drivers, and opportunities in each state for each product under consideration. Agricultural beneficial use was selected as cost-effective option. Assisted with permitting Class B biosolids and developed RFP to solicit third-party contractors. Ongoing work includes program oversight, data review, and annual reporting.

Recent Publications and Presentations

- Challenger, L. Using a Risk Register Approach for Derry Township Municipal Authority's Biosolids Beneficial Use Program. June 7, 2022. PWEA PennTec Annual Conference, State College, PA. (Presentation)
- Challenger, L. Investigating Alternative Products and Markets to Enhance Capacity and Outlet Diversity for Citizens Energy Group. May 27, 2022. Water Environment Federation Residuals and Biosolids Conference, Columbus, OH.
- Challenger, L. "Starting with the End in Mind" – Howard County's Journey through Master Planning and Dryer Start-up to Create a Marketable Product. May 25, 2022. Water Environment Federation Residuals and Biosolids Conference, Columbus, OH.
- Challenger, L. End Use Market Assessment (Tail Wags the Dog). May 7, 2019. Master Planning Workshop. Water Environment Federation Residuals and Biosolids Conference (Master Planning Workshop).
- Challenger, L. The Power of Branding and Marketing for High Quality Biosolids. October 4, 2017. WEFTEC. Chicago, IL. (Presentation)
- Boudeman, L. Not All Dryer Products are Created Equal. November 15, 2016. Mid-Atlantic Biosolids Association (MABA) Annual Meeting and Fall Symposium, Wilmington, DE (Presentation).
- Boudeman et al. Identifying High Strength Wastes Suitable for Co-Digestion at Blue Plains AWTP. 2016. Water Environment Federation Residuals and Biosolids Conference.
- Boudeman et al. Odors and Alkaline Stabilized Biosolids: In-House Assessment Strategy to Improve Product Quality. 2015. Water Environment Federation Residuals and Biosolids Conference.

FULL NAME:	Jeffrey Michael Coyne	JOB TITLE:	Associate
DESIGNATIONS: Examples – P.E., Ph.D., AIA, BCEE, etc.	PE		
Years Experience w/H&S: <i>List Dates</i>	2017-present	Years Experience With Other Firms: <i>List Firms & Dates</i>	2010 – Olver Inc. (acquired by CHA) 2011-2014 – Timmons Group 2014-2017 – MWH (acquired by Stantec)
Principal Areas of Expertise: See Sample Resume for Examples	<ul style="list-style-type: none"> • Wastewater Process Mechanical Design • Wastewater Solids Thickening, Dewatering, Management • Water Treatment Residuals Thickening, Dewatering, Management • Master Planning • Pilot Treatment Systems • Operations/Water Quality Sampling 		
Professional Affiliations or Memberships: Examples: AWWA, WEF, etc.	<ul style="list-style-type: none"> • Water Environment Federation (WEF) • Virginia Water Environment Association (VWEA) 		
Technical Publications/Papers/Presentations:	<p>Coyne, J., Spalding, S., Bullard, C., Bizier, P., Williams, M., Muller, C., Williams, T., “Seeking the Skinny on Sludge: MOP-8 Stabilization Fundamentals”, WEF Residuals and Biosolids Conference, Columbus, Ohio, May 2022</p> <p>Roy, S., Coyne, J., Novak, J., Edwards, M., “Flow-induced failure mechanisms of copper pipe in potable water systems”, Corrosion Reviews, 2018</p> <p>Coyne, J., Wilson, C., Scarborough, M., Umble, A., “Anaerobic Digestion Fundamentals”, WEF Municipal Resource Recovery Design Committee Factsheet, 2017</p> <p>Coyne, J., Jones, A., “Increasing Zinc and Copper Removal by Improving Biological Flocculation”, PNCWA Annual Conference, Bend, OR, October, 2016; WEFTEC, Chicago, IL, September, 2015; CWEA Annual Conference, San Diego, CA, May, 2015; VWEA WaterJAM, Virginia Beach, VA, September, 2013</p> <p>Coyne, J., Odell, A., “Flushables: the New ‘F’ Word”, Oregon Operators Conference, Canyonville, OR, August, 2016; PNCWA Annual Conference Boise, ID, October, 2015; CWEA Annual Conference San Jose, CA, April, 2016</p> <p>Coyne, J., Brown, N., “Deammonification and Phosphorus Recovery of Centrate Return Flows”, WEA of Texas W. Wesley Eckenfelder Lecture Series, Arlington, TX, June, 2016</p> <p>Coyne, J., “BNR Alternative Processes and Emerging Technology”, Oregon Water Education Foundation Water Environment School, Oregon City, OR, March 2015</p>		
Other Items of Importance (Honors, Awards, etc.):	Click here to enter text.		
ACADEMIC CREDENTIALS			

<p>EDUCATION:</p> <p>M.S. Environmental Engineering, Virginia Tech, 2009</p> <p>B.S. Civil and Environmental Engineering, Virginia Tech, 2007</p>	<p>ACTIVE REGISTRATIONS/LICENSURES W/EXP DATES: (P.E., ETC)</p> <p>PE:</p> <p>VA: (5/31/2013): #51002,</p> <p>Washington: (2015): #52388,</p>
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PROFESSIONAL RECORD

WASTEWATER TREATMENT

Post Dewatering Processing Alternatives Screening, WSSC, Laurel, MD
 Project Engineer. Responsible for evaluating historical residuals production data, developing projected residuals production through 2045, and alternatives analysis for water treatment residuals (WTR) and biosolids end uses. Historically, water treatment residuals (WTR) generated at the two WSSC WTPs are dewatered onsite and disposed of offsite. WSSC is interested in exploring beneficial end use opportunities for WTR and biosolids. Alternatives considered include WTR blending with biosolids, biosolids pad drying, etc. Alternatives analysis included capital cost estimate, life cycle cost estimate, and facility sizing.

Piscataway WRRF BioEnergy Project, WSSC, Laurel, MD
 Project Engineer. Responsible for design of solids conveyance system. Project also included solids pumping, dewatering via belt filter press, and solids storage. Shafted screw conveyors were included in the project to transport dewatered cake from the belt filter presses to the Solids Storage Facility. Jeff worked closely with vendors to ensure screw conveyors fit in congested facility.

Roberto R. Bustamante Wastewater Treatment Plant (RRBWTP) Upgrade, El Paso, Texas
 Project Engineer. Plant expansion from 29 million gallons per day (mgd) 51 mgd on an annual average basis. Managed the design of the biosolids handling building, including GBTs, BFPs, rotary lobe pumps, progressive cavity pumps, polymer and ferric dosing systems, sludge storage tanks ultimately handling primary sludge, WAS, TWAS, and digested sludge.

Sludge Management Plan Evaluation, Henrico County, VA
 Project Engineer. Reviewed and updated the Sludge Management Plan (SMP) in accordance with Virginia DEQ requirements. Reviewed the current solids handling process, disposal operations, and solids testing program maintained at the Henrico County WRF. Worked closely with plant staff to collect and analyze current solids production data, which included evaluation of hydraulic flows and solids loading from sludge generating processes, as well as digester performance. The updated document also included updated process flow diagrams to assist in the communication of engineered operations to DEQ.

Peppers Ferry Regional Water Treatment Facility Liquid Sludge Holding Tank Rehabilitation, PFRWWTA Radford, VA
 Project Manager. Project includes removal of existing digester gas pipe inside digester tankage and installation of new stainless steel gas pipe on tank exterior.
 (current)

Peppers Ferry Regional Water Treatment Facility Digester Gas Pipe Replacement, PFRWWTA, Radford, VA

Project Manager. Project includes removal of existing digester gas pipe inside digester tankage and installation of new stainless steel gas pipe on tank exterior. Project included design services and construction assistance.

(current)

Proctors Creek Wastewater Treatment Plant DCEN CA Office, Chesterfield County, VA

Engineering Assistance during Construction. Part of construction assistance team. Visited site to observe equipment start up and testing. 2020.

Redmond WPCF Modeling and Capacity Evaluation Project, City of Redmond, OR

Project Engineer. Developed a calibrated biological process model of the Redmond WPCF using GPS-X software. The model was used to conduct a capacity evaluation of the oxidation ditch biological treatment system, which is currently rated at 2.99 mgd. The client will use the results of the capacity analysis to plan for future upgrades. Also developed a targeted sampling and analysis plan to ascertain organics fractionation, review of plant record drawings, and analysis of historical influent and process operations data. Served as client service manager for Redmond responsible for interfacing with Redmond wastewater department leadership.

(MWH/Stantec)

Tri-City WRRF Solids Handling Improvements Project, Water Environment Services, Clackamas County, OR

Project Engineer. Developed and calibrated the biological process model of Tri-City WRRF (12 mgd average dry weather capacity and 70 mgd peak flow capacity) using GPS-X software, completed a flow and loads analysis (using population projections and historic plant data to develop projected flows and loads up to Y2040), and was part of the conceptual design team focused on anaerobic digestion, centrifuge dewatering, cogeneration, and supporting equipment and processes. The process model was used for capacity analysis and solids production projections.

(MWH/Stantec)

Robert W. Hite Treatment Facility Nuisance Struvite and Dewaterability Improvements Project, Metro Wastewater Reclamation District, Denver, CO

Project Engineer. Project included defining improvements to manage phosphate recycle, struvite accumulation, and dewaterability challenges at the 140-mgd facility. Helped develop the conceptual design report, which included an evaluation of pre-dewatering and post-dewatering phosphorus recovery technology and implementation options, including developing conceptual design calculations for process and equipment sizing. Evaluated phosphorus recovery post-dewatering using a combination of WASSTRIP and a Pearl Reactor.

(MWH/Stantec)

Stowe Regional Resource Recovery Facility, Charlotte, NC

QC Reviewer. Provided technical review of primary clarifiers and secondary clarifiers design drawings and specifications.

(Current)

Proctors Creek WWTP Clarifier Improvements, Chesterfield County, VA

Project Engineer. Provided technical guidance to project engineering staff for replacement design four primary clarifiers and four secondary clarifiers. Project includes conversion of an existing peripheral-feed secondary clarifiers to a center-feed, peripheral-outflow secondary clarifier.

(Current)

Henrico County WRF Clarifier Improvements, Henrico County, VA

Project Engineer. Provided technical guidance to project engineering staff for replacement design of six primary clarifiers and 11 secondary clarifiers. Project includes all stainless-steel construction, tie-ins to existing scum removal and NPW systems.

(Current)

Totopotomoy WWTP PER, Hanover County, VA

Lead Engineer. Led the evaluation of the existing plant facilities and the development of a preliminary engineering report that is the basis of the future plant design. New or upgraded processes include aeration tanks, process blowers, chemical feed, secondary clarifiers, RAS pumping, solids thickening and dewatering, ultraviolet disinfection, and odor control. (Current)

Peppers Ferry Regional Water Treatment Facility Sludge Handling Building Electrical room Expansion Construction, PFRWWTA Radford, VA

Project Manager. Project includes expansion of existing electrical room, relocation of electrical gear.

(current)

South Central WWTP Nutrient Removal Upgrade Design, SCWWA, Petersburg, VA

Lead Engineer. Led the design of the nutrient removal upgrade. New or upgraded processes include primary clarification, aeration tanks, process blowers, chemical feed, secondary clarifiers, RAS pumping, solids thickening and dewatering, tertiary filtration, and non-potable water pumps. (current)

Fredericksburg Wastewater Treatment Plant Nutrient Upgrade Preliminary Engineering Report, Fredericksburg, VA

Engineer. Evaluated existing sludge handling system and developed preliminary design of proposed sludge handling system suitable for nutrient upgrade and expansion.

(2022)

Peppers Ferry Regional Water Treatment Facility Arc Flash Hazard Analysis, PFRWWTA, Radford, VA

Project Manager. Hazen provided an update to the power system study model developed in 2015 for PFRWWTA. The scope of this task order included all previously studied and labeled electrical equipment. Hazen prepared a draft and final Arc Flash Hazard Analysis Report, provided onsite training for PFRWWTA staff, and placed labels on equipment.

2021.

Doswell WWTP PER, Hanover County, VA

Lead Engineer. Oversaw evaluation of the existing plant and development of a preliminary engineering report (PER) that was the basis of a plant upgrade design. The existing plant requires a nutrient removal upgrade to meet more stringent effluent discharge limitations. New or upgraded processes include aeration tanks, process blowers, chemical feed, intermediate pumping, and tertiary filtration.

(2021)

Hanover County Wastewater Treatment Plants WIP III Study, Hanover County, VA

Lead Engineer. Oversaw nutrient evaluation of the existing plants and development of a recommendations to comply with upcoming nutrient discharge requirements.
(2019-2021)

Totopotomoy WWTP Improvements, Hanover County, VA

Lead Engineer. Responsible for overall project coordination, aerobic digester blower design. Constant speed aerobic digester blowers were replaced with higher-capacity blowers on VFDs to meet greater air demand while enabling turndown to meet lower air demand requirements. Project also included replacement of nitrified recycle (NRCY) vertical turbine with submersible solids-handling pumps to prevent ragging, and replacement of sodium hydroxide diaphragm pumps with hose pumps to reduce O&M issues. Mr. Coyne was responsible for aerobic digester blower equipment sizing, hydraulic calculations design, building layout, and design features.

Hanover County WWTPs WIP III Study, Hanover County, VA

Project Manager. Responsible for overall project coordination. Project includes an evaluation of Hanover County's three WWTPs (Ashland, Doswell, and Totopotomoy) to determine impacts from the implementation of the WIP III and identify and improvements and upgrades in anticipation of WIP III. Upgrades included near-term/low cost and longer term. Study included a biological process model to evaluate biological treatment system, and capacity evaluation of other unit processes.

South Central WWTP Nutrient Removal Upgrade PER and VE, SCWWA, Petersburg, VA

Project Engineer. Assisted in evaluation of the existing plant and development of a preliminary engineering report (PER) that was basis of a future plant design. The existing plant required a nutrient removal upgrade, and a capacity expansion from 7 mgd to 10 mgd average daily flow. New or upgraded processes include aeration tanks, process blowers, chemical feed, secondary clarifiers, RAS pumping, and solids thickening and dewatering.

Proctors Creek WWTP Secondary Clarifier Mechanism Replacement Design and Construction, Chesterfield County, VA

Lead Engineer. Responsible for design of secondary clarifier mechanism replacement. Project included replacing mechanisms in four 118-ft secondary clarifiers. Design included converting from organ-pipe-style sludge removal to suction header, converting from a pumped scum removal system to a gravity scum removal system, adding energy dissipation inlets to feedwells, adding density current baffle along outer wall interior, adding a spray system for scum/foam mitigation, and converting from a chain/gear electrically-powered drive to a hydraulic drive. Reviewed submittals and worked with contractor and owner during construction.

Proctors Creek WWTP Clarifier Replacement Projects, Chesterfield County, VA

Lead Engineer. Throughout multiple projects, Jeff led the design for equipment rehab and replacement projects for eight secondary clarifiers and four primary clarifiers. The projects included converting the existing secondary clarifier mechanism type from an organ pipe to a suction header, and converting the existing secondary clarifier configuration from a peripheral-feed to center-feed, peripheral-outflow system.

Christiansburg WWTF UV and NPW System Upgrades, Town of Christiansburg, VA

Lead Project Engineer. Responsible for design of UV system and overall project coordination. The preliminary design report included evaluation of technologies to upgrade from the outdated UV disinfection system to modern technology, including system with clean-in-place technology. Design and construction include new horizontal UV banks, vertical turbine non-potable water (NPW) pumps, NPW valves and piping, UV channel

influent gates, and enhanced instrumentation and control for improved operation. He coordinated detailed design of the new and upgraded systems.

Proctors Creek WWTP Master Plan, Chesterfield County, VA

Project Engineer. Responsible for plant-wide asset condition assessment and evaluation of primary clarifiers, secondary clarifiers, chlorine contact tanks, and sludge thickening. The Master Plan project included asset evaluation, hydraulic evaluation, alternatives analysis, and regulatory review. Mr. Coyne was responsible for analysis of historical plant operational data; capacity analysis of existing primary clarifiers, secondary clarifiers, chlorine contact tanks, and sludge thickening; and alternatives analysis considering new technology such as UV disinfection.

Proctors Creek WWTP Tracer Testing, Chesterfield County, VA

Project Manager. Responsible for planning and execution of dye tests at a municipal WWTP to evaluate maldistribution at a distribution structure and short circuiting through Integrated Fixed-film Activated Sludge (IFAS) biological treatment basins in response to periodic spike of ammonia in secondary effluent with unknown cause. Tests included dosing set mass of dye to upstream location, collecting samples at downstream locations for discrete analysis using a fluorometer, and analyzing time and concentration curves using statistical methods.

Henrico County WRF Nutrient Removal Upgrade, Henrico County, VA

Project Engineer. Responsible for design of air scour blowers for deep bed filtration system. Project includes two new ENR basins, upgraded carbon feed, enhanced instrumentation and control for improved nutrient removal, and deep bed denitrification filters. Mr. Coyne was responsible for design of air scour blowers including equipment sizing, hydraulic calculations design, building layout, and design features.

Publications:

Authored or co-authored over 30 technical publications and one paperback covering various water and wastewater treatment disciplines, including:

- Supercritical oxidation of PFAS contaminated wastes
- Thermal treatment of PFAS contaminated sludge
- Organics diversion strategy and energy production at municipal resource recovery facilities
- High solids thermal hydrolysis
- Anaerobic digestion of municipal and industrial sludge.
- Acid gas phase digestion technologies for co-digestion.
- High strength and high solids treatment
- Waste to energy conversion technologies
- Biological nitrogen removal from wastewater
- Oxygen transfer efficiencies in activated sludge utilizing plastic media for attached growth
- Biological aerated filter cell management to minimize energy utilization of facilities
- Surrogate measurements to aid drinking water monitoring

Background:



Mr. Viswanathan is Vice President at 374Water, a global cleantech, social impact company based in Durham, NC. He currently spearheads the commercialization and business development of the Supercritical Water Oxidation technology. He is involved with developing effective and strategies for opportunities and advocate solutions that best fits the end-users needs. He is leading business development efforts in North America.

Mr. Viswanathan has over 22 years of work experience in our industry. He has been involved in all aspects of the water and wastewater treatment and served in roles ranging from pilot plant engineer, research and development, product management and technical sales.

Key Experience:

2022 - Vice President, 374Water, Durham, NC

- Responsible for developing opportunities for 374Water's Supercritical Water Oxidation technology.
- Build industry network with owners, consulting engineers, project developers and contractors to expand 374Water's presence and market reach.

2016 to 2022 National Sales Manager, Biosolids & Bioenergy, VEOLIA, Cary, NC

- Responsible for developing biosolids and bioenergy projects.
- Built industry network with owners, consulting engineers, project developers and contractors to expand VEOLIA's presence and market reach.
- Developed over half billion-dollar pipeline from scratch in under 6 years.
- Responsible for doubling the installation reference for Veolia's thermal drying systems in the US.

2013 to 2016 - Group Manager, Biosolids Group, SUEZ, Richmond, VA

- Responsible for managing a \$7MM+ annual sales portfolio. Increased sales of non-thermal products in North America by 6% annually since 2013.
- Participate in national and international conferences as key biosolids business developer.
- Assist in determining bid strategy.
- Oversee and manage a group of technical sales engineers, application engineers and product managers to support internal and external sales representatives.

2010 to 2013 - Product Manager, Biosolids Group, SUEZ, Richmond, VA

- Increased market shares for advanced anaerobic digesters by 50%.
- Diversified digester mixing technology to water management applications.
- Deployed solar drying offering to North American markets.

Education:

Master of Science,
Environmental
Engineering, Syracuse
University, 2001

Bachelor of Engineering,
Environmental
Engineering, University of
Mysore, 1997

2008 - 2010 - Principal Engineer, Biosolids Group, SUEZ, Richmond, VA

- Championed technical sales and developed market for advanced anaerobic digestion technology nationally, and increased sales for digester mixer technology internationally.
- Assisted in preparation of product related sales tools such as product bulletins and media.

2006 to 2008 - Senior Research Engineer, Research Development & Industrialization Group, SUEZ, Richmond, VA

- Responsible for transfer of Integrated Fixed-Film Activated Sludge (IFAS) technology to the US market; developed detailed design models for applications including IFAS and Moving Bed Biological Reactor (MBBR).
- Assist in developing new Ultrafiltration Membrane for the US market; developed test protocols in collaboration with engineering team; oversight of construction and commissioning of pilot plant units.
- Developed new Biological Nutrient Removal (BNR) Filter Technology to address low total nitrogen requirements for Chesapeake Bay watershed applications.
- Championed Stage-Gate Project Management with accountability throughout the "New Technology" RDI Cycle;
- Managed technology transfers to various business units within organization
- Developed intellectual property, internal invention disclosures and patents.
- Managed process box to strengthen technical expertise of the organization; developed detailed design models.

2002 to 2006 - Research Engineer, Research Development & Industrialization Group, SUEZ, Richmond, VA

- Lead the research team involved in optimization of innovative physical-chemical and biological technologies.
- Supervised transfer of Dissolved Air Flotation (DAF) Technology to the US market, developed new saturator nozzles to minimize differential pressure loss and diversified technology to nutrient removal applications in wastewater.

2000 to 2002 - Pilot Plant Engineer, Research Development & Industrialization Group, SUEZ, Richmond, VA

- Designed and developed testing protocols, programs and implemented start-up and optimization of pilot plant units
- Provided support for regulatory approval process and served as a liaison with federal, state, and universities addressing contemporary environmental issues via pilot scale testing.

CURRICULUM VITAE

Banu Örmeci, Ph. D., P. Eng.

Professor

Jarislowsky Chair in Water and Health

Director, Global Water Institute

Canada Research Professor

Department of Civil and Environmental Engineering

Carleton University, Ottawa, ON K1S 5B6

Canada

E-mail: banu.ormeci@carleton.ca

EDUCATION

Ph.D. Civil and Environmental Engineering, Duke University, USA, 2000

M.S. Civil and Environmental Engineering, Duke University, USA, 1996

B.S. Environmental Engineering, Dokuz Eylül University, Turkey, 1993

PROFESSIONAL EXPERIENCE

07.2014 – current Professor

01.2017 – current Jarislowsky Chair in Water and Health, Department of Civil and Environmental Engineering, Carleton University, Canada.

08.2017 – current Director of the Global Water Institute, Carleton University, Canada

01.2017 – current Canada Research Professor, Department of Civil and Environmental Engineering, Carleton University, Canada.

01.2012 – 12.2016 Canada Research Chair (Tier II) in Wastewater Treatment Engineering, Department of Civil and Environmental Engineering, Carleton University, Canada.

07.2009 – 07.2014 Associate Professor, Department of Civil and Environmental Engineering, Carleton University, Canada.

01.2007 – 01.2012 Canada Research Chair (Tier II) in Wastewater and Public Health Engineering, Department of Civil and Environmental Engineering, Carleton University, Canada.

07.2005 - 07.2009 Assistant Professor, Department of Civil and Environmental Engineering, Carleton University, Canada.

01.2003 - 07.2005 Assistant Research Professor, Department of Civil and Environmental Engineering, Duke University, USA.

04.2000 - 01.2003 Research Associate, Department of Civil and Environmental Engineering, Duke University, USA.

08.1996 - 12.1999 Teaching and Research Assistant, Department of Civil and Environmental Engineering, Duke University, USA.

AWARDS AND RECOGNITIONS

2022 IWA (International Water Association) Fellow

2021 Water's Next Award – Category: Academic Leader (Canadian Water Summit)

2021 Jarislowsky Chair in Water and Health (Carleton University)

2020 Professional Engineers of Ontario Ottawa Chapter Engineering Excellence Award (PEO)

2019 Faculty of Engineering and Design Teaching Excellence Award (Carleton University)

2019	Professional Engineers of Ontario Ottawa Chapter Citizen Award (PEO)
2017	Jarislowsky Chair in Water and Health (Carleton University)
2017	Canada Research Professor (Carleton University)
2016	Engineering Ambassador Award (Partners in Research National Awards)
2015	Carleton University Research Achievement Award (Carleton University)
2014	ESSO University Research Award (Imperial Oil)
2013	30 Inspiring Women in Engineering (CWSE-ON)
2012	Canada Research Chair in Wastewater Treatment Engineering (Federal Government of Canada)
2011	Faculty Graduate Mentoring Award (Carleton University)
2010	OCRI Research Award Finalist (Ottawa Centre for Research and Innovation)
2010	President's Doctoral Fellowship (Carleton University)
2008	Global Young Academy (The Royal Society of Canada and the InterAcademy Panel)
2007	Ontario Early Researcher Award (Provincial Government of Ontario)
2007	Canada Research Chair in Wastewater and Public Health Engineering (Federal Government of Canada)
2006	Carty Research Fellowship (Carleton University)
2006	Research Achievement Award (Carleton University)
2006	Carleton University Students' Association (CUSA) Teaching Excellence Award (Carleton University)
2001	Vice Provost Travel Award (Duke University)
1998	Chi Epsilon (The National Civil Engineering Honor Society, Duke University Chapter)
1998	Sigma Xi (The Scientific Research Society, Duke University Chapter)
1996	Jeffrey B. Taub Environmental Engineering Graduate Student Award (Duke University)
1996	Graduate Student Scholarship (Duke University)
1994	Higher Education Council of Turkey Fellowship (Government of Turkey)

PATENTS

1. Measurement of treatment agent in a process stream using Ultraviolet-Visible (UV-VIS) spectroscopy, and related systems and processes.

United States. US 10,545,088 B2.

Patent Status: Granted/Issued, 2020

Inventor: Banu Örmeci

2. Measurement of treatment agent in a process stream using ultraviolet visible (UV-vis) Spectroscopy, and related systems and processes.

Canada. CA2867779C

Patent Status: Granted/Issued, 2021

Inventor: Banu Örmeci

3. Measurement of treatment agent in a process stream using ultraviolet visible (UV-vis) Spectroscopy, and related systems and processes.

Europe. EP2828640B1

Patent Status: Granted/Issued, 2021

Inventor: Banu Örmeci

4. A device for detecting algae concentration using first derivative of visible light absorbance. United States. US 2019/0145901 A1
Patent Status: Granted/Issued, 2019
Inventors: Banu Örmeci, Andrew Glover, and Kerim Kollu

5. A device for detecting algae concentration using first derivative of visible light absorbance. Europe. EP3465148
Patent Status: Granted/Issued, 2019
Inventors: Banu Örmeci, Andrew Glover, and Kerim Kollu

6. A new spectrophotometry-based method to monitor and optimize the maturation and activation of polymers.
United States. US 62/481,081 (provisional patent). 2017/04/03.
Patent Status: Allowed
Inventors: Banu Örmeci and Narek Martirosyan

7. Method for Water and Wastewater Sludge Treatment Using Flocculation or Network Strength. United States. US 7,037,433 B2.
Patent Status: Granted/Issued, 2006
Inventors: Mohammad AbuOrf and Banu Örmeci

8. System for Water and Wastewater Sludge Treatment Using Flocculation or Network Strength. United States. US 6,964,737 B2.
Patent Status: Granted/Issued, 2005
Inventors: Mohammad AbuOrf and Banu Örmeci

SELECTED PROFESSIONAL AND SERVICE ACTIVITIES

- International Water Association (IWA) Strategic Council (2017-current)
- Co-Chair (2020-current) and Member (2019-current), IWA Covid-19 Task Force
- Chair (2012-2019) and Executive Committee Member (2012-current), IWA Specialist Group on Sludge Management
- Canadian Focal Point, Inter-American Network of Academies of Science (IANAS) Water Program.
- Vice President – Central Region (2021-current) and Board Member (2015-current), Canadian Association on Water Quality
- President (2008-2010, 2012-2014) and Board Member (2006-current), Women in Science and Engineering Ottawa Chapter.
- Residuals and Biosolids Committee, Water Environment Association of Ontario (2012-current)
- Co-Chair (2020-2022) and Member (2019-2022), NSERC (Natural Sciences and Engineering Research Council of Canada, Discovery Grants Evaluation Committee
- Killam Awards and Fellowships Selection Committee (2016-2019)
- Carleton University Board of Governors (2019-current, 2015-2017)
- Carleton University Senate (2014-2017)
- International Standards Development (ISD) Canadian Mirror Committee, SMC/ISO/TC275 Sludge Recovery, Recycling, Treatment and Disposal (2014-2018); SMC/ISO/TC282 Water Reuse (2014-2018).
- Editor (2020-current) and Associate Editor (2017-2020), Water Science and Technology

- Conference co-chair
 - 2022 CAWQ Atlantic-Eastern Conference
 - 2019 WEF Residuals and Biosolids Conference, USA.
 - 2015 WEF Residuals and Biosolids Conference, USA.
- International Conference Scientific Committees
 - 2022 IWA Agro Conference,
 - 2019 WEF Residuals and Biosolids Conference, USA
 - 2019 IWA Agro Conference, Greece
 - 2018 IWA Sludge Management in Circular Economy, Italy
 - 2017 IWA SludgeTech, UK
 - 2016 IWA Holistic Sludge Conference, Sweden
 - 2016 Romanian Sludge Management Conference, Romania.
 - 2015 Third International Conference on Faecal Sludge Management, Vietnam
 - 2015 WEF Residuals and Biosolids Conference, USA
 - 2014 European Sludge Management Conference, Turkey
 - 2014 IWA Waste Management Problems in Agro-Industries, Japan
 - 2014 IWA First Specialist Conference on Municipal Water Management and Sanitation in Developing Countries, Thailand
 - 2014 IWA Ecotechnologies for Wastewater Treatment Plants, Italy
 - 2013 IWA Small Water and Wastewater Systems Conference, China
- Workshop organizer/chair, 2022 IWA World Water Congress
 - Microplastics in Water Environments
- IWA Webinar organizer, Early detection of Omicron variant with wastewater surveillance, on January 12, 2022
- IWA Webinar organizer, Detecting COVID-19 variants in wastewater, on April 13, 2021
- Workshop organizer/chair, 2015 Third International Faecal Sludge Management Conference, Vietnam
 - Resource Recovery from Faecal Sludge
- Workshop organizer/chair, 2014 IWA World Water Congress, Portugal
 - Energy and Resource Recovery from Biosolids
 - Sustainable Wastewater and Sludge Management in Developing Countries
- Workshop co-organizer, 2014 IWA World Water Congress, Portugal
 - Advanced Processes for the Removal of Micropollutants: Lessons learned from full-scale plants
- Faculty Advisor, Women in Science and Engineering, Carleton Student Chapter (2006-current)
- Faculty Advisor, Water Environment Association of Ontario – Carleton Student Chapter (2015-current)
- Co-chair, Women in Science and Engineering Network for Female Faculty (2015-2018)
- Research Mentor, Department of Civil and Environmental Engineering, Carleton University (2014-2019)

CONFERENCE KEYNOTE SPEAKER INVITATIONS

- 2022 Canadian Biosolids Conference, Canada
- 2019 iWISE Conference, Canada
- 2019 RTESE Conference, Canada
- 2018 Ajman International Environment Conference, UAE
- 2017 Izmir International Water Congress, Turkey
- 2017 Alberta Onsite Wastewater Management Association Convention, Canada

- 2017 iWISE International Conference on Water, Informatics, Sustainability, and Environment, Canada
- 2016 IWA Holistic Sludge Management Conference, Sweden
- 2016 Romanian Sludge Management Conference, Romania
- 2014 IWA Waste Management Problems in Agro-Industries, Japan
- 2014 European Conference on Sludge Management, Turkey.
- 2013 IWA Small Water and Wastewater Systems Conference, China

INVITED WEBINARS

- 2022 HUDDLE, Wireless World Research Forum
- 2022 Biosolids Treatment and Management: Challenges and Opportunities, CentrEAU
- 2022 Surfacing Solutions: Microplastics in Freshwater, waterNEXT, Canada
- 2022 Microplastics in Water and Wastewater, CWWA National Water and Wastewater Conference, Canada
- 2021 Emerging contaminants in wastewater. Canadian Water Summit, Canada
- 2021 Tracking and understanding COVID-19 in wastewater and water environments. Environment and Climate Change Canada (ECCC), Canada
- 2021 Biosolids management in the age of emerging pathogens, PFAS, nanoparticles and microplastics, Canadian Water and Wastewater Association (CWWA) Webinar, Canada
- 2021 Biosolids management in the age of emerging pathogens, PFAS, nanoparticles and microplastics. What is next? Ontario Ministry of the Environment, Conservation and Parks (MECP) webinar, Canada
- 2021 Future of Water: Imagining possibilities. Canadian Environmental Professionals Webinar, Canada
- 2021 Water and Health: Research and answers from science. Peru Water Quality, Ecosystems, and Human Health Conference, Peru
- 2020 Monitoring of COVID-19 virus in sewage as an early warning surveillance tool. Ingenious Talks, Canada
- 2020 COVID-19: Implications for Wastewater Treatment and Biosolids Management. Water Environment Association of Ontario (WEAO) Webinar, Canada
- 2020 Facing the Floods: Infrastructure Resilience to Face Climate Change. Future Cities Canada

CURRENT RESEARCH FUNDING

PI: Banu Örmeci

Ontario Wastewater Surveillance Initiative for Covid 19, 2021/1 - 2023/3

Funding Sources: Ontario Ministry of the Environment, Conservation and Parks

Total Funding – \$2,000,000

PI: Banu Örmeci

Freshwater Plastics Detection/Removal Technology Acceleration Project, 2020/10 - 2022/3

Funding Sources: Environment and Climate Change Canada, Zero Plastic Initiative

Total Funding - \$240,000

PI: Banu Örmeci, Co-Applicants: Jesse Vermaire, Ravi Prakash

Monitoring of Emerging Water Pollutants and Development of Next Generation Sensors, 2021/1 - 2025/1

Funding Sources: Canada Foundation for Innovation (CFI)
Total Funding - \$640,836

PI: Patrick Drogui, Co-Applicants: Rajeshwar Tyagi, Satinder Kaur Brar, Banu Örmeci, et al. (total 10)

Programme FONCER en Technologies Environnementales de Décontamination et Gestion Intégrée des Eaux et Effluents Résiduaire (TEDGIEER), 2017/9 - 2023/9

Funding Sources: Natural Sciences and Engineering Research Council of Canada (NSERC) CREATE

Total Funding - \$1,650,000

PI: Banu Örmeci

Jarislowsky Chair in Water and Global Health Research Chair, 2022/1 - 2027/1

Funding Sources: Jarislowsky Foundation

Total Funding - \$450,000

PI: Banu Örmeci

Optimization of sludge conditioning and dewatering using sludge network strength and residual polymer concentration, 2015/04 - 2023/04

Funding Sources: Natural Sciences and Engineering Research Council of Canada (NSERC), Discovery Grant

Total Funding - \$384,000 (\$48,000/year)

PI: Banu Örmeci

MRCF Fund for Water Cluster, 2019/1 - 2023/1

Funding Sources: Carleton University

Total Funding - \$30,000

PI: Banu Örmeci

Title: Fate and persistence of COVID-19 virus during wastewater treatment, 2020/5 - 2022/5

Funding Sources: Carleton University

Carleton University COVID-19 Early Response Fund

Total Funding - \$20,000

PI: Banu Örmeci

Sewage based epidemiology for COVID-19 monitoring at Carleton University's campus, 2020/9 - 2023/5

Funding Sources: Carleton University

Total Funding - \$60,000

PI: Liam O'Brien, Co-Applicants: 5 co-applicants including Banu Örmeci

Modeling for the new normal on University campuses, 2021/3 - 2023/3

Funding Sources: Carleton University MRCF

Total Funding - \$30,000

PEER-REVIEWED JOURNAL PUBLICATIONS

(Bold names indicate students supervised by Dr. Örmeci)

1. **E Poorasgari**, B Örmeci (2022) Development of non-linear empirical models to estimate the abundance of carbapenem resistance genes during anaerobic digestion of wastewater sludge at mesophilic and thermophilic temperatures. Chemical Engineering Journal 450, 138290.

2. **Z Cui**, G Xu, B Örmeci, H Liu, Z Zhang (2022) Transformation and stabilization of heavy metals during pyrolysis of organic and inorganic-dominated sewage sludges and their mechanisms. *Waste Management* 150, 57-65.
3. **LC Bitter**, **R Kibbee**, **GC Jiménez**, B Örmeci (2022) Wastewater Surveillance of SARS-CoV-2 at a Canadian University Campus and the Impact of Wastewater Characteristics on Viral RNA Detection, *ACS ES&T Water*, <https://doi.org/10.1021/acsestwater.2c00060>
4. **PK Brar**, B Örmeci, A Dhir (2022) Parametric optimization of rice bran-based bi-functional catalyst in the one-pot conversion of indigenous algal biomass into biodiesel using response surface methodology. *Biomass Conversion and Biorefinery*, 1-13.
5. **PK Brar**, B Örmeci, A Dhir (2022) Algae: A cohesive tool for biodiesel production along with wastewater treatment. *Sustainable Chemistry and Pharmacy* 28, 100730
6. **I Thakur**, A Verma, B Örmeci (2022) Inactivation of bacteria present in secondary municipal wastewater effluent using the hybrid effect of Fe-TiO₂ catalyst. *Journal of Cleaner Production*, 46, 102540.
7. **E Poorasgari**, B Örmeci (2022) A mathematical model for the kinetics of concurrent volatile solids destruction and water evaporation during aerobic and anaerobic digestion of wastewater sludge under mesophilic and thermophilic temperatures. *Journal of Water Process Engineering*, Volume 46, 102540.
8. E Arts, S Brown, D Bulir, TC Charles, CT DeGroot, et al. (2022) Community Surveillance of Omicron in Ontario: Wastewater-based Epidemiology Comes of Age. *Europe PMC*, <https://europepmc.org/article/ppr/ppr468647>
9. **Mishra, S., Singh, V.,** Cheng, L., Hussain, A., Örmeci, B. (2022) Nitrogen removal from wastewater: a comprehensive review of biological nitrogen removal processes, critical operation parameters and bioreactor design. *Journal of Environmental Chemical Engineering*, 10 (3), 107387.
10. **I Thakur**, A Verma, B Örmeci, V Sangal (2022) Applications of waste-derived visibly active Fe-TiO₂ composite incorporating the hybrid process of photocatalysis and photo-Fenton for the inactivation of E. coli. *Environmental Science and Pollution Research*, 1-13, doi: 10.1007/s11356-022-19202-1
11. **E Poorasgari**, B Örmeci (2022) Relationship between ultraviolet-visible spectra and soluble species in the liquid phase of wastewater sludge during biological digestion under mesophilic and thermophilic conditions. *Biochemical Engineering Journal* 179, 108318
12. **J Singh**, B Örmeci (2022) Monitoring indigenous microalgae using derivative spectrophotometry and comparison with *M. aeruginosa* and *C. vulgaris*. *Journal of Water Supply: Research and Technology-Aqua*, <https://doi.org/10.2166/aqua.2022.128>
13. A Hinz, L Xing, E Doukhanine, et al. (2022) SARS-CoV-2 Detection from the built environment and wastewater and its use for hospital surveillance. *FACETS* 7 (1), 82-97
14. **A Malhotra**, B Örmeci (2021) Monitoring of cyanobacteria using derivative spectrophotometry and improvement of the method detection limit by changing pathlength. *Water Supply*, 22 (3), 2914-2928.
15. **I Thakur**, A Verma, B Örmeci (2021) Visibly active Fe-TiO₂ composite: A stable and efficient catalyst for the catalytic disinfection of water using a once-through reactor. *Journal of Environmental Chemical Engineering* 9 (6), 106322.
16. **V Singh**, B Örmeci, S Mishra, A Hussain (2021) Simultaneous partial Nitrification, ANAMMOX and denitrification (SNAD)—A review of critical operating parameters and reactor configurations. *Chemical Engineering Journal*, 133677
17. **Z Abdulsada**, **R Kibbee**, D Schwertfeger, J Princz, M DeRosa, B Örmeci (2021) Fate and removal of silver nanoparticles during sludge conditioning and their impact on soil health after simulated land application. *Water Research*, 206, 117757

18. **Z Abdulsada, R Kibbee, J Princz, M DeRosa, B Örmeci** (2021) Transformation of Silver Nanoparticles (AgNPs) during Lime Treatment of Wastewater Sludge and Their Impact on Soil Bacteria. *Nanomaterials* 11 (9), 2330.
19. **I Thakur, A Verma, B Örmeci** (2021) Fe–TiO₂ Composite Mediated the Hybrid Effect of Photocatalysis and Photo-Fenton for the Inactivation of Escherichia coli Using a Continuous Flow Recirculation Reactor. *Industrial & Engineering Chemistry Research* 60 (20), 7558-7571.
20. C Chen, K Hayward, SJ Khan, B Örmeci, S Pillay, JB Rose, JV Thanikal, (2021) Role of wastewater treatment in COVID-19 control. *Water Quality Research Journal* 56 (2), 68-82
21. **I Thakur, A Verma, B Örmeci** (2021) Mathematical modeling of E. coli inactivation in water using Fe-TiO₂ composite in a fixed bed reactor. *Separation and Purification Technology* 260, 118242
22. **Y Zhou, PD Kiely, R Kibbee, B Örmeci** (2021) Effect of polymeric support material on biofilm development, bacterial population, and wastewater treatment performance in anaerobic fixed-film systems. *Chemosphere* 264, 128477
23. **AM Salam, B Örmeci, PH Simms** (2021) Determination of optimum polymer dosage for dewatering of oil sands tailings using torque rheology. *Journal of Petroleum Science and Engineering* 197, 107986
24. **EM Hassan, BR Dixon, SA Sattar, A Stalker, B Örmeci, MC DeRosa** (2021) Highly sensitive magnetic-microparticle-based aptasensor for Cryptosporidium parvum oocyst detection in river water and wastewater: Effect of truncation on aptamer affinity. *Talanta* 222, 121618
25. **I Thakur, A Verma, B Örmeci** (2021) Fe–TiO₂ Composite Mediated the Hybrid Effect of Photocatalysis and Photo-Fenton for the Inactivation of Escherichia coli Using a Continuous Flow Recirculation Reactor. *Industrial & Engineering Chemistry Research*, 60, 20, 7558-7571.
26. **EM Hassan, B Örmeci, MC DeRosa, et al.** (2021) A review of Cryptosporidium spp. and their detection in water. *Water Science and Technology* 83 (1), 1-25
27. **Z Abdulsada, R Kibbee, B Örmeci, M DeRosa, J Princz** (2021) Impact of anaerobically digested silver and copper oxide nanoparticles in biosolids on soil characteristics and bacterial community. *Chemosphere* 263, 128173
28. **Kibbee, R. and Örmeci, B.*** (2020) Peracetic acid and low-pressure ultraviolet inactivation of Coxsackievirus B3 in municipal wastewater, individually and as an advanced oxidation process, *Water Research*, 183, 116048.
29. **Abdulsada, Z., Kibbee, R., Örmeci, B.*, DeRosa, M., Princz, J.** (2020) Impact of anaerobically digested silver and copper oxide nanoparticles in biosolids on soil characteristics and bacterial community. *Chemosphere*, 128173.
30. **Hassan, E., Dixon, B. R., Sattar, S. A., Stalker, A. Örmeci, B.*, DeRosa, M. C.*** (2020) Highly Sensitive Magnetic-Microparticle-Based Aptasensor for Cryptosporidium parvum Oocyst Detection in River Water and Wastewater: Effect of Truncation on Aptamer Affinity. *Talanta*, 121618.
31. Cooke, S. J. et al. (2020) On “success” in applied environmental research – What is it, how can it be achieved, and how does one know when it has been achieved? *Environmental Reviews*, <https://doi.org/10.1139/er-2020-0045>.
32. **Waltham, B. and Örmeci, B.*** (2020) Fluorescence intensity, conductivity, and UV-Vis absorbance as surrogate parameters for real-time monitoring of anaerobic digestion of wastewater sludge. *Journal of Water Process Engineering*, 37, 101395.
33. **Boyle, K. and Örmeci, B.*** (2020) Microplastics and nanoplastics in the freshwater and terrestrial environment: A review. *Water*, 12(9), 2633.

34. **AlMomani, F.*** and Örmeci, B. (2020) Assessment of algae-based wastewater treatment in hot climate region: Treatment Performance and Kinetics. *Process Safety and Environmental Protection*, 141, 140-149.
35. Rivas, E.J., Perez, R. G., Tundisi, J. G., Vammen, K., Örmeci, B. and Forde, M. (2020) Eutrophication: A growing problem in the Americas and the Caribbean. *Brazilian Journal of Biology*, 80 (3), Braz. J. Biol. vol.80 no.3 São Carlos July/Sept. 2020.
36. Örmeci, B.* (2020) Your COVID-19 Questions Answered. *Influents*, Volume 16, 42-43.
37. Bicudo, J., **Gerber, J.**, Celmer-Repin, D., Örmeci, B., Shirkhani, H. (2020) Carbon footprint of biosolids processes – A practical case study. *Influents*, Volume 16, 46-49.
38. **Yan, Z.**, Örmeci, B.*, Han, Y.*, and Zhang, J. (2020) Supercritical water oxidation for treatment of wastewater sludge and recalcitrant organic contaminants. *Environmental Technology and Innovation*, 18,100728.
39. **Murray, A.** and Örmeci, B.* (2020) Removal effectiveness of nanoplastics (<400 nm) with separation processes used for water and wastewater treatment. *Water*, 12(3), 635.
40. **Thakur, I.**, Örmeci, B, Verma, A.* (2020) Inactivation of E. coli in water employing Fe-TiO₂ composite incorporating in-situ dual process of photocatalysis and photo-Fenton in fixed-mode. *Journal of Water Process Engineering*, 33, 101085.
41. **Agberian, V. A.** and Örmeci, B.* (2020) Monitoring of Cyanobacteria in water using spectrophotometry and first derivative of absorbance. *Water*, 12(1), 124.
42. Mohan, S., Princz, J., Örmeci, B., DeRosa, M.C. (2019) Morphological transformation of silver nanoparticles from commercial products: Modeling from product incorporation, weathering through use scenarios, and leaching into wastewater. *Nanomaterials*, 9(9), 1258.
43. **Murray, A.** and Örmeci, B.* (2019) Use of non-imprinted polymer particles for removal of heavy metal ions from water and wastewater. *Journal of Environmental Science*, 75, 247-254.
44. **AlMomani, F.**, Örmeci, B.*, Kiely, P. (2019) Improving the Performance of Attached-growth Wastewater Treatment Processes by Altering the Support Media Surface. *ASCE Journal of Environmental Engineering*, 145(8), 04019045.
45. **Diak, J.** and Örmeci, B.* (2018) Stabilisation and dewatering of primary sludge using ferrate(VI) pre-treatment followed by freeze-thaw in simulated drainage beds. *Journal of Environmental Management*, 216, 406-420.
46. **Murray A.**, Örmeci B.* (2018) Competitive effects of humic acid and wastewater on adsorption of methylene blue dye by activated carbon and non-imprinted polymers, *Journal of Environmental Sciences*, 66, 301-317.
47. **Ma, T., Hu, T., Jiang, D., Zhang, J, Li, W., Han, Y.***, and Örmeci B.* (2018) Treatment of penicillin with supercritical water oxidation: Experimental study of combined ReaxFF molecular dynamics, *Korean Journal of Chemical Engineering*, 53(4), 900-908.
48. **AlMomani, F.** and Örmeci, B.* (2018) Monitoring and measurement of microalgae using the first derivative of absorbance and comparison with chlorophyll extraction method, *Environmental Monitoring and Assessment*, 190 (2), 90.
49. **Diak, J.** and Örmeci, B.* (2017) Ferrate(VI) and freeze-thaw treatment for oxidation of hormones and inactivation of fecal coliforms in sludge. *Water Science & Technology*, 75 (7), 1625-1632.
50. **Murray A.**, Örmeci B.*, and Lai E. P. (2017) Use of sub-micron sized resin particles for removal of endocrine disrupting compounds and pharmaceuticals from water and wastewater. *Journal of Environmental Sciences*, 51, 256-264.
51. Örmeci, B. and DiMassimo, R. (2017) Dewatering optimization with in-line and real-time measurement of polymer: Results from full-scale treatment plants. *Water Science & Technology*, 76 (6), 1318-1323.
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53. **Diak, J.** and Örmeci, B.* (2017) Effect of combined freeze-thaw and ferrate(VI) treatments on *Escherichia coli* in phosphate-buffered saline. *Journal of Cold Regions Engineering*, 31 (3), 04017004.
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 55. Örmeci, B. and DiMassimo, R. (2017) Real-Time dewatering optimization by measuring excess polymer in sludge. *Influents*, 11, 42-45.
 56. **Murray A.,** Örmeci B*., and Lai E. P. (2016) Removal of endocrine disrupting compounds from wastewater using polymer particles. *Water Science and Technology*, 73(1), 176-181.
 57. **AlMomani, F.** and Örmeci, B.* (2016) Performance of *C. Vulgaris*, *N. Oleoabundans*, and mixed indigenous microalgae for treatment of primary effluent, secondary effluent, and centrate. *Ecological Engineering*, 95, 280-289.
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 64. **Kollu K.** and Örmeci B*.. (2015) UV-induced self-aggregation of *E. coli* after low and medium pressure UV disinfection. *Journal of Photochemistry and Photobiology*. 148: 310-321.
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 69. **Al Momani F.** and Örmeci B.* (2014) Optimization of polymer dose based on residual polymer concentration in dewatering supernatant. *Water, Air, and Soil Pollution*, 225 (11),

- 2154.
70. **Al Momani F.**, Delatolla, R.* and Örmeci B. (2014) Field study of moving bed bioreactor (MBBR) technology for post-treatment of wastewater lagoon effluent at 1 °C. *Environmental Technology*, 35 (13), 1596-1604.
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 75. **Linklater N.** and Örmeci B.* (2013) Real-time and near real-time monitoring options for water quality. *Monitoring Water Quality: Pollution Assessment, Analysis and Remediation*, 189-225.
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 81. **Murray A** and Örmeci B.* (2012) Application of molecularly imprinted and non-imprinted polymers for removal of emerging contaminants in water and wastewater treatment: A review. *Environmental Science and Pollution Research*, 19 (9), 3820-3830.
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- Science and Technology, 64 (8), 1736-1742.
87. **Hassanzadeh-Khayyat, M.**, Lai, E. P. C.*, **Kollu, K.**, and Örmeci, B. (2011) Degradation of diclofenac in molecularly imprinted polymer submicron particles by UV light irradiation and HCl acid treatment. *Journal of Water Resource and Protection*, 3 (9), 643-654.
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 96. Örmeci, B. and Linden, K. G.* (2008) Development of a fluorescence in-situ hybridization protocol for studying microorganisms associated with wastewater and sludge flocs. *Journal of Environmental Science and Health: Part A*, 43 (13), 1484-1488.
 97. **Murray, A.** and Örmeci, B.* (2008) Impact of polymer-sludge interaction on rheogram peaks and optimum dose determination. *Water Science and Technology*, 57 (3), 389-394.
 98. Örmeci, B.* (2007) Optimization of a full-scale dewatering operation based on the rheological characteristics of wastewater sludge. *Water Research*, 41, 1243-1252.
 99. Örmeci, B.* and Abu-Orf, M. (2006) Using torque rheology for the identification of the optimum polymer dose and the best performing polymer. *Journal of Residuals Science and Technology*, 3 (4), 227-232.
 100. Örmeci, B. and Linden, K. G.* (2005) Comparison of physical and chemical procedures for extraction of particle-associated coliform in wastewater. *Environmental Engineering Science*, 22 (4), 459-471.
 101. Örmeci, B., Ducoste, J. J., and Linden, K. G.* (2005) UV Disinfection of chlorinated water: Interaction of UV and chlorine. *Journal of Water Supply: Research and Technology - AQUA*, 54 (3), 189-199.
 102. Örmeci, B.* and Abu-Orf, M. (2005) Protocol for measuring comparative sludge network strength – Relation to dewaterability. *ASCE Journal of Environmental Engineering*, 131 (1), 80-85.
 103. Chuang, L. C., Örmeci, B. and Vesilind, P. A.* (2005) Understanding the mechanics of desiccation cracking of alum sludge: Experimental results and model verification. *Journal of Residuals Science and Technology*, 2 (3), 125-132.
 104. Abu-Orf, M. M.* and Örmeci, B. (2005) Sludge network strength using rheology and relation to dewaterability, filtration and thickening – Laboratory and full-scale experiments. *ASCE Journal of Environmental Engineering*, 131 (8), 1139-1146.

105. Örmeci, B., Vesilind, P. A.*, and Chuang, L. C. (2004) Understanding the mechanics of desiccation cracking of alum sludge: Model development. *Journal of Residuals Science and Technology*, 1 (4), 201-271.
106. Örmeci, B.* (2004) Freeze-thaw conditioning of activated sludge: Effect of monovalent, divalent, and trivalent cations. *Journal of Residuals Science and Technology*, 1 (3), 143-150.
107. Örmeci, B*., Cho, K., and Abu-Orf, M (2004) Development of a laboratory protocol to measure network strength of sludges. *Journal of Residuals Science and Technology*, 1 (1), 35-44.
108. Örmeci, B. and Linden, K. G. (2002) Comparison of UV and chlorine inactivation of particle and non-particle-associated coliform. *Water Science and Technology: Water Supply*, 2 (5-6), 403-410.
109. Örmeci, B. and Vesilind, P. A.* (2002) The effect of extracellular material on freeze-thaw conditioning of activated sludge. *Water Science and Technology*, 46 (10): 269-275.
110. Örmeci, B. and Vesilind, P. A.* (2001) Effect of dissolved organic material and cations on freeze-thaw conditioning of activated and alum sludges. *Water Research*, 35 (18): 4299-4306.
111. Örmeci, B. and Vesilind, P. A. (2001)* Response to comments on “Development of an improved synthetic sludge: A possible surrogate for studying activated sludge dewatering characteristics”. *Water Research*, 35 (5): 1365-1366.
112. Örmeci, B. and Vesilind, P. A. (2000)* Development of an improved synthetic sludge: A possible surrogate for studying activated sludge dewatering characteristics. *Water Research*, 34 (4): 1069-1078.
113. Vesilind, P. A., and Örmeci, B. (2000)* A modified capillary suction time apparatus for measuring filterability of super-flocculated sludges. *Water Science and Technology*, 42 (9): 135-139.
114. Örmeci, B., Sanin, S. and Peirce, J. J. (1999)* Laboratory study of NO flux from agricultural soil: Effects of soil moisture, pH, and temperature. *Journal of Geophysical Research: Division of Atmospheres*. 104(D1), 1621-1629.

PEER-REVIEWED CONFERENCE PROCEEDINGS

Conference papers after 2020 will be added

1. Örmeci B.* (2020) Dewatering optimization using UV-vis absorbance: Real-time determination of optimum polymer dose and polymer maturation. IWA World Water Congress, Denmark. Accepted.
2. Örmeci B.* (2020) Microplastics in Wastewater and Biosolids, Accepted.
3. **Yan, Z.**, Örmeci B.*, Han, Y., Zhang, J. (2020) Supercritical Water Oxidation for Sludge Treatment and Removal of Emerging Compounds. IWA World Water Congress, Denmark. Accepted.
4. **MacDonell, C.**, Kibbee, R., and Örmeci B.* (2020) Effects of Chlorine, Peracetic Acid and UV disinfection on antibiotic resistant E. Coli isolates in wastewater. IWA World Water Congress, Denmark. Accepted.
5. **Malhotra, A.** and Örmeci B.* (2020) Early detection and monitoring of potentially toxic Cyanobacteria using derivative spectrophotometry. CAWQ Virtual Conference, Canada.
6. Örmeci B.* (2019) Biosolids Management in Circular Economy: Lessons from around the world. CWWA National Water and Wastewater Conference, Montreal, Canada.
7. **Martirosyan, N.** and Örmeci, B.* (2019). A New Spectrophotometry Based Method to Monitor and Optimize the Maturation and Activation of Polymers. WEF/IWA Residuals and Biosolids Conference, Fort Lauderdale, FL, USA.

8. Örmeci B.* (2019). Biosolids Management in Circular Economy: Lessons from around the world. WEF/IWA Residuals and Biosolids Conference, Fort Lauderdale, FL, USA.
9. **Smyth, J.** and Örmeci, B.* (2019). Utilization of Ultraviolet/Visible Spectrophotometry and Rheology for Sludge Monitoring. WEF/IWA Residuals and Biosolids Conference, Fort Lauderdale, FL, USA.
10. **Yan, Z.,** Örmeci, B.*, Han, Y, and Zhang, J. (2019). Supercritical water oxidation for treatment of wastewater sludge and recalcitrant organic contaminants. WEF/IWA Residuals and Biosolids Conference, Fort Lauderdale, FL, USA.
11. **Macdonell, C., Kibbee, R.,** and Örmeci, B.* (2019). Effects of Chlorine, Peracetic Acid and UV disinfection on antibiotic resistant E. Coli isolates in wastewater. CWWA National Water and Wastewater Conference, Montreal, Canada.
12. **Salam, A. M.,** Simms, P. H.* and Örmeci, B. (2019). Structuration in polymer amended oil sands fine tailings. 71st Canadian Geotechnical Conference. Edmonton, Alberta, Canada.
13. **Yan, Z.,** Örmeci, B.*, Han, Y, and Zhang, J. (2018). Supercritical water oxidation for treatment of wastewater sludge and recalcitrant organic contaminants. iCAMP, Montreal, Canada.
14. **Abdulsada, Z.,** Örmeci, B.*, De Rosa, M., Schwertfeger, D., Princz, J., Scroggins, R. (2018). Transformation and toxicity of silver nanoparticles during sludge conditioning and after land application. Nano Conference, Ottawa, Canada.
15. **Smyth J.** and Örmeci, B.* (2018). Torque rheology and UV-vis spectrophotometry for monitoring sludge characteristics and optimization of treatment processes. IWA Sludge Management in Circular Economy, Rome, Italy.
16. Örmeci B.* (2018). Climate Change and Smart Water Management. Ajman International Environment Conference, Ajman, UAE.
17. **Salam, A. M.,** Simms, P. H.* and Örmeci, B. (2018). Structuration in polymer amended oil sands fine tailings. 71st Canadian Geotechnical Conference, Canada.
18. **Yan, Z.,** Örmeci, B.*, Han, Y, and Zhang, J. (2018). Supercritical water oxidation for treatment of wastewater sludge and recalcitrant organic contaminants. 2018 National Water and Wastewater Conference, Montreal, Canada.
19. **Yan, Z.,** Örmeci, B.*, Han, Y. and Zhang, J. (2018). Supercritical Water Oxidation of Wastewater Sludge Contaminated with p-tert-butylcatechol. IWA Sludge Management in Circular Economy, Italy.
20. Örmeci, B.* and DiMassimo, R. (2017). Dewatering optimization with in-line and real-time measurement of polymer dose: Results from full-scale treatment plants. WEAO Conference, Ottawa, ON, Canada.
21. **Martirosyan, N.** and Örmeci, B.* (2017). A New Spectrophotometry Based Method to Monitor and Optimize the Maturation and Activation of Polymers. IWA Specialist Conference on Sludge Management SludgeTech 2017, London, UK.
22. **Abdulsada, Z., Kibbee, R.,** Örmeci, B.*, DeRosa, M., Schwertfeger, D., Princz, J., and Scroggins, R. (2017). Fate of Silver Nanoparticles During Sludge Conditioning and Their Impact After Land Application. IWA Specialist Conference on Sludge Management SludgeTech 2017, London, UK.
23. **Smyth, J.** and Örmeci, B.* (2017). Utilization of Ultraviolet/Visible Spectrophotometry and Rheology for Treatment Performance. WEAO Conference, Ottawa, ON, Canada.
24. **Abdulsada, Z., Kibbee, R.,** Örmeci, B.*, DeRosa, M., Schwertfeger, D., Princz, J., and Scroggins, R. (2017). Fate of Silver Nanoparticles During Sludge Conditioning and Their Impact After Land Application. WEAO Conference, Ottawa, ON, Canada.
25. **Smyth, J.** and Örmeci, B.* (2017). Utilization of Ultraviolet/Visible Spectrophotometry and Rheology for Sludge Monitoring. IWA Specialist Conference on Sludge Management

SludgeTech 2017.

26. **Salam A. M.**, Örmeci, B.* and Simms, P. H. (2017). A new method for real-time optimization of polymer dose and dewatering of oil sands tailings. 70th Canadian Geotechnical Conference, Ottawa ON.
27. **Linklater, N.** and Örmeci, B.* (2017). Wastewater disinfection with peracetic acid and UV irradiation. WEAO Conference, Ottawa, ON, Canada.
28. **Salam, A. M.**, Simms, P. H.* and Örmeci, B. (2017). Investigation of creep in polymer amended oil sands tailings. 70th Canadian Geotechnical Conference. Ottawa, Ontario, Canada.
29. **Martirosyan, N.** and Örmeci, B.* (2017). A New Spectrophotometry Based Method to Monitor and Optimize the Maturation and Activation of Polymers. WEAO Conference, Ottawa, ON, Canada.
30. Örmeci, B.*, **Almomani, F.**, and DiMassimo, R. (2016). Real-time measurement of residual polymer concentration and dewatering optimization: Lab and full-scale results. National Water and Wastewater Conference, Toronto, Canada.
31. **Linklater, N.** and Örmeci, B.* (2016). Bench-scale evaluation of the combined use of peracetic acid and ultraviolet irradiation (UV) for wastewater disinfection. National Water and Wastewater Conference, Toronto, Canada.
32. Örmeci, B.* and DiMassimo, R. (2016). Dewatering Optimization with In-Line and Real-Time Measurement of Polymer: Results from Full-Scale Treatment Plants. IWA World Water Congress, Brisbane, Australia.
33. **Diak, J.**, and Örmeci, B.* (2016). Ferrate(VI) and freeze-thaw treatment for oxidation of hormones and inactivation of fecal coliform in sludge. IWA Holistic Sludge Management Conference, Sweden.
34. **Linklater, N.** and Örmeci, B.* (2016). Combined use of peracetic acid and ultraviolet irradiation (UV) for wastewater disinfection. CAWQ Eastern Conference, Canada.
35. **Diak, J.** and Örmeci, B.* (2016). Individual and combined effects of freeze-thaw and ferrate(VI) oxidation for the stabilisation and dewatering of wastewater sludges. CAWQ Eastern Conference, Canada.
36. **Abdulsada, Z.**, Örmeci, B.*, DeRosa, M., Schwertfeger, D., Princz, J. and Scroggins, R. (2016). Fate of silver nanoparticles during sludge conditioning and after land application. CAWQ Eastern Conference, Canada.
37. **Linklater, N.** and Örmeci, B.* (2015). Use of PMA-qPCR to investigate the effectiveness of chlorine and chlorine-free alternatives for the disinfection of wastewater. CWWA/CAWQ National Water and Wastewater Conference, Canada.
38. **Murray, A.** and Örmeci, B.* (2015). Evaluation of Non-Imprinted Polymer Particles for Advanced Treatment of Water and Wastewater. CWWA/CAWQ National Water and Wastewater Conference, Canada.
39. **Al Momani, F.** and Örmeci, B.* (2015). Wastewater treatment with microalgae in hot climate regions. IWA Water and Development Congress, Jordan.
40. **Al Momani, F.** and Örmeci, B.* (2015). Advanced Wastewater Treatment Using Microalgae: Removal of Nutrients and Organic Carbon. CWWA/CAWQ National Water and Wastewater Conference, Canada.
41. Örmeci, B.* and **Al Momani, F.** (2015). Development of a spectrophotometry based method for detection of polymers and optimization of polymer dose during sludge dewatering. WEF/IWA Residuals and Biosolids Conference, USA.
42. DiMassimo, R. and Örmeci, B.* (2015). Use of In-line Real-Time polymer concentration measurement in full-scale dewatering operation. WEF/IWA Residuals and Biosolids, USA.
43. Örmeci, B.* (2015). Resource recovery from faecal sludge. International Faecal Sludge

- Management Conference, Vietnam.
44. **Murray A**, Örmeci B.* and Lai E.P.C. (2014). Evaluation of molecularly imprinted and non-imprinted particles for the removal of endocrine disrupting compounds from wastewater. IWA Agro-Waste Management Conference, Japan.
 45. Örmeci, B.* (2014). Future challenges and opportunities in sludge treatment and management. ECSM European Sludge Management Conference, Turkey.
 46. **Aghamir-Baha, S.** and Örmeci B.* (2014). Determination of optimum polymer dose using UV-vis spectrophotometry and its comparison to filtration-based tests. European Sludge Management Conference, Turkey.
 47. Örmeci, B.* (2014). Opportunities and Challenges in Beneficial Use of Wastewater and Sludge from Agricultural Waste. IWA Agro 2014, Japan.
 48. **Kollu, K.** and Örmeci, B.* (2014). Regrowth potential of bacteria after UV disinfection. Regrowth potential of bacteria after UV disinfection, CWWA 16th National Drinking Water Conference, Canada.
 49. Spinosa, L. and Örmeci, B. (2014). Sludge/Biosolids characterization: The key to proper management. International Workshop on Biosolids/Sludge Management, Canada.
 50. **Aghamir-Baha, S.** and Örmeci B.* (2014). Comparison of N-Bromination, Dye complexation and UV-vis absorbance methods for measuring polymer concentration. IWA World Water Congress, Lisbon, Portugal.
 51. **Al Momani, F.**, Delatolla, R.* and Örmeci, B. (2014). Field study of moving bed bioreactor (MBBR) technology for post-treatment of wastewater lagoon effluent at 1 C. CWWA/CAWQ Central Conference, Canada.
 52. **Mirbaha, S.** and Örmeci, B.* (2014). Comparison of three methods for measurement of residual polymer and optimization of sludge dewatering. CWWA/CAWQ Central Conference, Canada.
 53. **Al Momani, F.** and Örmeci, B.* (2014). Advanced wastewater treatment using microalgae: Removal of nutrients and organic carbon. CWWA/CAWQ Central Conference, Canada
 54. **Diak J.** and Örmeci B.* (2013) Effect of sequential freeze-thaw and ferrate (VI) treatment for inactivation of *Escherichia coli*. IWA Small Water and Wastewater Treatment Systems Conference, Harbin, China.
 55. Örmeci B*, **Al Momani F**, Gallant P, DiMassimo, R., Privott, J. (2013) An approach to dewatering optimization using UV-vis spectroscopy by monitoring polymer concentration in centrate. WEF Residuals and Biosolids Conference, Nashville, TN, USA.
 56. **Murray A**, Örmeci B.* , and Lai E.P.C. (2013) Removal of emerging contaminants using smart polymer particles. WEAO Conference, Toronto, ON.
 57. **Linklater N** and Örmeci B.* (2012) Evaluation of the adenosine tri-phosphate (ATP) assay for microbial monitoring of water. IWA World Water Congress, Busan, Korea.
 58. **Soleimani S.**, Örmeci B.* , and Isgor B. Evaluation of E. coli biofilm as a protective barrier against microbially influenced deterioration of concrete (MICD) under mesophilic temperatures. IWA World Water Congress, Busan, Korea.
 59. **Gibbons M.** and Örmeci B.* (2012) Determination of residual polymer concentration and optimum polymer dose using UV-visible spectroscopy. WEF Residuals and Biosolids Conference, North Carolina, USA.
 60. **Linklater N.** and Örmeci B.* (2012) Evaluation of the adenosine tri-phosphate (ATP) bioluminescence assay for monitoring of wastewater disinfection with chlorine and UV irradiation. WEAO conference, Ottawa, ON.
 61. **Kollu K** and Örmeci B.* (2012) Ultraviolet disinfection performance in presence of particles and flocs. WEAO conference, Ottawa, ON.
 62. **Gibbons M** and Örmeci B.* (2012) Determination of residual polymer concentration and

- optimum polymer dose using UV-visible spectroscopy. WEAO conference, Ottawa, ON.
63. **Murray, A.**, Örmeci, B.*, Lai, E.P.C. (2011) Removal of 17 β -estradiol (E2) and its Disinfection By-products from Water and Wastewater Using Non-Imprinted Polymer (NIP) Particles. IWA Agro-2011 Conference, Cesme, Turkey.
 64. **Murray, A.** and Örmeci, B.* (2010) Evaluation of non-imprinted polymer nanoparticles for removal of endocrine disrupting compounds from surface water and wastewater. WEFTEC, New Orleans, Louisiana, USA.
 65. **Soleimani, S.**, Örmeci, B.*, Isgor, B., and Papavinasam, S. (2010) Evaluation of Biofilm Performance as a protective barrier against biocorrosion using an enzyme electrode. IWA World Water Congress, Montreal, Quebec, Canada.
 66. **Diak, J.**, Proux, C., and Örmeci, B.* (2010) Freeze-thaw treatment of RBC Sludge: A sustainable option for sludge dewatering in cold regions. WEF Residuals and Biosolids Conference, Savannah, Georgia, USA.
 67. **Soleimani, S.**, Örmeci, B., Isgor, B.*, and Papavinasam, S. (2010) Evaluation of biofilm as a protective barrier for the inhibition of microbially influenced deterioration in treatment structures and sewer pipelines. CSCE Conference, Winnipeg, Canada.
 68. **Gardner, J.** and Örmeci, B.* (2009) Regrowth of sludge bacteria after centrifuge dewatering. Canadian Biosolids Conference, Niagara Falls, Ontario.
 69. **Gozen, I.** and Örmeci, B.* (2009) Effect of daylight on regrowth of bacteria in anaerobically digested sludge after centrifuge dewatering. 2009 IWA Specialist Sludge Conference, China.
 70. **Drake, S.**, Örmeci, B.*, and **Diak, J.** (2009) Do enzymes work? Effect of enzymes on sludge dewaterability and anaerobic digestion. 2009 IWA Specialist Sludge Conference, China.
 71. **Murray, A.** and Örmeci, B.* (2009) Determination of the sludge strength that yields the best dewaterability: Cancelling out the polymer effects. 2009 IWA Specialist Sludge Conference, China.
 72. **Kollu, K.** and Örmeci, B.* (2009) Effect of bioflocculation on ultraviolet disinfection. 2009 WEF Disinfection Conference, Atlanta, GA.
 73. Örmeci, B.* (2008) Rheology as a tool for measurement of sludge shear. 2008 IWA World Water Congress, Vienna, Austria.
 74. **Murray, A.** and Örmeci, B.* (2008) Determination of the optimum polymer dose during single and dual polymer conditioning. 2008 WEAO Annual Conference, Collingwood, ON.
 75. **Gardner, J.** and Örmeci, B.* (2008) Fate and survival of fecal coliform through centrifuge dewatering and role of centrate in growth inhibition. 2008 WEAO Annual Conference, ON.
 76. **Diak, J.**, Örmeci, B.*, Kennedy, K. (2008) Effect of enzymes and grinding on septic tank performance and sludge accumulation rates. 2008 WEAO Annual Conference, ON.
 77. Örmeci, B.* and **Ahmad, A.** (2008) A new method for the measurement of sludge shear to optimize the conditioning and dewatering processes. 2008 WEF/AWWA Residuals and Biosolids Conference, Philadelphia, PA.
 78. **Gardner, J.** and Örmeci, B.* (2008) Fate and survival of fecal coliform in sludge through centrifuge dewatering. 2008 WEF/AWWA Residuals and Biosolids Conference, PA.
 79. **Gardner, J.** and Örmeci, B.* (2007) Impact of polymer type and dose on the fate and survival of fecal coliform during centrifuge dewatering. 2007 WEFTEC, San Diego, CA.
 80. **Murray, A.** and Örmeci, B.* (2007) Impact of Polymer-Sludge Interaction on Rheogram Peaks and Optimum Dose Determination. 2007 IWA International Biosolids Conference, NB.
 81. Örmeci, B.* and Linden, K. G. (2007) Development of a fluorescence in-situ hybridization protocol for studying microorganisms associated with wastewater and sludge flocs. IWA Facing Sludge Diversities: Challenges, Risks and Opportunities Conference, Antalya, Turkey.
 82. Örmeci, B.* and Earle, J. K. (2007) Optimization of sludge dewatering at the Plum Island

- Water Reclamation Facility using an innovative technology. WEF/AWWA Joint Residuals and Biosolids Conference, CO, USA.
83. Örmeci, B.* and Abu-Orf, M. (2006) A quick and simple protocol to identify the best performing polymer for sludge dewatering. WEF 2006 Residuals and Biosolids Conference, Greater Cincinnati, USA.
 84. Örmeci, B.* and Abu-Orf, M. (2004) Estimation of Optimum Polymer Dose Using the Area under a Torque-Time Rheogram (Totalized Torque). IWA World Water Congress, Morocco.
 85. Abu-Orf, M.* and Örmeci, B. (2004) A new protocol for measuring sludge network strength and its relation to filterability. 9th World Filtration Congress, New Orleans, USA.
 86. Örmeci, B.* and Abu-Orf, M. (2004) Development of a protocol to determine the optimum polymer dose using rheology. WEF/WEA Biosolids and Residuals Conference, UT, USA.
 87. Abu-Orf, M.* and Örmeci, B. (2003) Using rheology for measuring comparative residuals network strength and its relation to dewaterability. WEFTEC 2003, Los Angeles, CA.
 88. Örmeci, B. and Linden, K. G.* (2003) Inactivation and detection of particle-associated bacteria. Second International IUVA Congress, Vienna, Austria.
 89. Örmeci, B.* and Abu-Orf, M. (2003) A protocol to measure network strength and its relation to dewaterability. IWA Biosolids 2003 International Conference. Trondheim, Norway.
 90. Örmeci, B. and Linden, K. G.* (2002) Comparison of UV and chlorine inactivation of particle and non-particle-associated coliform. 3rd IWA World Water Congress. Melbourne, Australia.
 91. Örmeci, B. and Linden, K. G.* (2002) Comparative effectiveness of UV and chlorine for inactivation of particle associated coliform. WEF Disinfection 2002 Conference. St. Petersburg, Florida, USA.
 92. Örmeci, B. and Vesilind, P. A.* (2001) The effect of extracellular material on freeze-thaw conditioning of activated sludge. IWA Specialized Conference on Sludge Management: Regulation, Treatment, Utilization, and Disposal. Acapulco, Mexico.
 93. Örmeci, B. and Linden, K. G.* (2001) Impact of chlorine and monochloramine on ultraviolet light disinfection. First IUVA International UV Congress, Washington, D.C., USA.
 94. Vesilind, P. A.* and Örmeci, B. (1999) A modified capillary suction time apparatus for measuring filterability of super-flocculated sludges. IWA Specialized Conference on Disposal and Utilization of Sewage Sludge: Treatment Methods and Application Modalities, Athens, Greece.

Books

1. Abu-Orf, M. and Örmeci, B. (2004) “A Protocol for Measuring Sludge Network Strength and Its Relation to Dewaterability”. WERF Report: Biosolids and Residuals (01-CTS-32-ET), ISBN: 1843397137, Water Environment Research Federation, Alexandria, VA.

Book chapters

1. Kumar, S., Talan, A., Boyle, K., Örmeci, B., Drogui, P., Tyagi, R.D. (2020) “Water Recycling: Economic and Environmental Benefits” in *Circular Bioeconomy*, Publisher: Elsevier, accepted.
2. Forde, M., Izurieta, R., Örmeci, B., Arrelano, M. (2019) “Water and Health” in *Water Quality in the Americas – Risks and Opportunities*, Publisher: The Inter-American Network of Academies of Sciences (IANAS) and UNESCO, pages 27-36, ISBN: 9786078379330.
3. Forde, M., Izurieta, R., Örmeci, B., Arrelano, M. (2019) Agua y Salud, *Calidad del Agua en las Américas Riesgos y Oportunidades*. IANAS and UNESCO, 29-38, ISBN: 9786078379330
4. Henry, F., Maldonado, M. C., Badrie, N., Moraes, M., Garcia, M. E., Villamar, C., Örmeci, B. and Alvarez, D. (2019) “Women and the quality of water” in *Water Quality in the Americas –*

- Risks and Opportunities*, Publisher: IANAS and UNESCO, pages 432-453, ISBN: 978-607-8379-33-0.
5. Henry, F., Maldonado, M. C., Badrie, N., Moraes, M., Garcia, M. E., Villamar, C., Örmeci, B and Alvarez, D. (2019) Artículo Especial Género, la mujer y la calidad del agua. *Calidad del Agua en las Américas Riesgos y Oportunidades*. IANAS and UNESCO, 443-465, ISBN: 978-607-8379-33-0
 6. Örmeci B. (2016) “Sludge Management” in *Global Trends & Challenges in Water Science, Research and Management*. Second edition. Ed. Hong Li, International Water Association, ISBN 9781780408378.
 7. Örmeci B. (2015) An Overview of Water Supply, Use and Treatment in Canada. Edt. Roldan, G., Torregrosa, M. L., Vammen, K., Gonzalez, E. J., Campuzano, C., Hidalgo, H., de la Cruz Molina, A. in *Water Challenges in the Americas*. Publisher: IANAS and UNESCO.
 8. Örmeci B. (2015). Un analisis de los recursos hidricos, su uso y tratamiento en Canada. Edt. Roldan, G., Torregrosa, M. L., Vammen, K., Gonzalez, E. J., Campuzano, C., Hidalgo, H., de la Cruz Molina, A. in *Desafios Del Agua Urbana en Las Americas*. Publisher: IANAS and UNESCO.
 9. Linklater N. and Örmeci B.* (2013) Real-time and near real-time monitoring options for water quality. Book chapter in “Monitoring Water Quality: Pollution Assessment, Analysis and Remediation”. Elsevier Major Reference Series. ISBN: 978-0-444-59395-5

Experience Summary

John L. Willis has over 30 years of professional experience passionately attacking inefficiency and waste and developing innovative solutions for municipal utilities. He has served as principal investigator for WERF's Barriers to Energy Efficiency, Barriers to Biogas Use, WaterWatts, Conveyance Asset Prediction System, and Undocumented Sources of Methane from Wastewater Treatment and Conveyance research; and EPA's Evaluation of CHP Technologies for Wastewater Treatment Facilities. His ground-breaking biosolids work includes the USA's first Class-A thermophilic anaerobic digestion facilities at OWASA's Mason Farm WWTP; the CBFT³ Class-A digestion and renewable power demonstration project for Columbus Water Works; St. Petersburg's Class-A digestion and biogas-to-vehicle-fuel upgrades; thermal hydrolysis/digestion/gas-use projects for DC Water, HRSD, Raleigh, SFPUC, and WSSC; and life-cycle GHG lead for WRF's HYPOWERS hydrothermal liquefaction demonstration. He is currently Chair of WEF's Residuals and Biosolids Committee and a member of the Water Research Foundation's (WRF) Research Advisory Committee. He completed his Ph.D. on wastewater-treatment and -conveyance greenhouse gas emissions at The University of Queensland's Advanced Water Management Center in 2017.

Education

Ph.D., Chemical Engineering, The University of Queensland, 2017

M.S., Environmental Engineering, Duke University, 1990

B.S.E., Electrical Engineering, Duke University, 1988

Registration

Professional Engineer 21097, Georgia, 1994

Professional Engineer 20322, North Carolina, 1994

Professional Engineer 20750, Kentucky, 1999

Professional Engineer 34347, Virginia, 2000

Professional Engineer 26201, Maryland, 2001

Professional Engineer PE900388, District of Columbia, 2001

Professional Engineer 64297, Florida, 2006

Professional Engineer 094208, New York, 2014

American Academy of Environmental Engineers: BCEE, 2004

Experience

30 years

Joined Firm

1990

Relevant Expertise

- Wastewater Treatment Design
- Energy Conservation and Renewable Energy Production
- Biosolids Management

Biosolids/Energy

Biogas Harvester Research – WRF – Demonstration

Principal Investigator. BC is leading a demonstration of a new process called "Biogas Harvester" (patent pending) to extract dissolved gases from domestic sewage and other WWTP flow streams at pressures of less than 0.5-atm of vacuum. The research conducted at Miami-Dade WASHD's Central District WWTP collects CH₄, H₂S, CO₂, and other gases from Miami Beach sewage. The process is intended to reduce headwork's odor, corrosion, and safety issues; recover renewable energy; reduce fugitive GHG/CH₄ emissions; and enable full-scale anaerobic sewage treatment by recovering most of saturated CH₄ discharged by such processes.

Owner's Agent – Metropolitan Sewer District of Greater Cincinnati (MSD) – Little Miami Class-A Digestion Owner's Agent

Technical Lead. BC developed a business case evaluation (BCE) for Class-A digestion options, biogas uses, hauled waste feedstocks, and struvite-mitigation/recovery for the Little Miami WWTP. This centralized system will also handle sludges from Polk Run and Sycamore Creek facilities, producing Class-A biosolids and biogas to offset purchased power and potentially be used as RNG for vehicle fuel. The project also developed solicitation for progressive design build of the upgrades and support the Owner during its construction.

NREL Waste to Energy System Simulation (WESyS) Tool Development – National Renewable Energy Lab (NREL)

Technical Reviewer. Reviewed the WESyS tool while under development; this tool uses a variety of inputs to assess the adoption curves for new waste to energy processes by sector inclusive of wastewater, agriculture, and solid waste. The review process used hydrothermal liquefaction as a sample technology for consideration.

HYPOWERS– Water Environment Research Foundation (WRF) – Genifuel Hydrothermal Liquefaction Demonstration

Technical Lead. BC participated in a WRF-led project as part of a consortium on a Department of Energy (DOE) / California Energy Commission (CEC) funded demonstration of Genifuel's hydrothermal liquefaction and catalytic



hydrothermal gasification processes at Central Contra Costa (CA). The process converts dewatered sludge into biological/renewable crude oil and renewable natural gas (rNG). BC was responsible for documenting the life-cycle greenhouse gas (GHG) emissions for the products (rNG and renewable diesel and naphtha or “jet fuel”). New templates were created in CA-GREET 3.0 for each fuel’s low-carbon-fuel-standard (LCFS in CA) “score” and renewable indication number (RIN) quality (likely D3). BC then negotiated these pathways with California Air Resource Board (CARB) and USEPA, respectively.

Solids Handling Master Plan – Metropolitan Sewer District of Greater Cincinnati (MSD) – Solids Master Plan

Technical Lead. BC developed comprehensive scenarios for handling all of MSD solids produced at 7 facilities ranging in size from ~1 to ~100mgd average treated flows. Operating, capital, and present-worth costs for over 40 options were developed including a “universe” of technologies (that included fluid-bed incineration (FBI), 4 thickening and 3 dewatering options, 5 digestion processes, combined heat and power (CHP), biogas to rCNG vehicle fuel, and consolidated solids-treatment) with emphasis on lowering costs and reducing odors. The recommend solution includes features to optimize the Mill Creek FBIs and regional, Class-A, advanced digestion with gas-upgrading to vehicle fuel at Little Miami for the solids generated at two or three other WRRFs.

Biosolids Management – Hillsborough County, FL – Business Case Evaluation (BCE)

Technical Lead. BC developed 5 comprehensive scenarios for replacement/ upgrading the moth-balled dryer and aging thickening, dewatering, and storage equipment and tankage at the County’s Northwest Biosolids Handling Facility (BMF). Options included combinations of: A) Thermal hydrolysis + digestion; B) Class-A (with EPA time-and-temperature batch tanks) temperature-phased digestion (“TPAD”; thermophilic followed by mesophilic digestion); C) Biogas- and/or natural-gas-fueled combined heat and power (CHP) using an already under construction, 7MW combustion turbine; and D) Biogas upgrading to rNG for vehicle fuel use. The evaluation showed that Class-A TPAD and production of rNG vehicle fuel would pay for the nominally \$25-million in additional capital and return an additional \$10-million over a 20-year present worth.

Lulu Island Pilot Digestion Optimization Study – Metro Vancouver, Richmond, British Columbia

Technical Reviewer and Resource. BC developed predesign and detailed design for a pilot-scale digestion facility at the Lulu Island WWTP. The pilot facility will accommodate testing of emerging technologies that have high potential, but limited information as to their actual full-scale performance. By using a pilot-scale facility, the Metro Vancouver will be able to: Evaluate process operations on specific sludges; Run a new-process “incubator” for staff training, testing operational controls and regimes; and develop design metrics for full-scale implementation. The detailed design is being finalized in 2019 with process tie-in plans and operational guidelines for construction soon after.

Bioenergy Facilities – Washington Suburban Sanitary Commission (WSSC) – Gas-Use Evaluation and Progressive Design Build Program Management/Review

Technical Lead. Evaluated options for meeting steam demand for thermal-hydrolysis at WSSC’s Regional Bioenergy Facilities at the Piscataway WRRF as part of a Program Management Contract (with BC as a subconsultant to HDR). The resulting technology included natural-gas-fueled engines for power, steam and hot water production; composite boilers; water-solvent gas upgrading; with rNG pipeline injection for conveyance to bus fleet fuel. Personally assisted in/guided negotiations with the USEPA; Washington Gas (developing their first-ever rNG-injection “special contract” at attractive, site-specific rates); Montgomery-County Transit for sale/use of rNG to fuel their bus fleet; and other necessary 3rd-party contracts.

Hunts Point Digester Replacement, New York City Department of Environmental Protection (DEP) – Alternatives Evaluation

Technical Lead for Alternatives Evaluation. As the first step in DEP’s design process, facility planning is intended to “identify all feasible alternatives and conduct a comprehensive evaluation and ranking of each alternative”. BC’s alternatives evaluation for the Hunts Point digestion upgrade design included three workshops and multiple intermediary meetings. An initial set of 26 options was developed; each with a SWEET mass and energy balance linked to a calibrated-to-DEP-cost, present-worth economic model. Review of the first iteration led to consolidation, leveraged hybridization, and development of another 23 options. The results justified addition of enhanced thickening in the scope; state-of-good-repair projects for both processes



could be done for considerably less capital cost than digestion improvements alone. The effort also informed DEP of the costs and benefits of various food waste receiving and gas-use options. Because of the City's GHG reduction goals, an annual GHG emissions estimate was developed for each of the 49 options.

Solids-Water-Energy Evaluation Tool (SWEET) Development and Re-Invention of Solids Master-Planning, Brown and Caldwell

Technical Lead. John led the development of BC's re-invigorated approach to biosolids and energy master-planning. Conventional (predominantly solids) master plans have resulted in soft recommendations for very large capital expenditures without clear identification of the resulting benefits; these plans often "sit on the shelf" as they fail to motivate implementation. John developed an approach, and the SWET tool to enable cost-effective development of many options, that allows options to be optimized and results in recommended solutions that can save 15-25% off a program's 20-year present worth. Key approach fundamentals include: 1) calibration of a baseline mass and energy balance that is also calibrated to the utility's actual annual costs; 2) iterative development, evaluation, and optimization of options (often 30 to 50 options) in at least three workshops; 3) possible inclusion of triple-bottom-line (TBL) metrics; and 3) "live" testing of recommended solutions and their sensitivities to assumed unit-cost and TBL valuations. The results create broad consensus on the developed option; save considerable costs; and provide recommendations with readily quantified and understood benefits – often accelerating these normally "discretionary"/non-core-business projects.

Neuse River Resource Recovery Facility (NRRRF) Bioenergy Recovery Program – Preliminary Design, City of Raleigh Public Utilities Department (CORPUD), Raleigh, NC

Project Technical Lead. BC has one of two design contracts for the CORPUD's Bioenergy Recovery Program, and is responsible for primary sludge dewatering; GBT upgrades; sludge blending; centrifuge pre-dewatering; pre-dewatered cake storage and loadout; thermal hydrolysis; and anaerobic digestion; and odor control associated with these facilities. BC is working closely with Hazen who holds the other design contract and is responsible for post-dewatering and sidestream treatment; Black & Veatch is responsible for biogas use as a sub to Hazen.

Digester Operational Review for Tallman Island and Hunts Point WPCPs, New York City Department of Environmental Protection (DEP), New York, NY

Technical Lead. An initial investigation was performed at the Tallman Island Water Pollution Control Plant (WPCP) to assess causes and potential mitigating options for catastrophic digester cover failures of recently-commissioned digester improvements. Failures were attributed to accumulation of low-specific-gravity material on the digester surface and/or sudden-volume-expansion. DEP was pleased with the results and recommendations of the Tallman Island investigation and requested a similar investigation at the Hunts Point WPCP. Both efforts were completed on time, within budget, and to the satisfaction of DEP staff.

Energy Recovery from Biosolids and Class-A TPAD Detailed Design, City of St. Petersburg, FL

Project Manager. BC developed the conceptual and then detailed design for consolidated treatment of the City's three WWTP's sludge production at the Southwest Water Reclamation Facility. The project included new primary treatment; contact stabilization for increased liquid treatment capacity; replacement TPAD digestion with Class-A batch tanks; odor control; FOG receiving; and digester gas upgrading to remove carbon dioxide and all traditional contaminants and produce renewable-compressed-natural gas (rCNG) vehicle fuel for use in the City's sanitation truck fleet. The project was constructed using Construction Manager at Risk delivery method. Three other consultants designed the 1) thickening upgrades; 2) a new dewatering building; 3) natural-gas-fueled engines and a new plant 12kV distribution system.

Class-A Digestion Detailed Design, City of Savannah, GA

Technical Advisor/Reviewer. BC is currently developing a detailed design to upgrade thickening and implement a Class-A temperature-phased digestion design to replace the aging multiple hearth incinerators.



San Francisco Biosolids Digester Facilities Project, San Francisco Public Utilities Commission, San Francisco, CA

Expert Reviewer. Provided technical review of the following draft Technical Memoranda: 1) Biogas Incentive Potential and 2) Initial Screening of Biogas End Use and Energy Recovery Alternatives for the solids upgrade program at the Southeast Water Pollution Control Plant.

Atlantic WWTP Cambi Upgrades - Detailed Design, Hampton Roads Sanitation District (HRSD), Hampton Roads, VA

Technical Lead for FOG and Technical Reviewer. As a sub-consultant to HDR, BC is responsible for preliminary and detailed design of the thermal hydrolysis (Cambi) process, anaerobic digestion, heating and cooling, and FOG-receiving aspects of upgrades at HRSD's largest WWTP: the 54-mgd Atlantic WWTP.

Barriers to Energy Conservation, WERF, Alexandria, VA

Principal Investigator. As a follow-on project with linkage to Barriers to Biogas Use, this project sought to determine the factors that impede adaptation of energy efficiency improvements for wastewater utilities. Tasks include an electronic survey of utility staff, four focus groups to solicit/collect first-hand input, a thorough review of all plants' electrical profile in the State of NY, a comparison of efficiency incentives and program in three states with varying degrees of regulatory and incentivizing practices to encouraging enhancements, among other tasks.

Energy Program, Metropolitan Government of Nashville and Davidson County, Tennessee

Expert Guidance. Provided senior guidance for a project that assessed opportunities for Nashville Metro to save energy and leverage renewable resources produced by three major WWTPs and landfill assets. Options considered and recommended included CHP, vehicle fuel production, Class-A temperature-phased digestion, diagnoses of water plant residuals impact on Central WWTP solids processing effectiveness, and leveraging imported digester feedstocks, among other options.

Acoustic Doppler Digester Diagnostics and Mainline Anaerobic Treatment, WERF, Alexandria, VA

Co-Principal Investigator. BC was selected by WERF to investigate two innovative approaches. The first uses an acoustic Doppler meter to measure 3-dimensional velocity gradients within an active digester. To our knowledge this would be first source of primary data as to the actual effectiveness of various mixing systems. Additionally, it is envisioned that this approach could be used to detect areas of zero velocity and suggest when digester cleaning is needed without removing a digester from service. As a second task, BC is working with the University of Queensland to investigate the effectiveness of UASBs for mainstream anaerobic treatment of domestic wastewater.

Biosolids Planning Effort, Metropolitan Council Environmental Services, MCES, Minneapolis and St. Paul, MN

Visioning Panel Expert. Served as a member of a three-expert team in a quality assurance/quality control role for solids, energy, and resource recovery planning at MCES' seven WWTPs (currently treating 240 mgd). Effort included development of a sustainable vision for the Council's future facility needs. Specific technologies included various form of incineration, advanced digestion, and drying.

Hartford WPCF Solids Design Projects, Metropolitan District (MDC) Hartford, CT.

Technical Advisor. The 80-mgd Hartford WPCF currently treats its own primary and secondary solids and approximately 50 percent additional solids imported from other plants using DAFT and gravity thickening, centrifuge dewatering and multiple hearth incineration. The MHIs have recently been retrofit to produce 1.5MW of renewable power using a waste-heat boiler and steam turbine. BC's ongoing projects will add solids processing capacity and further optimize the overall performance. As an initial task, BC used the Solids-Water-Energy Tool (SWET) to identify opportunities for system-wide performance optimization.

Energy Recovery from Biosolids and Yard Waste Feasibility Study, City of St. Petersburg, FL

Technical Lead. Used a business case evaluation format to evaluate the feasibility to derive renewable energy from sludge generated at the City's four WWTPs and collected yard waste. Brown and Caldwell's Solids-Water-Energy Tool (SWET) to develop solids/energy balances and present worth analyses for over 30 options.



Technologies considered included Class-A and phased anaerobic digestion, gasification, fluid bed incineration, screw-press dewatering, generation of electricity using either reciprocating engines or steam turbines, solar drying, and sewer conveyance of WAS to consolidate treatment at one of four, nominally 20-mgd WRFs. The recommended solution included Phase-1 project to convey WAS from the northern WRFs to the SWWRF for consolidated treatment. The digestion process at the SWWRF would be upgraded to a Class-A TPAD process and the digester gas used to fuel an engine and produce 1 to 1.4MW of power. Phase-2 would be deferred until such time as the recommended technology was better proven: gasification of yard waste solids (and possibly biosolids) to fuel syngas-fueled internal combustion engine(s) for added power production. The Phase-1 improvements are projected to save the City \$30 million over the next 20 years.

Biogas Use Alternative Evaluation, Orange Water and Sewer Authority (OWASA), Chapel Hill, NC

Project Manager. Performed a business case evaluation to determine the best use of OWASA's currently flared digester gas. The effort was supported by use of BC's Solids-Water-Energy Tool (SWET) to develop present worth analyses and solids/energy balances for 21 options with various combinations of reciprocating engines, microturbines, cell lysing technologies, FOG and food waste receiving, and conversion of biogas to a renewable compressed natural gas for vehicle fuel. The recommended project would save \$480,000 of the utility's \$580,000 annual operating cost for solids and recycle processing.

Barrier to Biogas Research, WERF, Alexandria, VA

Principal Investigator. This effort used an online survey and four separate focus groups in Miami, New York City, Sacramento, and Chicago to investigate the barriers that inhibit wastewater utilities from using digester gas that is currently wasted/flared and success stories where other utilities have overcome similar barriers. A key finding of this research was the importance of properly valuing the long-term benefits of biogas utilization projects in order to support credible "go" decisions.

Biosolids and Odor Control Master Plan, City of Savannah, GA

Expert Technical Resource. The City of Savannah's 26-mgd President Street WWTP currently uses 40-year-old multiple hearth incinerators (MHIs) for solids disposal. This master plan evaluated long-term options in light of the EPA's revised MACT emissions standards that would likely curtail the useful life of the existing MHIs. Options considered included continuation with multiple hearth incineration, fluid bed incineration, conventional and Class-A anaerobic digestion, and heat drying as well as various thickening, dewatering, and green power technologies and beneficial reuse/disposal options. The master plan also considered plant-wide odor

Biosolids Program Management, District of Columbia Water and Sewer Authority, Washington, D.C.

Senior Technical Resource. Participated in the development of the Biosolids Program to implement Cambi/Anaerobic digestion/CHP improvements to replace the aging lime-stabilization system at the 370-mgd Blue Plains AWTP. Principal focus included procuring a design-build-operate combustion turbine installation with gas treatment and steam production for Cambi. The system included five ultra-high-efficiency Solar Mercury 50 combustion turbines, a steam turbine for supplemental power generation, HRSGs for steam production, duct burners for production of additional heat when needed, back-up boilers in case of turbine failure, and flexibility to operate on either digester or natural gas fuel. Also led the development of DCWASA's utility-wide greenhouse gas inventory and subsequent audit and certification of that inventory with the Climate Registry. Determined that the upgrades would reduce DCWASA's "carbon footprint" by 73,000 MT of CO₂e/yr or 38 percent.

Technology Evaluation for Digester-Gas-Fueled Combined Heat and Power (CHP), United States Environmental Protection Agency (US EPA), Washington, D.C.

Principal Investigator. Secured a sole-source grant from US EPA to author a Technology Evaluation for Digester-Gas-Fueled CHP. This manual provides guidance to utility management and engineers considering options for beneficial use of anaerobic digester gas. Combustion turbines, reciprocating engines, microturbines, fuel cells, cleaning to pipeline-quality natural gas quality, and other technologies are discussed in detail. The document provides guidance in the context of emissions requirements, capital and operating costs, electrical and thermal efficiencies, gas cleaning requirements, and operational track record.



Wastewater Treatment Plant Design and Operation Modifications to Improve Management of Biosolids Odors and Sudden Increases in Indicator Organisms, Water Environment Research Foundation (WERF), Alexandria, Virginia

Technical Advisor. This project, led by Bucknell and Virginia Tech researchers, investigated mechanisms for sudden increases in indicator organism densities and odors in anaerobically digested biosolids. Mr. Willis's support for this project centered on review and understanding of bacterial sudden increase phenomenon and identification of possible mitigating techniques

Developing Better Indicators for Pathogen Presence in Sewage Sludges, Water Environment Research Foundation (WERF), Alexandria, Virginia

Technical Advisor. Part of a team led by Texas A&M and US EPA researchers to identify pathogen and potential surrogate indicator densities in raw and digested sludges from various parts of the country. Project identified and determined inactivation levels for potential surrogates using thermophilic anaerobic digestion that represent complete inactivation of pathogenic strains found in raw sludge feedstocks.

Biosolids Master Plan and Technology Evaluation, Reedy Creek Improvement District, Orlando, Florida

Technical Resource. The Reedy Creek Improvement District provides water and sewer services for the Walt Disney Corporation in Orlando, Florida. Reviewed and planned the best option for disposal of the WWTP sludges, residual food wastes from eating establishments, collection system FOG, and manures from the Animal Kingdom and other parks. Historically, these materials had been composted and beneficially reused for sod farming. Due to odor concerns from park visitors, alternatives were to be considered to improve the sustainability of Reedy Creek's solids disposal. Technologies considered included: advanced anaerobic digestion with CHP, gasification, landfilling, fluid bed incineration, and continued or modified composting. Drivers for the study included a desire to reduce odors from the existing composting facilities, renewable energy generation, and the need for a long-term, sustainable solution.

Biosolids Master Plan, City of Lynchburg, Virginia

Senior Technical Resource. Participated in the development of the Biosolids Management Study for the 26-mgd Lynchburg Regional Wastewater Treatment Plant. Options considered included composting, lime stabilization, fluid bed incineration, conventional and Class-A anaerobic digestion, and heat drying. The recommended solution recommended a combination of landfill and land application using their existing lime stabilization equipment with transition to anaerobic digestion and with combined heat and power. Product diversity was emphasized including the possible use of lime (even with a digested product) for alkalinity addition on farms that require positive pH adjustment.

Digestion Evaluation, Northeast WPCP, Philadelphia Water Department, Philadelphia, Pennsylvania

Technical Lead. An innovative research project was conducted to determine the benefits that could be derived from adding mixing to the Philadelphia Water Department's 40 million gallons of unmixed, pancake-shaped anaerobic digestion volume at the Northeast and Southeast WPCPs. A pilot-scale digestion system was assembled and run by research partners at Villanova University to test a factorial experimental design determining the relative impacts of interrelated variables of feedstock concentration, residence time, and mixing intensity. Serum bottle tests were also performed to determine nutrient deficiencies and the digestibility of supplemental feedstock such as aircraft deicing fluid and sludge from the Sunoco refinery. A feasibility study evaluated modifications required for accommodating hauled grease trap waste and primary scum from the three WPCPs so that it could be digested and contribute to the gas produced.

Biosolids Master Plan, Portsmouth, New Hampshire

Expert Project Advisor. This Master Plan considered options for beneficial reuse of biosolids in support of objectives to discontinue landfilling practices. Among many options considered, a public-private partnership was explored to use waste heat from a power plant for sludge drying and use of the dried pellets as a renewable fuel source.



Fournier Press Design, Snapfinger WWTP, DeKalb County, Georgia

Technical Advisor. Designed installation details for four Fournier presses to dewater raw primary and secondary sludges at the 36-mgd Snapfinger WWTP. The installation replaces maintenance-intensive, plate-and-frame presses and associated drag conveyors with energy efficient equipment. The new presses were pilot tested prior to their selection.

Biosolids Master Plan, City of North Port, Florida

Senior Technical Advisor. Master Plan evaluated over 30 options for consolidated treatment of sludge produced from the City's three wastewater treatment plants. Options considered included solar and thermal drying and various thickening and dewatering technologies. Trucked and pumped conveyance were also considered.

Class A Digestion Assessment, F. Wayne Hill Environmental Center, Gwinnett County, Georgia

Project Manager. Evaluated options to convert the 60-mgd Environmental Center's five 1.5-million-gallon, egg-shaped digesters from mesophilic to Class A thermophilic anaerobic digestion.

Biosolids Blue Ribbon Panel, Jacksonville Electrical Authority, Jacksonville, Florida

Sludge Treatment/Biosolids Expert. Participated in three-person Blue Ribbon Panel to identify the best approach to handling the sludge produced by JEA's 80 mgd of raw sewage that is treated at 12 plants. Panel has addressed optimized anaerobic digestion, grease trap waste handling, heat drying, dewatering, transportation, land application, green power generation, production of biodiesel, and use of sludge in coal-fired power plants, among other options.

Biosolids Flow-Through Thermophilic Treatment Class A Demonstration Project, Columbus Water Works, Columbus, Georgia

Principal Investigator. Led the development of a WERF-peer reviewed, new Class A process to produce pathogen-free biosolids. Development included pilot-scale testing with helminth, poliovirus, salmonella and fecal coliform and full-scale testing of a plug-flow digestion system. System was designed to reduce required batch time to 30 minutes at 53°C (much less than EPA's less than the 24 hours at 55°C) downstream of a thermophilic digester. The project also included the first digester-gas-fueled "ARES"-generation CHP engines (that produced over 15% more power than prior engines at microturbine-like emissions). Helped secured and administer \$5.3 million in congressional grants. This project won the IWA's 2008 Superior Achievement Award (as the top project in the world for the previous two years) and Grand Prize for Research; ACEC-Georgia's 2005 Grand Conceptor Award (top honor); and the American Academy of Environmental Engineers' (AAEE's) 2007 Grand Prize for Research.

Blue Plains Advanced Wastewater Treatment Plant Egg-Shaped Digesters Facility Preliminary Design, District of Columbia Water and Sewer Authority, Washington, D.C.

Task Manager. Project consisted of preliminary design for addition of the world's largest egg-shaped digesters. Eight 4.5-million-gallon eggs are planned with options for thermophilic, temperature-phased, acid-phased, and Class A operation. Use of digester gas in regenerative turbines and/or for sludge drying was considered.

Short-Term Critical Needs Study, Town of Hanover, New Hampshire

Technical Lead. A study was performed to identify short-term critical needs at an aging anaerobic digestion facility. Other recommendations included options for process optimization and other elements to be included in a longer-term improvement project.

Biosolids Program Review, Metropolitan Government of Nashville and Davidson County, Tennessee

Technical Reviewer. Provided senior review and guidance for preliminary design for the City's biosolids program. Projects that were reviewed included design build of improvements at the 125-mgd Central WWTP and the design-bid-build of digestion upgrades at the 24-mgd Dry Creek WWTP. The project at the Central WWTP included DAFT co-thickening, anaerobic digestion, centrifuge dewatering, heat drying, odor control and centralized hauled waste receiving and treatment. The Dry Creek project included consideration of GBT co-thickening, anaerobic digestion, and multiple dewatering technologies.



South Columbus Water Resource Facility Odor Control and Digester Gas Handling Expansion, Columbus Water Works, Columbus, Georgia

Project Manager. Developed plans and specifications and administered construction of primary sedimentation tank cover retrofits to allow odor control of tank emissions. Also expanded the digester gas piping to accommodate peak gas production. Converted gravity belt thickeners to co-thicken primary and waste active sludge, effectively increasing the available digester capacity by over 80 percent.

Conversion to Class A Thermophilic Anaerobic Digestion Study, Columbus Water Works, Columbus, Georgia

Project Manager. Performed a study exploring cost-effective options for conversion to Class A thermophilic anaerobic digestion processes. An evaluation of the impact on land application programs was included in this effort.

Floating Digester Covers Study, Columbus Water Works, Columbus, Georgia

Project Manager. Performed study to assess the causes of significant tilting in floating digester covers. Study recommendations included liquid stream and solids treatment process modifications and other improvements that eliminated the tilting problem.

RFP Specifications Development, City of Toronto, Canada

Biosolids Conveyance and Storage Specialty Consultant. Provided specialized expertise to the lead consultant and the City in drafting a request for proposals soliciting design/build bids for the construction of \$50 million in dewatered sludge storage and conveyance facilities at the Ash Bridges Bay WWTP. The facilities were to provide 4 days' worth on storage at 500 metric tons per day of dry solids production. Developed RFP specifications, plans and design criteria for publication to bidders. Coordination was critical between this project, a digester gas boiler/plant hot-water-loop design/build project and a design/build/operate proposal request for biosolids drying.

Sludge Storage and Dewatering System Design, Cobb County Water System, Cobb County, Georgia

Project Manager. Designed a 35 dry-ton/day sludge storage and dewatering system for the expanded 40-mgd South Cobb WRF. This effort was negotiated as a sole source change order with the contractor performing the balance of the construction project. Equipment was prepurchased in order to fast-track the project completion. Design included retrofits providing 1.5 million gallons of thickened sludge storage and a biofilter for odor control.

Remote Sludge Storage Expansion, Orange Water and Sewer Authority, Chapel Hill, North Carolina

Project Manager. Designed a 1.5-million-gallon expansion to the remote sludge storage facility, including sludge pumping and mixing systems, and pre-negotiated sole-source equipment costs.

Remote Sludge Storage, Orange Water and Sewer Authority, Chapel Hill, North Carolina

Project Manager. Designed a 1-million-gallon remote sludge storage facility, including sludge pumping and mixing systems and a sludge force main. Pre-negotiated sole-source equipment costs.

Sludge Treatment and Biosolids Master Plan, City of Phoenix, Arizona and SROG

Project Engineer. Performed study evaluating options for sludge disposal and/or reuse, including co-incineration with municipal solid waste, agricultural land application, nonagricultural land application, dedicated land disposal, and sludge dewatering and transportation.

Inter-plant Sludge Capacity Evaluation, City of Phoenix, Arizona and SROG

Project Engineer. Evaluated the impacts of sludge handling at the 23rd Avenue Wastewater Treatment Plant on operations at the 91st Avenue Wastewater Treatment Plant.

Municipal Wastewater

Energy Program, Metropolitan Government of Nashville and Davidson County, Tennessee

Expert Guidance. Provided senior guidance for a project that assessed opportunities for Nashville Metro to save energy and leverage renewable resources produced by three major WWTPs and landfill assets. Options



considered and recommended included CHP, vehicle fuel production, Class-A temperature-phased digestion, diagnoses of water plant residuals impact on Central WWTP solids processing effectiveness, and leveraging imported digester feedstocks, among other options.

Capacity Assessment of the Southwest WRF, City of St. Petersburg, Florida

Technical Guidance. Effort included development of calibrated BioWin™ and hydraulic plant models and an assessment of the SWWRF's ability to process flows from both its own service area and the service area of the adjacent Albert Whitted WRF that was to be decommissioned. In addition, CFD modeling was used to assess capacity of new primary clarifiers to both capture sewer-conveyed waste activated solids from the NEWRF and NWWRF and reduce the raw sewage load. Recommendations included contact stabilization for peak wet weather capacity, and CFD-modeling for design configuration for improved primary solids capture.

Chesapeake-Elizabeth WWTP Conversion to Equalization Assessment, Hampton Roads Sanitation District (HRSD), Hampton Roads, Virginia

Technical Reviewer. Lead technical reviewer for options to convert the infrastructure at the Chesapeake-Elizabeth WWTP to a peak wet weather storage facility. Primary efforts were developed by a BC sub consultant under our direction, review and program integration.

Blue Plains Advanced Wastewater Treatment Plant Enhanced Nitrogen Removal Design, District of Columbia Water and Sewer Authority, Washington, D.C.

Preliminary Design Manager. Led efforts on the enhanced nitrogen removal upgrades to the 370-mgd AWTP to achieve effluent total nitrogen levels of 3.0 to 3.5 mg/L, including assistance in process design and detailed design of gallery and sedimentation improvements. Detailed design also included the world's largest methanol storage system at a wastewater treatment plant with over 210,000 gallons of total storage capacity (60,000 are dedicated to methanol; 90,000 are dedicated to alternative carbon sources; and 60,000 are available for use with either material). The system allows receipt and processing of a variety of alternative carbon substrates, providing economic flexibility and potential to use biogenic sources of carbon rather than fossil-fuel-derived methanol and reduce the associated carbon footprint of the AWTP's operation.

Professional Engineering Services, DeKalb County Department of Watershed Management, Georgia

Lead Mechanical Engineer. Providing as-needed services and assistance for the design, study and construction associated with water and sewer systems. Task orders have included: lift station analysis and design improvements for the Lower Crooked Creek No. 1, 2, and 3 lift stations, structural evaluation construction support for the Snapfinger Influent Lift Station, Snapfinger AWTP Influent Lift Station design and construction management, and design of a new dewatering system at the Snapfinger AWTP.

Johns Creek Environmental Campus, Fulton County, Georgia

Lead Solids Management Design. Designed a first-in-the-state-of-Georgia below ground, state-of-the-art, 15-mgd Membrane Bioreactor (MBR) water reclamation facility. Using a design-build approach, the design includes an influent pump station, bar screens, vortex-type grit removal systems, double entry-type fine screens, primary clarification basins, biological nutrient removal, membrane bioreactors, UV disinfection, and post-aeration, as well as aerobic digesters and centrifuge dewatering.

South Columbus Water Resource Facility Master Plan, Columbus Water Works, Columbus, Georgia

Project Manager. Effort included development of calibrated BioWin™ and hydraulic plant models and an assessment of the SCWRF's ability to process an additional 7 mgd of flow from Fort Benning and accommodate growth in the Muscogee County Basin through 2030. Recommendations addressed aeration, secondary clarification, solids handling and hydraulic capacity limitations.

Quigg Branch WWTP Capacity Review, Rockdale Water Resources, Georgia

Technical Lead. Reviewed plans for phased expansion of the Quigg Branch WWTP using BioWin modeling and discussion with the engineer or record. Determined that the capacity of the WWTP was simultaneously constrained by two separate factors: oxygen transfer capacity and aeration basin volume to accommodate mixed liquor to allow winter nitrification without overloading the clarifiers during peak flows.



Snappfinger Creek Advanced WWTP Capacity Assessment, DeKalb County, Georgia

Project Manager. Developed calibrated BioWin™ and hydraulic plant models in order to identify critical, capacity-limiting features that could be addressed, allowing optimization of the available plant tankage. Low-cost solutions were identified to increase the AWTs from a present dry weather flow capacity of 33 to 44 mgd for a cost of roughly \$20 million.

Cedar Creek WWTP, Athens-Clarke County, Georgia

Project Manager. Designing a new 4-mgd facility to replace the existing 2-mgd Cedar Creek WWTP. The project includes a new headworks, activated sludge with anaerobic selectors, low-pressure/high-intensity UV disinfection, aerobic digestion and dewatering centrifuges.

Lynchburg Regional Wastewater Treatment Plant, City of Lynchburg, Virginia

Technical Lead, Nutrient Treatment Basis of Design and Capacity Assessment. Analyzed the capacity of Lynchburg's existing 22-mgd treatment plant and evaluated options to reduce effluent nitrogen and phosphorus to the James River in accordance with the Chesapeake Bay Initiative. Four tiers of treatment effectiveness were evaluated (for N and P limits as low as 3.0 and 0.1 mg/L, respectively), along with options for further enhanced treatment for nutrient trading that would allow cost-effective nutrient trading.

Nancy Creek Capacity Management Facility, City of Atlanta, Georgia

Project Manager, Preliminary Design. Designed by Brown and Caldwell and constructed by Western Summit Constructors, Inc. (prime contractor) using a design-build delivery approach, the 100-mgd station provides relief to the existing Nancy Creek Trunk sewer and provides capacity for growth in the basin. The tunnel provides a large transport capacity and approximately 60 million gallons of wastewater storage. The pumping station will be used to dewater the tunnel at a rate to maximize the available capacity of the R.M. Clayton WRC. The pumping station is 150 feet deep with a flow range from 15 to 100 mgd, odor control facilities for the pumping station and tunnel, and an 85-foot-diameter shaft. In addition to design services, permit applications were prepared.

Blue Plains Advanced Wastewater Treatment Plant, District of Columbia Water and Sewer Authority, Washington, D.C.

Task Leader. Designed improvements to the nitrification reactors and sedimentation tanks at the 370-mgd plant. Improvements included enhancements to extremely poor hydraulic and solids distribution to available sedimentation tanks. Other elements included rehabilitation of sludge collectors, gates, and RAS pumps, and addition of instruments to allow improved process control.

Mason Farm Wastewater Treatment Plant Expansion II, Orange Water and Sewer Authority, Chapel Hill, North Carolina

Project Manager. Providing preliminary and detailed design of facilities to expand capacity from 12 to 14.5 mgd. Facilities include deep bed filtration, ultraviolet disinfection, and expansion of the patented OWASA biological phosphorus system. The expanded facilities are designed to meet an effluent total nitrogen limit of 4.5 mg/L and effluent phosphorus of 0.23 mg/L. Use of gravity belt thickeners will separate solids from the primary sludge fermentation stream to reduce solids loading on the secondary process. The process also upgraded the country's first Class A thermophilic anaerobic digestion system with five tank retrofits: conversion of two floating covers to fixed covers; replacement of third and fourth floating covers with one concrete cover and one gas-holding membrane-type cover; and replacement of the aging membrane-type, fermenter cover with a PVC-lined corrosion-resistant concrete cover for high acid concentrations in the fermenter offgasses.

Wastewater Master Plan, Orange Water and Sewer Authority, Chapel Hill, North Carolina

Project Manager. Project included developing a dynamic sewer model of the client's collection and transmission mains, an assessment of plant expansion options, and an estimate of capital expenditures for the next 10 years within the context of the utility's needs in 50 years.



Mason Farm Wastewater Treatment Plant Expansion I, Orange Water and Sewer Authority, Chapel Hill, North Carolina

Project Manager. Designed the expansion of the plant from 8 to 12 mgd, including patented secondary treatment processes and the country's first Class A thermophilic anaerobic digestion system.

Utoy Creek Water Reclamation Center Expansion, City of Atlanta, Georgia

Senior Technical Reviewer. Performed the final review of the hydraulic profile for the Utoy Creek WRC and recommended minor modifications for improved flow splitting features. Plant is designed to treat average flow rates of 44 mgd and peak wet weather flow rates of 90 mgd. Design included tertiary filtration, medium-pressure ultraviolet disinfection, bar screens, vortex grit removal, fine drum screens, phosphorus removal system, filter influent pumping station, and deep-bed sand filters. The phosphorus removal system included biological treatment as well as physical/chemical treatment (PCT) with ferric chloride. The expansion also included a LEED-certified administration/laboratory building.

South Cobb Water Reclamation Facility, Cobb County Water System, Cobb County, Georgia

Project Manager. Design included traveling bridge filters to treat peak flows of 75 mgd and an additional 135-foot-diameter secondary clarifier. Plant features also included a 100-mgd filtered effluent pumping station and a 15-mgd pumping station to handle stormwater, site sanitary flows, and recycles from thickening and dewatering.

South Cobb Water Reclamation Facility Expansion, Cobb County Water System, Cobb County, Georgia

Project Manager. Provided project management, preliminary and detailed design, bidding services and office engineering during construction for this 40-mgd expansion project. Responsibilities included detailed design of the screenings building, aeration basins, aeration blower building, and secondary gallery; coordination of plant hydraulics and layout; and supervision of the efforts of other design engineers and subconsultants. Additional responsibilities included budgeting cost to complete, managing project through production of finished construction documents, and signing and sealing final general, mechanical, and civil drawings and specifications. In 2002, the expanded South Cobb WRF to 40 mgd won EPA's National First Place Award for Operations Excellence. The design also received a State of Georgia, ACEC Honor Award in 1999.

Camp Creek Water Pollution Control Plant Upgrade, Fulton County, Georgia

Engineer of Record. Designed the aeration basins and single-stage blower facilities for a secondary process upgrade to 24 mgd. Process features included biological phosphorus removal, fine-bubble diffusion, foam wasting system, and use of "fermented" thickener effluent as a readily available carbon source.

Medford Wastewater Treatment Plant Expansion Study, City of Medford, Oregon

Project Engineer. Performed study on plant expansion through the year 2040. Included work on cost estimates, necessary unit expansion, and evaluations of alternative nutrient removal, solids handling, and effluent reuse alternatives.

President Street Water Quality Control Plant Expansion, City of Savannah, Georgia

Project Engineer. Performed office engineering for construction of the plant expansion. Features of the expansion included bar screens, grit removal, physical/chemical treatment (PCT) in rectangular primary sedimentation tanks.

Kachina Village Improvement District, Flagstaff, Arizona

Project Engineer. Designed a 200-gpm raw sewage lift station.

Northwest Wastewater Treatment Plant Upgrade, City of El Paso, Texas

Project Engineer. Provided detailed design of headworks, including grit and screenings removal, aeration basins, secondary clarifiers, plant service air system, and dissolved air flotation thickeners for upgrade of the plant from 5 to 17.5 mgd. Included modeling of solids balance and hydraulic profile for both new and existing facilities.



Haskell Street Wastewater Treatment Plant Study, City of El Paso, Texas

Project Engineer. Performed a study evaluating design versus actual loading rates.

Non-Hazardous Liquid Waste Master Plan, City of Phoenix, Arizona and the Sub-Regional Operating Group (SROG)

Project Engineer. Evaluated the current liquid waste hauling forms, practices, and regulations, and provided recommendations for future modification and standardization.

Pilot Studies, 23rd Avenue Wastewater Treatment Plant, City of Phoenix, Arizona

Project Engineer. Performed filtration pilot studies including evaluation of filter media performance and recommendations concerning polymer and coagulant type and dosage.

Sustainability/Green House Gases

Energy Recovery from Biosolids – 3rd-Party Contracting Support, City of St. Petersburg, FL

Utility Advisor. Advised on and assisted with negotiations with 3rd-party entities on the City's renewable-natural-gas (rNG) for vehicle fuel and power-production facilities for operations after start-up. Contracted entities included: 1) Natural gas provider (TECO) for rNG injection and NG delivery; 2) Petroleum companies (BP and Valero) for D3-RIN trading; 3) Contract O&M vendors (various - to be bid) of engine-CHP and gas-upgrading facilities; 4) RIN verifiers (various - to be selected); and 5) RIN-pricing information services (Argus and OPIS).

Doctorate of Philosophy, School of Chemical Engineering – The University of Queensland, Advanced Water Management Centre, St. Lucia, Australia

Researcher. Completed Ph.D. thesis entitled "GHG Methodologies for Sewer CH₄, Methanol-Use CO₂, and Biogas-Combustion CH₄ and their Significance for Centralized Wastewater Treatment". Emphasis was on wastewater-related GHG emissions sources that were either poorly defined, inaccurate, or unrecognized by most, if not all GHG Protocols. Specific research included: A) Development of a new sewer- CH₄ method that was applied to DC Water's collection system and those results extrapolated to estimate that this GHG source represents at least 55% of the industry's Scope-1 emissions; B) Application of ICLEI's method WW.9 for anthropogenic CO₂ from methanol feed for nutrient removal – this source was similarly estimated to represent roughly 11% of the industry's Scope-1 emissions; C) Development of a new, more accurate, use-specific method for estimating fugitive digester-gas CH₄ emissions; and D) Analysis of the suitability of electricity-intensity metrics as a function of load- and flow parameters for blower- and total-power consumption.

GHG Inventory Update, DC Water, Washington, D.C.

Technical Lead. BC updated DC Water's greenhouse gas (GHG) inventory template and data-mining software in 2017 to include new emissions sources that DC Water added since their original development in 2009. New GHG sources include: 1) CH₄, N₂O, and CO₂ (only CO₂ from natural gas combustion and methanol-CH₄ are "counted" but all combustion-derived CO₂ is recorded) from biogas and/or natural gas combustion in the new turbines, flares, and auxiliary boilers; 2) fugitive CH₄ from new digesters, digested-biosolids storage tanks, and dewatering; 3) sewer CH₄ and sewer-generated CH₄ that is emitted from preliminary pumping and treatment and dissolved CH₄ in primary influent; 4) new N₂O emissions rates for the new mainstream denitrification and new sidestream deammonification processes; 5) revisited land-application-related carbon sequestration and N₂O release; and 6) new chemicals that are being used or are considered for use with Scope-1 or Scope-3 impacts like ethanol as a methanol surrogate. The template is also being reconfigured for improved monthly and by-operating-unit emissions summaries and adding other features to meet DC Water's needs.

Water Watts, WERF, Alexandria, VA

Principal Investigator. An investigation of over 45 WRRFs with various process configurations and effluent requirements is being conducted to correlate actual power consumption by process area with actual process performance under varying process conditions over the course of at least 365 consecutive days. Each of the plants analyzed has some form of sub-metered power monitoring which will be compared with daily process and laboratory data. This is believed to be the first analysis ever conducted on actual power use rather than modeled/simulated predictions and as such, is expected to shed new light on something that we have somewhat naively believed that we fully understood.



Barriers to Energy Efficiency and Solutions to Promote These Practices, WERF, Alexandria, VA

Principal Investigator. As a follow-on project with linkage to Barriers to Biogas Use, this project sought to determine the factors that impede adaptation of energy efficiency improvements for wastewater utilities. Tasks include an electronic survey of utility staff, four focus groups to solicit/collect first-hand input, a thorough review of all plants' electrical profiles in the State of NY, a comparison of efficiency incentives and program in three states with varying degrees of regulatory and incentivizing practices to encouraging enhancements, among other tasks.

Conveyance Asset Prediction System (CAPS), WERF, Alexandria, VA

Principal Investigator. This investigation, in cooperation with DC Water and the University of Queensland has developed a calibrated sewer-process model based on full-scale data collected at Potomac Interceptor and Potomac Forcemain. Collected data covered the range of winter and summer temperatures for extrapolation of the developed kinetics over a year-round operation. The model is used to simulate how ferrous sulfate affects sulfur and carbon cycles within the PI as a demonstration of its application to other potentially hydrogen-sulfide- and methane-mitigating chemicals. Finally, an algorithm for predicting methane generation and release from gravity sewers and force mains is developed and applied to the majority of the DC Water collection system. This projection, when considered in the context of the utility's already-developed carbon footprint, provides the first-ever determination of the significance of collection-system methane on the greenhouse gas emissions of a wastewater operation.

Energy Recovery Project, City of St. Petersburg, Florida

Technical Lead. Conducted a feasibility study to determine the preferred citywide solution to process biomass (10,000 dt/yr of solids from four wastewater plants and 35,000 dt/yr of yard waste) for energy recovery. Options included integration with existing digestion, regionalization, gasification and fluid-bed combustion. This project was partially funded by a Department of Energy ARRA grant.

Barriers to Biogas Utilization for Renewable Energy, WERF

Principal Investigator. Led the effort to determine real and perceived barriers that discourage utilities with anaerobic digestion from implementing some form of biogas use. Effort included an online survey, four work sessions to discuss the topic with WERF subscribers, and development of a final report.

Utility-wide GHG Inventory, District of Columbia Water and Sewer Authority, Washington, D.C.

Technical Lead. Developed DCWASA's (now "DC Water") baseline greenhouse gas (GHG) inventories for calendar 2007 and 2008. This effort was done in accordance with The Climate Registry's General Reporting Protocol. GHG reductions and increases were also predicted for significant projects planned by DCWASA including the Cambi/Anaerobic Digestion/CHP Upgrades; Enhanced Nitrogen Removal Upgrades; fine bubble diffused air retrofits as part of the Nitrification/Denitrification Upgrades; and the Long-Term Control Plan. A subsequent task included development of data mining software that DC Water uses to semi-automatically populate GHG inventories using billing and process data.

Methane Emissions from Wastewater Treatment and Conveyance, Water Environment Research Foundation (WERF), Alexandria, Virginia

Principal Investigator. This study was awarded as one of only four projects out of almost 100 submissions under WERF's 2008 "Unsolicited Solicitation." The project tackled four aspects of currently undocumented methane generation, specifically:

A case study of methane emissions from sewers in DeKalb County, Georgia's 600,000-person service area using grab and continuous liquid- and gaseous-phase monitoring. The project leveraged collection-system inventory data previously collected by Brown and Caldwell and a prototype methane generation process model developed by the University of Queensland (Australia) Advanced Water Management Centre.

A series of case studies using a standardized review of installations of various digester-gas-fueled CHP installations including combustion turbines, reciprocating engines, microturbines, fuel cells, and steam turbines. The effort included development of a standard reporting form or datasheet that can be used by others in the industry to compare these various installations on an "apples-to-apples" basis.



A paper study predicting the fugitive emissions from conventional, candlestick digester and landfill gas flares. This study leveraged previous at-scale research by the University of Alberta on natural gas flare efficiencies under a wide variety of climate and fuel conditions.

An initial assessment of fugitive methane emissions from low-energy, apparently sustainable technologies of photosynthetic oxidation ponds and facultative sludge lagoons. While managed by Brown and Caldwell, the testing was actually performed by NASA's Ames Laboratory.

Industrial Wastewater

Major Confidential Food Processing Client

Technical Reviewer/Engineer. Visited a bakery and developed recommendations for elimination of foam in the pretreatment plant's secondary process and other improvements related to process and mechanical reliability on a system that had been operating for less than 1 year.

Major Confidential Food Processing Client

Technical Reviewer/Engineer. Services for this design/build project included optimizing the performance of the existing biological process and increasing the capacity of the pretreatment facility to double the influent flow and meet more stringent effluent limits.

Major Confidential Pulp and Paper Client

Technical Reviewer/Interim Project Manager. Services for this design/build project included increasing the capacity of the existing biological process. In order to fast-track the project completion, the project was bid using 25 percent complete plans and specifications. The design was completed while construction was ongoing in a design/build model without the contractual obligations normally present between design/build designers and constructors. This \$8 million project was completed within 8 months of design notice-to-proceed.

Major Confidential University Client

Engineer of Record. Provided design of a surface water VOC removal system. System included equalization, bag filtration and activated carbon filtration processes.

Major Confidential Metals and Machinery Client

Expert Consultant. Services included review of a sanitary treatment plant on site at a manufacturing and rehabilitation plant in Latin America. The sanitary treatment was reviewed for compliance with both national standards and client-specific standards and tolerances. Recommendations were implemented to increase overall process effectiveness and capacity.

Water

Sherrard Water Treatment Plant Expansion, City of Cheyenne, Wyoming

Senior Technical Reviewer. Performed final review of the hydraulic profile and design features for the Sherrard Water Treatment Plant expansion. The design included high-rate sedimentation and filtration.

Squaw Peak Water Treatment Plant, City of Phoenix, Arizona

Project Engineer. Provided detailed design of grit removal area, sludge blending tank, flow splitting structure, and used water recovery pumping station. Work included modeling of proposed hydraulic profile.

Squaw Peak Water Treatment Plant, City of Phoenix, Arizona

Project Engineer. Provided preliminary design on Squaw Peak Water Treatment Plant solids handling facility.

Deer Valley Water Treatment Plant, City of Phoenix, Arizona

Project Engineer. Supervised pilot testing for sludge dewatering equipment, specifically centrifuge and belt filter press.

Squaw Peak Water Treatment Plant, City of Phoenix, Arizona

Project Engineer. Developed and executed the solids sidestream sampling program.



Water Residuals Master Plan, City of Phoenix, Arizona

Project Engineer. Performed study work evaluating alternative disposal methods for water treatment plant sludges.

Water Distribution System, Forest Lakes Improvement District, Forest Lakes, Arizona

Project Engineer. Modeled existing water distribution system with recommendations to provide adequate fire flow and eliminate system dead ends.

Office Administration

Southeast Regional Wastewater Practice Leader

Responsible of general oversight of all wastewater treatment project delivery and pursuits in the southeastern region, representing between \$9 and \$12 million in annual revenue.

Municipal Department Manager, Atlanta Office

Managed performance and staffing of the Atlanta office's 25- to 30-person Municipal Department, dedicated to serving city and county utility clients.

Operations Manager, Atlanta Office

Responsible for forecasting and evaluating office performance in the 90- to 100-person Atlanta office. Other duties included development of the annual business plan and quarterly updates to that business plan. Also responsible for coordinating the import and export of work and labor to support other business units.

Department Manager, Engineering and Technical Services Department

Managed department of 25 to 35 individuals consisting of structural, electrical, and HVAC discipline staff, CADD group, and junior engineering staff in BC's Atlanta office. Position is part of the Atlanta Leadership Team responsible for office performance and growth.

Standards Coordination, Brown and Caldwell, Atlanta

Position required coordination of company and office design standard specifications, details, and procedures. Responsibilities included development of new company standards and region-specific standards.

Professional Organizations and Volunteer Efforts

Water Environment Federation (WEF) Residuals and Biosolids Committee (RBC) – Vice Chair/Chair

Became Vice Chair of the 200+ person RBC in 2016. The Vice-Chair supports Committee objectives and leads specific tasks for a period of four years prior to a 2-year term as Committee Chair (promoted to Committee Chair in fall-2019). These positions also include active leadership roles on the RBC leadership committee.

National Renewable Energy Laboratory's (NREL) Strategic Energy Analysis Center (SEAC) – Waste-to-Energy System Simulation (WESyS) Project – Expert Reviewer

One of three invited wastewater-industry expert reviewers for NREL-SEAC's WESyS project.

Water Environment Research Foundation (WERF), Water Environment & Reuse Foundation (WE&RF), Water Environment Foundation (WRF) – Research (Advisory) Council Member

Provided technical leadership to iterations of Research Councils as industry research foundations were consolidated to the current WRF structure. Participation began in spring-2016 with emphasis on wastewater, nutrients, energy, optimization, solids-handling and GHG.

WEFTEC Workshop Program Committee – Utility Management Symposium

RBC representative for the WEFTEC program committee on Workshops from 2009 through 2019. Effort includes soliciting, qualifying, and assisting/facilitating preparation of RBC-sponsored workshops. Also includes development of WEFTEC workshop program and attendance at the WEF mid-year meeting.



USDOE Bioenergy Technology Office's (BETO) Energy Efficiency and Renewable Energy (EERE) – Expert Reviewer and Selection-Guidance Committee Member

Participated in BETO's EERE selection process during the summer of 2019. Effort included review of technical and cost proposals for up to \$5-million grants from the US-DOE under Area of Interest 6: Renewable Energy from Urban and Suburban Wastes. Participation culminated in an NREL-hosted, selection-guidance-committee meeting in Denver during the week of August 26, 2019 where consensus-based guidance was finalized.

WEFTEC Workshop Program Committee – Workshop-Program Committee

RBC representative for the WEFTEC program committee on Workshops from 2009 through 2019. Effort includes soliciting, qualifying, and assisting/facilitating preparation of RBC-sponsored workshops. Also includes development of WEFTEC workshop program and attendance at the WEF mid-year meeting.

National Science Foundation (NSF)/EPA/DOE, Energy-Positive Water Resource Recovery Workshop – Invited Participant

Attended (and moderated a break-out session) at a joint NSF, EPA, and DOE workshop at the NSF in Arlington, VA over April 28 and 29, 2015. The workshop examined the role of Federal research and development to enhance WRRF energy recovery.

WERF, Technology Maturity Expert Panel – Principal Investigator and Program Lead

Chaired and led the program development for a Technology Maturity Expert Panel that was convened in Arlington, VA on June 11, 2015. The summary publication, [Assessment of Technology Advancements for Future Energy Reduction](#) was developed under John's leadership as Principal Investigator.

WEF Biosolids Convening – Invited Participant

Attended the WEF Biosolids Convening in Alexandria, VA over November 20 and 21, 2019 to determine the top policy, communication, and research needs to ensure sustainable biosolids practices into the future.

US-DOE, Biofuels and Bioproducts from Wet and Gaseous Feedstocks: Market Barriers and Opportunities Workshop – Invited Participant

Participated in a by-invitation, DOE biofuels facilitated workshop over June 6 and 7, 2017 in Berkeley, CA. Topics included policy obstacles and enablers and identifying potential customers and feedstocks.

WEF RBC – Bioenergy Subcommittee Chair

Chair of the 80-120 person Bioenergy Subcommittee from 2013 to 2016 with emphasis on Digestion and biogas use, sludge drying, incineration, gasification, resource recovery from solids, and other thermal processes. Position also includes participation on the RBC leadership committee.

US-DOE BETO, Hydrogen, Hydrocarbons, and Bioproduct Precursors from Wastewaters – Invited Participant

Attended a workshop at the NREL offices in Washington, DC over March 18 and 19, 2015 on renewable energy recovery from wastewater treatment. Technologies discussed included mainstream anaerobic treatment and mainstream/sidestream microbial fuel and electrolysis cells.

Global Methane Initiative (GMI) Methane Expo 2013 – WERF Representative

Served as WERF's Representative on the Program Committee for Methane Expo, in Vancouver, BC over March 12 through 15, 2013 including presentations on related personal and other WERF methane research.

WEF RBC, Bioenergy Subcommittee – High-Performance Digestion Taskforce Chair

Chair of the High-Performance Digestion Task Force from 2009 to 2013 with emphasis on anaerobic digestion, including advanced processes like thermal hydrolysis, TPAD, thermophilic, acid-phased; codigestion; and biogas use.

WEF Energy and Water Specialty Conference (July 2011, Chicago) - Conference Chair

Conference Chair of WEF's inaugural Water and Energy Conference that occurred in Chicago in the summer of 2011. Collaborated with EPA, US-DOE and others to provide broad perspectives on energy and wastewater.



Gates Foundation's Water Sanitation & Hygiene Team – Waste-to-Energy Small-Group Meeting

Participated in a by-invitation meeting in New Orleans on October 6, 2010 to provide input to the Gates Foundation to identify:

- Categories of waste-to-energy technologies that could/should be transferred to developing countries;
- Institutional pathways and obstacles to moving promising technologies into widespread use;
- Technological obstacles and research opportunities to improve the efficiency, robustness, and affordability of transforming human waste into energy in the developing world.

ICLEI, U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions – Wastewater and Water Technical Advisory Committee

Participated as an expert advisor on wastewater-related elements of ICLEI's 2012 U.S. Community Protocol. Additionally, served as lead author for WW.9 methodology for estimating anthropogenic CO₂ emissions from use of fossil-fuel-derived methanol as a nutrient-removal carbon source.

National Biosolids Partnership (NBP) Charting the Future of Biosolids Management – Participant

Participated in a WEF-/NBP-hosted two-day session over December 1 and 2, 2010 in Alexandria, VA to identify trends in technology, operations and management; regulatory and public policy drivers; research needs; and professional and training needs, within the context of biosolids-derived products.

Electric Power Research Institute (EPRI) Western Electric Power/Water Sector Collaboration Workshop – Invited Participant/Volunteer

Participated in a two-day, EPRI hosted workshop in Irwindale, CA over November 8 and 9, 2010 to explore synergies between the water and power industries in the water-scarce western US. Provided input for better-integrated water/energy/waste for centralized and distributed power generation.

WEF Residuals and Biosolids Conference (April 2010, Savannah, GA) – Conference Chair

Conference Chair of WEF's Residuals and Biosolids Specialty Conference in Savannah in 2010. Savannah-Biosolids was the first WEF conference to exceed budgeted attendance in over two years of conferences following the 2008 economic downturn.

WEF Residuals and Biosolids Specialty Conferences – Program Committee

Beginning in 2004 and continuing through today, Participated in development of the technical program for the annual WEF Residuals and Biosolids Specialty Conferences.

Publications/Presentations

1. "Evaluation of Alternative Thermophilic Anaerobic Digestion Configurations for Class A Sludge Treatment at the Mason Farm WWTP, Carrboro, North Carolina," Lead with Gottschalk; NC American Water Works Association (AWWA)/Water Environment Association (WEA) Annual Conference, 1995.
2. "Developing a Useful Computerized Operations Manual for the South Cobb Water Reclamation Facility," Lead with Hall & Riddle; Fall Georgia Water Pollution Control Association (GWPCA) Conference, Athens, GA, 1996.
3. "Thermophilic Anaerobic Digestion to Produce Class A Biosolids at the Mason Farm WWTP in Chapel Hill, North Carolina," Lead with Farrell & Kalb; Water Environment Federation (WEF) Residuals & Biosolids, Denver, CO, 1996.
4. "Start-up of OWASA's Thermophilic, Anaerobic, Class A, Digestion Process at the Mason Farm WWTP," Lead with Gottschalk; GWPCA Annual Conference, Columbus, GA, 2000.
5. "Ten Years of Design and Operating Experience with Classifying Selectors for Foam Control in the Activated Sludge Process in the USA," Contributor with Parker, Jones, McIntyre, Oppenheim, Pedregon, Pope, Richards, Volpe & Witzgall; WEFTEC, Atlanta, GA, 2001.
6. "Operational Improvements from Start-up of OWASA's Class A Thermophilic Anaerobic Digestion System," Lead with Gottschalk; WEFTEC, Atlanta, GA, 2001.
7. "Field Data and Experience Summary from Ashbridges Bay Treatment Plant Biosolids Loadout Facility Expansion in Toronto" Lead with Narareth, Rupke, Saknenko & Witzgall; WEF Residuals & Biosolids, Austin, TX, 2002.
8. "Anaerobic Digestion – Rebirth in the Making," Lead with Schafer; KT-TN WEA Conference, Knoxville, Tennessee, 2002.
9. "Columbus Biosolids Flow-Through Thermophilic Treatment (CBFT3) as a Cost-Effective Means to accomplish Class A Digestion" Lead with Aitken, Arnett, Hull, Schafer & Turner; WEF Residuals & Biosolids, Baltimore, MD, 2003.



10. "Early 2004: The State of the Practice of Class A Anaerobic Digestion" Lead with Schafer & Switzenbaum; WEF Residuals & Biosolids, Salt Lake City, Utah, 2004.
11. "An Update on the Longest Running Class A Thermophilic Anaerobic System in the USA", Lead with Gottschalk & Schuler; WEF Residuals & Biosolids, Nashville, Tennessee, 2005.
12. "The State of the Practice of Class A Anaerobic Digestion: Update for 2005", Lead with Schafer & Switzenbaum, WEFTEC, Washington, DC, 2005.
13. "Laboratory Evaluation of Thermophilic-Anaerobic digestion to Produce Class A Biosolids; 1. Stabilization Performance of a Continuous-Flow Reactor at Low Residence Time", Contributor with Aitken, Walters, Crunk, Farrell, Schafer, Arnett & Turner; Water Environment Research (WER, 77.7), 2005.
14. "Upgrading to Class A Anaerobic Digestion: Is Your Biosolids Program Ready To Make The Move?", Lead with Schafer; Public Works (137.1), 2006.
15. "Got Gas??? – Maximize the Mileage of your Methane", Lead with Arnett, Davis, Schettler, Shah & Shaw; WEF Residuals & Biosolids, Covington, KY, 2006.
16. "Advances in Thermophilic Anaerobic Digestion", Lead with Schafer; WEFTEC, Dallas, Texas, 2006.
17. "Fecal Coliform Reactivation and Regrowth: Process Perspective"; Presented at WEFTEC, Dallas, Texas, 2006.
18. "Advances in Thermophilic Anaerobic Digestion", Contributor with Durden, Shah, Shah, Shaw, Schettler, Arnett & Davis; WEFTEC, Dallas, Texas, 2006.
19. "Maximizing Methane", Lead with Arnett, Davis, Schettler, Shah & Shaw; Water Environment and Technology (WE&T) (19.2), 2007.
20. "How Pathogens are Destroyed in Thermophilic Anaerobic Digestion", Lead with Farrell, Murthy & Schafer; WEF Residuals & Biosolids, Denver, Colorado, 2007.
21. "A Comparison of the Carbon Footprint of Aerobic and Anaerobic Digestion", Lead with Arnett, Radcliffe & Toffey; WEF Residuals & Biosolids, Philadelphia, PA, April 2007.
22. "Carbon Footprint Analysis and Opportunities for Industry-wide Efficiency-Gain Tracking", Lead with Davis, Hull & Kerwin; 1st WEF Sustainability Conference, National Harbor, MD, 2007.
23. "JEA's Path out of Biosolids Purgatory through Anaerobic Digestion and Drying Enhancements", Lead with Bullard, Donovan, Schultz & Shaw; WEFTEC, San Diego, California, 2007.
24. "Pathogen Destruction in Anaerobic Digestion", Presented at WEF Disinfection, Atlanta, GA, 2009.
25. "DCWASA's Certifiable, Utility-Wide GHG Inventory", Lead with Bailey, Jolly, Murthy, Peot & Trueblood; WEFTEC, Orlando, FL, 2009.
26. "Quantifying Methane Evolution from Sewers: Phase 1 Results of the Water Environment Research Foundation (WERF) DeKalb County, Georgia, Case Study", Lead with Barnes, Fillmore & Shah; WEFTEC, New Orleans, LA, 2010.
27. Evaluation of Combined Heat and Power Technologies for Wastewater Treatment Facilities, Contributor with Wisler & Schettler; United States Environmental Protection Agency (EPA)/WERF/Columbus Water Works, 2010.
28. N₂O and CH₄ emission from wastewater collection and treatment systems – Technical Report, Contributor with Chandran, Foley, Keller, Senante, Shah, vanLoosdrecht, vanVoorthuizen & Yuan, Global Water Research Coalition, 2011.
29. N₂O and CH₄ emission from wastewater collection and treatment systems – State of the Science Report, Contributor with Chandran, Foley, Keller, Senante, Shah, vanLoosdrecht, vanVoorthuizen & Yuan, Global Water Research Coalition, 2011.
30. "Implications of the EPA's Endangerment Finding, Reporting Rule and Tailoring Rule for POTWs", Lead with Trueblood; WEF Residuals & Biosolids, Sacramento, CA, 2011.
31. "Energy and Water: Innovations Keep Moving the Bar", Lead with Turgeon; Presented at 1st WEF Energy & Water, Chicago, IL, 2011.
32. "Quantifying Methane Emissions from Gas Flares: WERF's New Flare Efficiency Estimator", Lead with Checkel, Fillmore, Handford, Joiner & Shah; 1st WEF Energy & Water, Chicago, IL, 2011.
33. "Anaerobic Digestion at an ENR Plant: Implications for Energy, Carbon, and GHG", Lead with Murthy, Peot & Wett; WEFTEC, Los Angeles, CA, 2011.
34. "Barriers to Biogas Utilization for WWTPs – A Summary of WERF's Project on Biogas Use Barriers", Lead with Beecher, Durden, Fillmore, Hemenway, O'Connor, & Stone; WEFTEC, Los Angeles, CA, 2011.
35. "Quantifying Methane Evolution from Sewers: Results from WERF/DeKalb Phase 2 – Continuous Monitoring", Lead with Fillmore, Shah, Sharma & Yuan; WEFTEC, Los Angeles, CA, 2011.
36. Methane Evolution from Wastewater Conveyance, Principal Investigator (PI) with Shah, Yuan, Sharma, Joiner & Bocarro, WERF, 2012.

37. Barriers to Biogas Use for Renewable Energy, PI with Stone, Durden, Beecher, Hemenway & Greenwood; WERF, 2012.
38. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Contributor and Lead with Griffith & Murthy for "Method WW.9: Process Carbon Dioxide Emissions from the Use of Fossil-Fuel-Derived Methanol for Biological Nitrogen Removal"; ICLEI – Local Governments for Sustainability USA, 2012.
39. Evaluation of Combined Heat and Power Technologies for Wastewater Treatment Facilities. Updated/Final Edition, Contributor with Wisner & Schettler; EPA/WERF/Columbus Water Works, 2012.
40. "The St. Petersburg Biosolids Planning Effort", Lead with Leavitt, Marshall & Bosso; WEFTEC, New Orleans, LA, 2012.
41. "Reframing the Economics of Combined Heat and Power Projects - Creating a Better Business Case Through Holistic Benefit and Cost Analysis", PI with Stone, Durden, Walch, Hajnosz, Elenbaas, & Patil; WERF Fact Sheet, WERF, 2013.
42. "Economic Methods Matter – Appropriate Analysis can Overcome the Biggest Barrier to Biogas Use", Lead with Durden, Elenbaas, Fillmore, Stone & Walch; WEF Residuals & Biosolids, Nashville, TN, 2013.
43. "Fresh financial options – Using the right economic analyses to overcome the biggest barrier to biogas use", Lead with Stone, Fillmore, Durden, Elenbaas, Hajnosz, O'Connor & Walch; WE&T, 2013.
44. Flare Efficiency Estimator and Case Studies, PI with Checkel, Handford, Shah & Joiner, WERF, 2013.
45. "Energy-Recovery from Solids in St. Petersburg, FL: Biogas to Vehicle Fuel and CHP", Lead with Jacobsen & Marshall; WEF Energy & Water, Nashville, TN, 2013.
46. "Technology-Based Methodology for Calculating Digester-Gas-Related Greenhouse-Gas Emissions", Lead with Checkel, Griffith, Trueblood & Yuan; WEFTEC, Chicago, IL, 2013.
47. Identification of Barriers to Energy Efficiency and Solutions to Promote these Practices, PI with Andrews, Stone, Cantwell & Greenwood; WERF, 2015
48. Current Energy Position of New York State Wastewater Treatment Facilities, Original PI with Andrews & Nascimento; WERF, 2015
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