

CURRICULUM VITAE

FELIZITAS ELEN SCHLEDERER

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EDUCATION

- currently-
09/2020 **Ph. D Chemical Engineering - Université Laval**
Project: *"Study the impact of process conditions to control the amount of pollutant in the generated end-product of sewage sludge pyrolysis at a demonstration plant in California."*
Emphasis: Research on a pilot and full-scale pyrolysis plant, laboratory analysis, project management, cost estimation.
- 12/2019 -
03/2017 **M. Sc. Chemical Engineering - Technical University of Munich**
Master Thesis: *"Design optimization by determination of the flake-related energy input in ultrasonic disintegration technology."*
Emphasis: Laboratory test, CFD simulation, process engineering, economic calculation, and thermal heat transfer.
- 01/2017-
09/2016 **Exchange student - Cardiff University**
Emphasis: Process modelling and wastewater treatment.
- 03/2017 -
10/2013 **B. Sc. Chemical Engineering - Technical University of Munich**
Bachelor Thesis: *"Experimental investigation of Co-combustion Coal with Biomass."*

WORKING EXPERIENCE

- 07/2020 -
03/2020 **Excellence AG – Engineering service provider**
Recruiter
Emphasis: First experience in HR, active sourcing of new candidates, connecting potential candidates with companies, conducting interviews.
- 10/2019 -
05/2019 **Technical University of Denmark – Visiting Researcher in water technology**
Pharmaceutical removal in wastewater obtained using forward osmosis with different membrane types pharmaceuticals removal in wastewater using forward osmosis with different membrane types.
Emphasis: Laboratory test, result evaluation and project planning.
- 04/2019 -
04/2017 **Florafuel AG – Startup process development to generate high-quality regenerative fuel out of biomass**
Working Student – Planning and Construction of a pilot plant
Emphasis: CAD designing using SolidWorks & Inventor, Process Flow Diagrams (PFD), Piping and Instrumentation Diagrams (P&ID), Test a the pilot plant.
- 03/2018 -
05/2017 **Technical University of Munich – Chair of Urban Water Systems Engineering**
Research Assistant
Emphasis: CFD Simulation of solute transport in feed channel through a membrane by using COMSOL-Multiphysics
- 01/2016 -
09/2015 **Technical University of Munich - Chair of Metal Forming and Casting**
Research Assistant
Emphasis: Material analysis by surface determination and tensile tests.

COMMUNITY AND VOLUNTEER ACTIVITIES

- currently-
09/2022 **President of the student society UCGCB – Université Laval**
The UCGCB society (Union des chercheurs en génie chimique et biochimique) aims to increase the scientific and social exchange between researcher. I take over the coordination of the association in terms of realizing social activities and welcoming new students.
- currently-
05/2022 **Mentorship Program - CentrEau and the International Water Association**
The mentoring program aims to exchange experience between universities and companies. It opens the mind to understand the challenges companies face in the field of industrial and wastewater treatment.
- 08/2022 -
09/2021 **Developer of ResearchMarket (StartUp), Entrepreneuriat Université Laval**
I aimed to realize "ResearchMarket", a platform allowing researchers to sell and buy laboratory and working equipment. Like a Facebook Marketplace for universities. Therefore I participated in the VIP3 program of the Entrepreneuriat Université Laval and attended several workshops and personal coaching. I refined my project idea, conducted a detailed market analysis, assembled a team, and drafted a business model.
- 01/2020 -
10/2013 **Annual spokeswoman for the chemical engineering students, Technische University of Munich**
During my bachelor's and master's, I represented my colleagues in front of the audit committee and the chemical and engineering faculty. I was the intermediary between professors and students and organized social events and activities for my academic year.
- 10/2018 -
10/2017 **Member of IKOM - Germany's largest career forum for students**
10/2017 - 10/2018

PUBLICATIONS

- 2023 **Journal of waste management (submitted)**
Micropollutants in biochar produced from sewage sludge: A review on the impact of pyrolysis in process conditions and strategies to improve product quality
- 2020 **Journal of Ultrasonics – Sonochemistry**
Effects of ultrasonic reactor design on sewage sludge disintegration
- 2019 **Ultrasonics sonochemistry**
Impact of ultrasound-induced cavitation on the fluid dynamics of water and sewage sludge in ultrasonic flatbed reactors
- 2018 **Journal of Membrane Science**
CT scanning of membrane feed spacers - Impact of spacer model accuracy on hydrodynamic and solute transport modeling in membrane feed channels

GRANTS

- 2022 Grands Bourse du Fonds Vision Topping entrepreneuriat (U'Laval)
2021 Bavaria-Québec Mobility Program
2020 Association des femmes diplômées des universités de Québec
2018 German Scholarship (Technical University of Munich)

PROFESSIONAL SKILLS

- Aspen
- Matlab
- COMSOL Multiphysics 5.4
- Visio Professional
- Solidworks (CAD)
- Autodesk-Inventor (CAD)

LANGUAGES

- German:** Native speaker
English: Business
France: Intermediate



DR. BEHNAZ KHAKBAZ, PE

20 Years Experience

Education

PhD | Civil Engineering – Water Resources |
University California at Irvine | 2010

Master of Science | Civil Engineering - Hydraulic

Structures

Sharif University of Technology | 2001

Bachelor of Science | Civil Engineering | Sharif University of
Technology | 1998

Registration

California Professional Engineer No. 79323

Texas Professional Engineer No. 143075

Background

Dr. Khakbaz brings a unique and valuable skillset with wide-ranging expertise in water distribution systems, sewer collection systems, hydraulic, hydrologic and transient modeling, and GIS. She has the theoretical background to quickly identify hydraulic-related problems and the real-world experience to know what methods and tools can be applied. She has extensive experience in advanced water resources issues including hydraulics modeling for transmission lines or distribution systems, steady state and extended period simulation model calibration, hydrologic modeling, sewer collection system modeling, rainfall-runoff analysis, watershed(basin) delineation, distributed hydrologic modeling, river/channel routing, application of GIS and remote sensing in watershed modeling and analysis, and processing data using GIS. She is proficient with InfoWater, WaterGEMS, SewerGEMS, InfoWorks ICM, InfoSurge, LIQT and EPANET.

As a Research Associate at Caltech Jet Propulsion Laboratory, she worked in the Climate, Ocean, and Solid Earth Sciences group to evaluate the hydrologic impacts of changes in land cover, and particularly forest removal, on the characteristics of drought in China using a meso-scale hydrologic model named Variable Infiltration Capacity (VIC). Her background also includes work with the Center for Hydrometeorology and Remote Sensing (CHRS) to develop a semi-distributed hydrologic model using SAC-SMA (lumped rainfall-runoff model of the US National Weather Service) as the water balance component and Kinematic Wave as the river routing component.

Experience

Water Distribution System Master Plan - City of Redlands, California: Project Engineer assisted in developing a hydraulic model of the City's water distribution system and performing master planning to identify Capital Improvement Projects needed over the next 10 years. The City's water system consists of two surface water treatment plants, approximately 40 wells, 17 reservoirs with 52.4 MG total storage capacity, 16 booster pump stations with total installed 38 booster pumps, more than 400 miles of distribution system pipeline in eight pressure

zones with approximately 21,500 service connections. Dr. Khakbaz was responsible for calibration of an all-pipe model for the city's water distribution system using GIS based InfoWater v7.0. The analysis also involved water quality modeling to ascertain the average turnover rate in the system and to evaluate the system's ability to meet EPA Stage 2 Disinfection/Disinfection Byproducts (D/DBP) regulations requirements.

Evaluation of Replacement versus Rehabilitation of the HVAC System - Eastern Municipal Water District (EMWD) Perris, California:

Project Engineer who identified three possible chillers to potentially replace the existing chiller. She evaluated the replacement option and recommended one of the three selected chillers which was most suitable for use in the District HVAC system based on the cost-benefit analysis. Dr. Khakbaz evaluated the rehabilitation option to determine the cost of replacing only the compressors. She prepared a technical memorandum summarizing the results of the analysis and recommending the best option.

North of River Sanitary District Sewer System Modeling using Sewer Gems - Bakersfield, California:

Project Engineer who developed a SewerGEMS sewer system model for NRSD which involved importing ArcGIS based data to the model, and model development and validation.

Groundwater Remediation - City of Barstow, California:

Project Engineer for groundwater flow and fate and transport modeling for this groundwater remediation project. She developed the MODFLOW/MT3D model to simulate the transport of nitrate and perchlorate contamination in groundwater and ran different pump and treat scenarios to help with selection of a remediation approach. Dr. Khakbaz calibrated the model using PEST and conducted sensitivity analysis.

Hydraulic Evaluation of Transmission Mains - Monterey, California:

Project Engineer who developed the WaterCAD/WaterGEMS model for the California American Water (CAW) Transmission Mains Hydraulic Evaluation and Sizing. The hydraulic model was used to assist with the selection of two potential alignment alternatives. Hydraulic evaluations looked at the following conditions: 1) Evaluation of water supplies, 2) Evaluation of water demands, 3) Evaluation of supply and demand scenarios, and 4) Evaluation of water delivery alternatives.

Wastewater Treatment Plant Efficiency Initiative - City of Redlands, California:

Project Engineer who developed the BioWin model for the City's wastewater treatment facility. Additional responsibilities included writing technical memorandum for the membrane bioreactor system and submersible mixers for the aerobic mixing in the City's plant.

Water Model Extended Period Calibration – City of Santa Ana, California:

Project Engineer who updated the City's WaterCAD

hydraulic model and conducted EPS calibration (using SCADA) for the off-peak (fall/winter) period.

Hydraulic Model Build, Calibration, and Implementation – Rubio Canyon Land and Water Association, Altadena, California: Project Engineer who built and calibrated the Utility's first water system hydraulic model in InfoWater. The model was built from GIS and CAD reference data. The steady-state calibration was done based on hydrant flow tests, pressure, and available SCADA data.

Fire Flow Evaluation of Lakewood Water Distribution System – Lakewood, California: Project Engineer who performed fire flow evaluation of the City's water distribution system with upgrading 4-inch pipes to 6-inch and provided available flow results at each hydrant location.

Hydraulic Modeling Project for Zone Models – Los Angeles Department of Water and Power (LADWP), California: Project Engineer who supported LADWP with the water model construction; steady-state and extended period simulation calibration; and documentation for zone models within LADWP water system. The project involved data collection, model development from LADWP GIS and best available data and calibration using pressure survey, SCADA data, and institutional staff knowledge and experience.

Hydraulic System Analysis – Nevada Irrigation District (NID), California: Project Engineer who evaluated the capacity of the proposed pipeline connection between Lake Wildwood (LWW) and Smartsville systems and evaluated the impact on the LWW system under existing demand conditions.

Hydraulic Model Update and Steady State Calibration – Snohomish PUD, Washington: Project Engineer who updated the existing SNOHUD hydraulic model from the most current GIS geodatabase. She conducted steady state model calibration and developed master planning scenarios.

Hydraulic Computer Model and Water Distribution Alternatives for Griffith Park – Los Angeles, California: Project Engineer who developed a hydraulic model for the Griffith park water system using InfoWater which involved importing GIS-based data to the model, demand allocation, model calibration, and validation.

Consolidated Water Works District No. 1 Hydraulic Modeling - Houma, Louisiana: Project Engineer who developed a WaterCAD hydraulic model of the District's water distribution system from the District's GIS geodatabase, available facility schematics, and demand information from the District's water customer billing database. She calibrated the model against supervisory control and acquisition data (SCADA) as well as historical hydrant flow data.

Targeted Uni-Directional Flushing Program – Santa Ana, California: Project Engineer who developed UDF sequences for

three areas of the City's water distribution system. A UDF program was piloted using the City's existing hydraulic model in conjunction with a built-in tool in WaterCAD™ for UDF sequencing with the objectives of 1) reducing the amount of flushing water volume and costs associated with maintaining a suitable level of water quality and 2) removing sediment in the pipes through high velocity scouring of pipes.

Hydraulic Modeling – City of Newport Beach, California: Project Engineer who developed the City's water distribution model in InfoWater using GIS data, customer billing information, and facility reference drawings. The model was calibrated under steady-state and EPS conditions using hydrant field test data and available SCADA.

Water System Analysis for Gene and Iron Mountain Pumping Plants – Metropolitan Water District of Southern California (MWD), California: Project Engineer who developed hydraulic models for potable and non-potable(irrigation) water systems to support the final design of the pipe replacements of the existing systems. She performed hydraulic analysis and determined the appropriate infrastructure sizes to support both existing and future flows.

Goleta Recycled Water Hydraulic Modeling and Analysis – Goleta, California: Project Engineer who developed a hydraulic model for GWD using InfoWater which involved importing ArcGIS based data to the model, model development and calibration. She conducted two scenarios for relocation of an existing pump station and evaluated capacity of the pumps and existing pipelines at the pump discharge of each of respective locations.

Hydraulic Water Model Build and Assessment for Mary Rhodes Pipeline Steel Dynamic (SDI) Tap – Sinton, Texas: Project Engineer who developed a hydraulic model using InfoWater which involved importing ArcGIS based data to the model, model development and validation. She conducted several scenarios to assess SDI tap effects on the water system.

Central Regional Wastewater System Elm Fork Rehabilitation and Replacement (CAC 7, 8A and 8B) – Trinity River Authority of Texas: Project Engineer who was responsible to develop several rehabilitation and replacement scenarios within the Authority's InfoWorks ICM hydraulic model to evaluate the impacts to the overall system, and compare the system capacity before and after the proposed improvements. In addition, temporary flow bypass and flow diversion scenarios were examined to provide general recommendations on feasibility of temporary flow routing between interceptors.

Flow Determination for Wastewater System – Laredo, Texas: Project Engineer who is responsible to develop existing and future average dry weather flowrates (DWF) based on available flowmeter data and water demand projections established in the City's water master plan.

Wastewater System Model Build and Calibration– Schertz, Texas: Project Engineer who conducted Quality Control (QC) of the Sewergems hydraulic model that was built for the City’s wastewater system and calibrated the model for dry weather flow (DWF) and wet weather flow (WWF) based on selected data.

Sanitary Sewer Overflow Initiative Support Phase II – Beaumont, Texas: Project Engineer responsible for confirming preferred areas within the sewer system to deploy flow monitoring. She is providing technical support for development of an InfoWorks ICM sewer collection system hydraulic model and calibrating the model for dry and wet weather scenarios at 20 flow monitoring locations.

Hydraulic Analysis of the 84" Finished Water Connection for City of Houston's NEWPP expansion project – Houston, TX: Project engineer built and ran scenarios to identify effects of additional headloss on the pump operation conditions of the 84" concept plan.

Aqua Texas Water System Model Build and Evaluation – South Kerrville, TX: Project engineer who is responsible to build hydraulic models for Aqua Texas’s three water systems (Erlund, Loma Vista, and Horizon), identify hydraulic system deficiencies, assess emergency interconnections and recommend improvements to the systems.

Lake Ralph Hall (LRH) Hydraulic and Transient Model Build and Evaluation – UTRWD, TX: Project engineer who is responsible to build an LIQT transient model for the LRH system and recommend surge mitigations (air valves and hydropneumatic tanks). Also, conducted Quality Control (QC) of the Infowater hydraulic model that was built for the LRH system.

West Harris County Regional Water Authority (WHCRWA) 2050 and Ultimate System Model Evaluation – WHCRWA, TX: Project engineer who is responsible to evaluate the Authority’s water distribution system in terms of VFD pump settings and line sizes using their Watergems hydraulic model.



Jeremy Kraemer

Wastewater Technical Director



Location

Waterloo, Ontario, Canada

Experience

20 years

Qualifications/Accreditations

- Doctor of Philosophy. University of Toronto, Toronto, ON, 2007
- Master of Applied Science. University of Toronto, Toronto, ON, 2003
- Bachelor of Applied Science. University of Toronto, Toronto, ON, 2001
- Professional Engineer: Ontario, 2008, #100075584
- Qualified Designer: OBC Part 8 Sewage Systems, 2019, BCIN # 112964

Memberships

- Water Environment Federation (WEF) – Greenhouse Gas Subcommittee
- Water Environment Association of Ontario (WEAO) – Climate Change Committee, Past Board Member
- Ontario Onsite Wastewater Association (OOWA)

Relevant experience summary

My 20 years of experience in sustainable wastewater treatment process engineering has been driven by continuous learning and development of new expertise. As a technical director of wastewater solutions at GHD, my role involves meeting and learning from our global experts and bringing our best knowledge to bear on our projects. I am motivated by our global climate emergency to help clients mitigate greenhouse gas (GHG) emissions and implement more resilient wastewater solutions. I am eager to pass along my knowledge to like-minded professionals. I enjoy educating our industry through conferences and committee work in my professional associations and mentoring motivated engineers to encourage growth and knowledge within my team.

Project experience

CCC GHG Inventory

Role: Process Emissions GHG Specialist
Client: Central Contra Costa Sanitary District
Location: California
Capital Cost: N/A
Dates: 2023-present

Act as a Technical Advisor to GHG internal team on GHG inventory approaches and guidance on process emissions from wastewater treatment including methane and nitrous oxide.

Green Municipal Fund (GMF) Water Sector Funding Priorities Identification Support

Role: Wastewater & Septic Systems Lead
Client: Federation of Canadian Municipalities (FCM)
Location: Ottawa, Ontario
Capital Cost: N/A
Dates: 2022-present

The Green Municipal Fund (GMF) is a \$1 billion program delivered by the Federation of Canadian Municipalities (FCM) and funded by the Government of Canada. GMF offers grants and loans and capacity building to help municipalities improve air, water, and soil quality, and protect the climate. This project will identify needs and drivers for local governments, identify ways that GMF can support innovation & action in the water sector, and recommend how GMF can best meet the needs of stakeholders through funding and capacity development support. This will be accomplished through desktop

research & stakeholder engagement, survey, and focus groups.

Consulting Services for the Quantification of GHGs and Evaluation of Reduction Opportunities in Water & Wastewater Infrastructure Capital Delivery

Role: Wastewater/Water GHG Subject Matter Expert
Client: Region of York
Location: Region of York, Ontario
Capital Cost: N/A
Dates: 2022-present

This project will support York Region's progression towards net zero GHG emissions for water and wastewater assets, formulate an approach to GHG emission reductions across the asset lifecycle with prioritized considerations for 1) elimination, 2) reduction (optimize / efficiency), 3) renewable sources, 4) lower emission solutions, and 5) offsets as a last resort, review and evaluate standard methods for quantifying GHG emissions, and establish requirements to enable a repeatable evaluation across projects to quantify and compare the GHG reduction means and methods employed, formalize requirements for integrating GHG reduction considerations into EAs, design, and construction phases for water and wastewater linear and vertical infrastructure projects.

Renewable Energy Technology Consulting

Role: Wastewater Treatment Specialist
Client: Region of Halton
Location: Region of Halton, Ontario
Capital Cost: N/A
Dates: 2022-present

This project will provide the Region with green energy options for Halton's largest WWTPs including technology review and feasibility assessments for the Skyway and Mid-Halton WWTPs. Green energy technologies will be identified and ranked, and then recommend a technology and implementation plan. During design and commissioning of the recommendation, act as a Technical Advisor to the Region.

Humber TP Blowers Replacement

Role: Process Engineering & Preselection Lead
Client: City of Toronto
Location: Toronto, Ontario
Capital Cost: \$60 million
Dates: 2022-Present

The City requires replacements of aging infrastructure to improve operational efficiency and reliability at the Humber Treatment Plant (HTP) rated 473 ML/d. Scope of work includes review of blower technologies and multi-technology preselection to procure 11,000 HP

(estimated) of new blowers with an estimated capital value of \$8-10 million, removal of old blowers and electrical systems, building HVAC and lighting rehabilitation, and installation of new blowers and electrical systems aligned with the preselected blower technology and supply voltage. The design will include extensive construction sequencing and constructability planning. Jeremy's role also includes operator training and commissioning.

Leachate Management Value Engineering

Role: Wastewater Treatment Specialist
Client: City of Calgary
Location: Calgary, Alberta
Capital Cost: N/A
Dates: 2022

Requested to participate as a wastewater treatment specialist in a week-long value management (value engineering) workshop to evaluate management strategies for leachate from the three City of Calgary landfills as an alternative or improvement over the existing strategy of disposing to the municipal sewer to the Bonnybrook WWTP.

Organic Rankine Cycle (ORC) Heat Engine

Role: Wastewater Treatment Specialist
Client: City of London
Location: London, Ontario
Capital Cost: N/A
Dates: 2022

The project involved implementing the first organic rankine cycle heat engine in North America at a wastewater treatment plant. The ORC captures waste heat from the sludge incinerator to generate electricity up to 800 kW. Supported the construction team investigating the erosion of flue gas dampers, flue gas temperatures and excess free water to allow project close-out.

Nobleton WRRF Capacity Assessment & Feasibility Study

Role: Process Advisor
Client: Region of York
Location: York Region
Capital Cost: N/A
Dates: 2021-Present

Provided process oversight and advice to the project engineering team related to assessing capacities of unit processes, hydraulic profile analysis, and offering alternatives for plant upgrades to achieve full rated capacity.

Ashbridge's Bay Treatment Plant Digesters 13-22 Refurbishing Study

Role: Senior Process Engineer
Client: City of Toronto
Location: Toronto
Capital Cost: TBD
Dates: 2021-2022

Led the delivery of TM6 on constructability issues, including process analysis to maintain adequate digester capacity and its influence on construction schedule in relation to other simultaneous construction programs, identified constructability and construction sequencing constraints, evaluated contractor constraints, and recommended a contracting strategy.

Water Supply Environmental Assessment and Indigenous Engagement

Role: Environmental Assessment Lead
Client: Gardens of Haliburton Inc.
Location: Haliburton, Ontario
Capital Cost: N/A
Date(s): 2020-2021

Schedule C Municipal Class Environmental Assessment for a new private water supply well for a new retirement residence. Coordinated the virtual public consultation (during Covid-19 pandemic) and public and stakeholder notifications, received and responded to regulatory stakeholder comments and questions, coordinated Stage 1 & 2 archaeological assessments and participated in indigenous engagement sessions to discuss the project, answer questions and solicit indigenous knowledge for inclusion in the Environmental Study Report (ESR). Wrote the ESR and coordinated in approval by the Ministry of the Environment.

Snow Storage Facility Public and Indigenous Engagement

Role: Project Manager
Client: City of Peterborough
Location: Peterborough, Ontario
Capital Cost: N/A
Date(s): 2020-2021

Project scope included additional stakeholder engagement regarding a new snow storage facility meltwater treatment system to improve water quality prior to river discharge. As project manager, coordinated with our indigenous engagement specialist sub-consultant and participated in indigenous engagement sessions as technical lead to discuss the project, answer questions and solicit indigenous knowledge and concerns.

Region of Durham, Uxville Industrial Park Well Site Sewage Holding Tank Replacement 2020-2021

Project Manager

Development of tender drawings and technical specifications to Region of Durham standards for replacement of a 9,000 L sewage holding tank in order to comply with setback requirements under the Ontario Building Code. Scope included new tank and sewer connection, new high level alarm, driveway "hammerhead" extension to facilitate septage truck access, and demolition/removal of existing tank after sewage pump out by an authorized hauler for disposal, along with miscellaneous civil improvements needed by the Region for the site.

Durham District School Board (DDSB), Scott Central Public School Septic System Replacement, 2019-2020

Project Manager

Development of tender drawings to DDSB standards for demolition and removal of existing septic system including septage pump-out by an authorized hauler for disposal, replacement with new 12,000 L/d Waterloo Biofilter advanced treatment septic system including nitrogen removal, comprised of reuse of existing sewage balancing tank, new septic tanks, biofilter units, effluent flow meter vault and Type 2 disposal bed. Included provisional allowance for potential asbestos cement pipe removal. Drawings were developed for competitive bidding via the Board's bids & tenders system.

Senior Project Manager / Senior Wastewater Engineer; Various Private Clients; Ontario; 2019-Present.

Wrote numerous proposals for private clients with consulting budgets typically \$5,000 to \$20,000. Oversaw technical assessments for wastewater projects including nitrogen and phosphorus treatment approaches to meet reasonable use guidelines, phosphorus loading calculations, Ministry pre-consultations, hydrogeological and wastewater design reports, and receiving water assessments. Oversaw improvements in drawing standardization and use of standard details.

Trail Road Landfill Leachate Treatment Plant Preliminary Design

Role: Design Manager & Process Lead
Client: City of Ottawa
Location: Ottawa
Capital Cost: \$15 million
Date(s): 2018-2019

Managed delivery of preliminary design for a new leachate treatment plant, including coordinating discipline engineering work among two consulting firms. Technical lead at all client meetings. Also acted as process design lead overseeing work by junior engineers and leading cost estimating.

Skyway WWTP Sidestream Treatment and Belt Filter Press Upgrades Study

Role: Process Engineer
Client: Region of Halton
Location: Burlington, ON
Capital Cost: \$7-15 million
Date(s): 2018 & 2015

The Region required the preparation of a business case capital upgrade plan for dewatering and sidestream treatment. As the lead for the dewatering portion of the 2018 study, oversaw process modelling and the development of the design loads for dewatering. Also, developed and analyzed dewatering technology options, including preparation of capital and O&M cost estimates, along with a multi-criteria evaluation to select and recommend the preferred dewatering approach. For the earlier sidestream treatment study in 2015, led facility design and conceptual design report components for a deammonification system to remove ammonia from dewatering filtrate/centrate.

West District Water Resource Recovery Facility Process Selection and Conceptual Design (TA-18)

Role: Process Engineer
Client: Miami Dade Water & Sewer Department
Location: Miami, FL
Date(s): 2017-2018

The West District Water Resource Recovery Facility (WDWRRF) is a critical part of the Miami-Dade Water & Sewer Department's (WASD) Ocean Outfall Legislation (OOL) Compliance Plan. The 100 mgd (380 ML/d) average rated capacity WDWRRF will provide WASD with the additional capacity required to manage the projected 2035 average and peak system-wide flows. As part of the Owner's Engineer team, led the technical and financial evaluations of technologies utilized by the Process Selection Advisory Board (PSAB) to select a recommended process configuration for conceptual design. As the process engineer for the solids and biogas systems, led the conceptual design of thickening, digestion, dewatering, drying, truck loading, biogas storage, and biogas treatment and cogeneration facilities.

Process Engineer; Servicing and Facility Plan for Northwest Langley Wastewater Treatment Plant; Greater Vancouver Sewerage and Drainage District; Vancouver, Canada; 2017. Based on population growth trends and measured and forecast flows and loads, Metro Vancouver required a staged servicing and facility plan for the Northwest Langley WWTP for the short term (to 2030), mid-term (to 2060) and long term (to 2100). As process engineer, led the capital and O&M cost estimating for liquids and solids treatment processes to

support technology selection and development of a phased facility plan.

Woodward Avenue Wastewater Treatment Plant (WWTP) Water Quality Upgrade

Role: Design Manager/Process Lead/Process Engineer
Client: City of Hamilton
Location: Hamilton, ON
Capital Cost: \$124 million
Date(s): 2009-2016

As a process engineer (circa 2012), led the process and facility assessment and development of Class 5 construction cost estimates of upgrade options to provide reliable nitrification and new tertiary phosphorus removal to 0.18 mg/L for this 409 ML/d activated sludge plant. Assisted in organizing and facilitating two workshops to solicit third-party peer review input to the process selection. As a process lead (circa 2014-2015), led the preparation of the Request for Pre-Qualification (RFPQ) and Request for Proposal (RFP) documents to competitively procure either membrane filtration or disk filtration tertiary treatment equipment. As design manager (circa 2016), led the pre-design for the \$124 million secondary/tertiary upgrade, including expansion of secondary treatment capacity and new disk filtration facility, including leading a secondary treatment condition assessment.

Process QA/QC; Georgetown WWTP UV Disinfection Replacement; Region of Halton; 2016. Senior process advisor and process design QA/QC for the replacement of aging UV disinfection equipment.

Process QA/QC; Georgetown Wet Weather Treatment Station; King County, Washington, USA; 2015 to 2016. Wet weather treatment subject matter expert and process QA/QC for the detailed design phase for the process and facility design of a high-rate treatment facility for peak wet weather flows.

Feasibility Analysis to Reduce Phosphorus Loading from the Holland Marsh

Role: Process Lead
Client: Lake Simcoe Region Conservation Authority
Location: Holland Marsh (Region of York)
Capital Cost: \$30 million
Date(s): 2015

Senior process advisor and QA/QC assessing treatment options and feasibility for removal of phosphorus from the Holland Marsh polder water. Assessment considered lagoon and mechanical treatment technologies, evaluation of potential sites, and life-cycle cost analysis.

Fish Creek WWTP Upgrade Study (South Catchment Servicing Strategy)

Role: Process Engineer
Client: City of Calgary
Location: Calgary,
Capital Cost: \$162 million
Date(s): 2015-2016

Led or contributed to the delivery of key technical memoranda in the development and recommendation of a preferred strategy for servicing the City of Calgary's South Catchment. TMs included long-list technology review, shortlisting of feasible alternatives, documentation of baseline plant performance and hydraulics constraints, development of conceptual plans for shortlisted upgrade alternatives for the Fish Creek WWTP, and development of a comprehensive capital and operating cost model.

South End WPCP Wet Weather High-Rate Treatment Facility

Role: Process and Facility Lead
Client: City of Winnipeg
Location: Winnipeg, MB
Capital Cost: \$15 million
Date(s): 2013-2016

Facility Lead for the high-rate treatment facility for treatment of peak wet weather flows. Responsibilities included the development of the process design basis, development of pre-purchase tender documents, including front-end and technical specifications to allow competitive bidding of three different technologies and led design of the facility and vendor coordination with successful vendor (Veolia Actiflo), including writing the process control narrative.

Skyway WWTP Phase 2 Expansion Program

Role: Process Lead
Client: Region of Halton
Location: Burlington, ON
Capital Cost: \$130 million
Date(s): 2008-2015

Process Lead during the Class C Environmental Assessment Phases 3 and 4 and conceptual design. Responsibilities included leading all technical assessments, including development of flows and loads, process alternatives and selection, hydraulics, and effluent criteria/receiving water assessment. Process lead for pre-design and detailed design for a \$130 million expansion from 118 to 140 ML/d, including expansion of headworks, secondary treatment, the addition of new deep bed granular media filters to remove phosphorus to 0.12 mg/L, and improved wet weather flow management up to 500 ML/d. Responsibilities included process leadership for all process analyses, process design, hydraulics, process

control narratives, and operations manuals, as well as managing junior engineers, coordinating with design disciplines, developing construction cost estimates during conceptual and preliminary designs. Prepared construction contract bid documents for major process equipment pre-selection of two 600 HP aeration blowers and new high-efficiency UV disinfection equipment. Assisted in preparation of the preselection evaluation methodology and technical bid forms to support selection of lowest life-cycle cost equipment. Member of the bid evaluation team and performed the technical and financial evaluations, including evaluating blower power across four technology options (single-stage with and without VFD, single-stage integrally geared [SSIG] and high-speed turbo). Performed shop drawing reviews and witnessing factory acceptance testing of 600 HP SSIG blowers. Led 3D model review workshops with operations & maintenance staff to solicit valuable design review input. Participated in value engineering, construction sequencing, process control narrative development and review workshops, and commissioning.

Satellite Plant Sludge Management Alternatives

Role: Process Lead and Project Manager
Client: Region of York
Location: Various
Capital Cost: N/A
Date(s): 2014-2015

This study evaluated three previously short-listed sludge management alternatives for waste sludge generated from York Region's satellite WWTPs using a triple-bottom-line cost-benefit assessment approach to understand the feasibility of discharging the sludge to the YDSS as compared to the current practice of trucking directly to Duffin Creek WPCP.

Process QA/QC; Seaforth STP Re-rating; Municipality of Huron East; 2015. Senior process advisor and QA/QC for a comprehensive technical assessment of the Seaforth STP to support re-rating the plant capacity based on the closure of a local food processing facility.

Food Waste Disposers

Role: Process Lead and Project Manager
Client: Region of York
Location: Region of York
Capital Cost: N/A
Date(s): 2013 - 2014

This study evaluated the cost and impact of food waste grinders versus alternative means of food waste management. Evaluated the impact of food waste grinders on York Region's sewage conveyance and treatment infrastructure. This included a characterization

of food waste contaminant loads and impacts through a literature review and desktop assessment. Led the development of a field sampling study and data analysis to measure sewage characteristics in a location known to have a high installation rate of food waste grinders. Assisted the Region's staff with the development of committee materials and participation in committee meetings as a subject matter expert.

Nonquon WPCP Expansion

Role: Process and Facility Design QA/QC

Client: Durham Region

Location: Port Perry, ON

Capital Cost: \$20 million

Date(s): 2010 - 2013

Acted as the technical lead for the Class C Environmental Assessment (EA) Phases 1 through 4, including evaluation of conventional and innovative treatment technologies for expansion of the existing lagoon process. Responsibilities included leading all technical assessments and acting as the technical resource for public interactions such as Public Information Centres and Stakeholder Advisory Committee. Provided process and facility design leadership and QA/QC for the preliminary and detailed design of a new 5,900 m³/d (average flow) advanced treatment plant upgrade of an existing lagoon facility. Plant components include influent pumping, screening, vortex grit removal, extended aeration, rapid-mixing coagulation, deep-bed sand filters and UV disinfection, along with supporting processes, including aeration blowers, alum chemical storage and metering, plant effluent water system, and backwash waste pumping. The facility has been designed to achieve an annual average effluent total phosphorus concentration of 0.08 mg/L through the application of the latest understanding of chemical phosphorus removal theory. The advanced treatment facility will operate as a base-loaded system with the existing lagoons used to seasonally store wet weather flows which are then decanted during summer low flow periods for advanced treatment. The lagoons are also used to store and treat biosolids.

Source-Separated Organics Anaerobic Digestion Assessment

Role: Process QA/QC

Client: Region of York

Location: Pickering, ON

Capital Cost: \$30-60 million

Date(s): 2013

Performed a desktop feasibility assessment of source-separated organics (SSO) anaerobic digestion at the Duffin Creek WPCP, including desktop SSO characterization and digestibility assessment, estimating the capacity of the existing anaerobic digestion facility

for SSO, assess the impacts of SSO digestion on the Duffin Creek WPCP, and conceptual cost estimate.

F. Wayne Hill Water Resources Center (WRC) Nitrified Sludge Recycle Pumps Replacement

Role: Process Lead and QA/QC

Client: Gwinnett County

Location: Buford, GA

Capital Cost: \$4 million USD

Date(s): 2014

Led BioWin process modelling in support of the nitrified recycle (NRCY) pump and anoxic mixer replacement, including assessment of pump capacity, swing zone functionality, potential total nitrogen (TN) limits, and tanks out-of-service for construction.

Crooked Creek Water Reclamation Facility (WRF) Plan

Role: Process Lead

Client: Gwinnett County

Location: Norcross, GA

Capital Cost: N/A

Date(s): 2012-2015

Led the process evaluations and BioWin modelling to support the wastewater facility assessment and facility plan for this 50 ML/d plant. Developed the influent design basis and evaluated technology options for primary treatment (conventional, chemically-enhanced, A/B process), primary sludge fermentation, sidestream treatment (nitrogen and phosphorus removal), and membrane bioreactor optimization to reduce energy use. Provided process design QA/QC review during the design implementation phase.

Process QA/QC and Facility Planning; Mountview WWTP; District of Muskoka; Gravenhurst, Ontario; 2013-2014. Provided QA/QC for process aspects of the Environmental Assessment, as well as performed facility planning to develop conceptual layouts for proposed alternatives as well as develop Class 5 cost estimates.

Process Lead; Beach Road WWTP; District of Muskoka; Gravenhurst, Ontario; 2014. Process review and equipment sizing for replacement aeration blowers and UV disinfection equipment. QC review of equipment specifications and performed shop drawing review.

Environmental Assessment for the Amherstview WPCP

Role: Process Lead
Client: Loyalist Township
Location: Amherstview, ON
Capital Cost: N/A
Date(s): 2010 -2014

Class C EA Phases 1 through 4 for the expansion of an extended aeration and lagoon system from 5,700 m³/d to 6,400 m³/d. Responsibilities included leading all technical assessments, including wastewater quality analysis and development of flows and loads, process alternatives evaluation and selection, hydraulics, effluent criteria/receiving water assessment, audit of the existing treatment process, and O&M problem identification. Assisted client with negotiations with the MOE on modifications to the ECA, including adjusting effluent objectives/limits and operating flexibility.

Nutrient Removal Improvements Study for Golden Pheasant WPCP

Role: Process Lead
Client: District Municipality of Muskoka
Location:
Capital Cost: N/A
Date(s): 2012

The Golden Pheasant WPCP is a tertiary wastewater treatment facility located in the Town of Huntsville, Ontario. Led the analysis of existing plant conditions using a steady-state process model to identify and evaluate process improvements and upgrades that could enhance the existing conventional process by using nitrification and denitrification to improve effluent quality. Led a desktop study, including process modelling, studying options for primary clarifier optimization, recommending operational enhancements such as routine sampling of primary effluent and coagulant dosing improvements, aeration system and blower improvements, and innovative biological treatment technologies.

Yellow River WRF Operations Support Model

Role: Process Lead
Client: Gwinnett County
Location: Lilburn, GA
Capital Cost: N/A
Date(s): 09/2011-11/2011

Developed a whole-plant process simulator for use by Yellow River WRF operations staff to support decisions on liquid train operation and provided training on BNR and the use of the model. Customized the model to mimic the plant control system screens and reflect the plant's unique process configuration.

Trenton WWTP Plant Expansion Predesign

Role: Process Engineer and QC
Client: City of Quite West
Location: Quite West
Capital Cost: \$72 million
Date(s): 2011

Provided process support during the Environmental Assessment to assess four technologies for upgrading the Trenton WWTP, including nitrification with granular media filtration, membrane bioreactor, biological aerated filter with granular media filtration, and tertiary nitrifying membrane bioreactor. Responsibilities included supervising technical assessments and process modelling and leading the development of conceptual cost estimates. Process QC for pre-design, including the development of flows and loads, refurbishment of existing shallow-bed filters, and secondary treatment refurbishment.

Process Engineer; Wilson Creek Regional WWTP Expansion and Advanced Treatment Improvements; North Texas Municipal Water District; Allen, Texas; 2010. Completed Biowin dynamic modelling of the first Bio-Actiflo process for secondary-equivalent treatment of wet weather flows. Assessed impacts of first flush and solids balance in the main secondary treatment process.

Process Engineer; Ina Road WRF Wet Weather Treatment Improvements; Pima County; Tucson, Arizona; 2009 & 2010. Completed Biowin dynamic modelling of diurnal variations in effluent ammonia based on several sidestream centrate management alternatives in order to determine feasibility of optimizing the plant design to decrease capital cost. The evaluation included sludge received from another facility thereby exacerbating centrate ammonia recycle loads. Sidestream options there were evaluated included no management, equalization, treatment using the BABE or multi-stage AT-3 processes. A conceptual process design was also developed.

Process Quality Control (QC); Kitchener WWTP; Region of Waterloo; Kitchener, Ontario; 2009 to 2010. Provided QC review and assistance to junior staff performing Biowin modelling of Kitchener Plant 2 nitrification improvements.

Process QC; F. Wayne Hill WRF; Gwinnett County, Georgia; 2009. Provided QC review of the Biowin modelling of advanced digestion upgrades evaluation and fat, oil, and grease (FOG) co-digestion to support design of a biogas co-generation system.

Process Engineer; Yellow River WRF to F. Wayne Hill Water Resources Center (WRC) Sludge Transfer Assessment; Gwinnett County; Buford, Georgia; 2008. Led the data and process analysis to support the strategy of transferring the Yellow River WRF sludge to F. Wayne Hill WRC for centralized sludge management. Developed a Biowin model to simulate sludge

transformations in the sewer system and force mains, and calibrated a Biowin model of F. Wayne Hill WRC to determine increase in loadings by sludge transfer.

Project Consultant; Yellow River WRF; Gwinnett County; Lilburn, Georgia, 2007 to Present. The Yellow River WRF will be expanded from 15 mgd (Orbal activated sludge) to a 22 mgd BNR (nitrogen and phosphorus) MBR. Provided process design and modelling for the liquid train MBR facility. Developed a Biowin model to support process analysis and selection and wrote a basis of design tech memo. Provided process review during design development and process support during construction.

Project Consultant; City of North Las Vegas; Las Vegas, Nevada; 2008. The City of North Las Vegas WWTP is a 30-ML/d greenfield plant that uses a BNR (nitrogen and phosphorus) MBR; responsibilities included the specialized analysis of process model calculations and impacts on aeration sizing.

Project Consultant; Great Blue Heron Charity Casino WWTP; Mississaugas of Scugog Island First Nation; Port Perry, Ontario; 2007. Involved in process modelling and design for an expanded Great Blue Heron Charity Casino; the new WWTP will be an MBR including influent screening and a membrane sludge thickener.

Project Engineer; Ontario Ministry of the Environment (MOE); 2009 to 2010. Comprehensive literature review of non-conventional contaminants ("microconstituents") removal by municipal WWTPs, including review of whole effluent toxicity and source control.

Project Engineer; Winnipeg Biosolids Master Plan (BMP); City of Winnipeg; Winnipeg, Manitoba; 2008 to 2010. Developed the Technomic Model to perform a solids mass balance, process sizing, and preliminary capital, operations and management (O&M), and present worth costing for biosolids technology options. Evaluated technologies included anaerobic digestion, thermal drying, thermal oxidation, Minergy GlassPack, Composting, and Cambi.

Project Consultant; Lagoon Lane WWTP; District of Muskoka; Bracebridge, Ontario; 2007 to 2008. The Lagoon Lane MBR will replace existing stabilization lagoons; Phase I design flow is 8 ML/d with most unit processes being designed for Phase II capacity of 27 ML/d peak hour flow; responsibilities included channel design (headworks, return activated sludge [RAS]) and hydraulics modelling. Led writing of the process control narratives and operations and maintenance manuals.

Project Consultant and Project Manager; Ainley & Associates Ltd., Ontario; 2008. Assisted in the preparation of an Expert Witness opinion on the Port McNicoll MBR facility.

Durham Region Computerized Maintenance Management System; Regional Municipality of

Durham; 2007. Assembled and entered data in a spreadsheet from equipment at the new Courtice WWTP; this spreadsheet will be uploaded to the Region's Computer Maintenance Management System (CMMS) database.

Summer Intern; June to August 2002 and 2003. Evaluated the integrated fixed-film activated sludge (IFAS) process and created process models to simulate nitrification upgrades and effects on sludge retention time (SRT); summarized technical information about energy conversion technologies for biogas utilization; developed a spreadsheet to calculate the seasonal temperature variations in a three-stage aerobic digester.

Technical Consultant; Anaerobic Wastewater Treatment, 3XR Research Inc.; Toronto, Ontario; August 2005 to September 2005 and May 2002. Provided data analysis and preliminary design of an anaerobic reactor for onsite wastewater treatment, and wrote a literature review on anaerobic treatment of swine manure.

Technical Consultant; Dufferin Organic Solid Waste Digester Pilot Plant; City of Toronto; Toronto, Ontario; January 2004 to February 2004. Evaluated possible causes of unstable operation and inability to reach design organic loading rate; results indicated possible inhibition by high ammonia concentrations and possible trace metal deficiencies; recommended solutions included decreasing internal water recycle and dilution with city water and supplementation of trace metals; also provided criteria for assessing future proposals for organic solid waste anaerobic digesters.

Technical Representative; Waterloo Biofilter Systems Inc.; 1999 to 2000 and 2001. Conducted site evaluations, supervised installations, collected wastewater samples, and provided preliminary designs for onsite wastewater treatment systems of 1 – 100 m³/d capacity; submitted applications and discussion papers for provincial and U.S. state regulatory approvals; prepared specifications for software to manage wastewater analytical data and wrote a user's manual; developed a new pricing guide for installers and wrote documentation explaining its preparation and use.

Career history

| | |
|----------------|---|
| 2021 - present | GHD, Process Specialist |
| 2019 - 2021 | Senior Project Manager. Cambium Inc., Peterborough, ON |
| 2017 - 2019 | Lecturer and Training Course Developer. Fleming College, Lindsay, ON |
| 2016 - 2019 | Design Manager. Jacobs (CH2M HILL), Toronto, ON |

Jeremy Kraemer | Wastewater Technical Director

2007 - 2015 Wastewater Engineer. Jacobs
(CH2M HILL), Toronto, ON

WORK EXPERIENCE

Senior Engineer, Sanitation District of Los Angeles County, California

Wastewater Research Section (June 2016 - Present)

- Major projects included:
 - ✓ Evaluation of Pilot-Scale Biotrickling Filters with Synthetic Media for Odor Control
 - ✓ Process Model for Optimization of Step-feed and MLE Biological Nutrient Removal Processes
 - ✓ Anoxic Zone Optimization using CFD Modelling for Long Beach Water Reclamation Plant
 - ✓ Boron Removal from Oil-field Wastewater using Electrocoagulation

Wastewater and Solid Waste Design Section (May 2008 – June 2016)

- Involved in several major projects including the following:
 - ✓ Valencia Water Reclamation Plant, Advance Water Treatment Facility
 - ✓ San Jose Creek Water Reclamation Plant, Flow Equalization Facilities – Phase I
 - ✓ San Jose Creek East Water Reclamation Plant, Aeration System Study
 - ✓ Whittier Narrow Water Reclamation Plant, Ammonia Station Upgrade
 - ✓ Whittier Narrow Water Reclamation Plant, UV Disinfection Facilities

Adjunct Professor (2005 - Present)

Department of Civil and Environmental Engineering, University of Southern California (USC)

- Courses taught include:
 - ✓ CE 485: Wastewater Treatment Plant Design
 - ✓ CE 484: Water Treatment Plant Design
 - ✓ CE 463L: Water Chemistry and Analysis
 - ✓ CE 453: Water Quality Control

Water/Wastewater Project Engineer/Manager (2003 - 2008)

LEE & RO, Inc., California

- Managed several major projects including the following:
 - ✓ City of Calipatria, Wastewater Treatment Plant, Cyanide Compliance Project
 - ✓ City of Los Angeles/Montgomery-Watson-Harza (MWH), Terminal Island Wastewater Treatment Plant: Future Utilization Concept Study
 - ✓ City of Holtville, Wastewater Treatment Plant Expansion: Analysis of Alternative Secondary Treatment Processes
- Involved in several major projects including the following:
 - ✓ City of Brawley, Wastewater Treatment Plant Improvements
 - ✓ Metropolitan Water District of Southern California (MWD), Mills Water Treatment Plant: Chemical System Upgrading and Modules 1 and 2 Rehabilitation
 - ✓ MWD, Jensen/Mills Water Treatment Plants: Chlorine Containment and Handling Facility
 - ✓ City of Riverside, Regional Water Quality Control Plant: Membrane Bioreactor Feasibility Study
 - ✓ County of Los Angeles, Department of Public Works: Chloramination Conversion
 - ✓ MWD, Skinner Water Treatment Plant: Oxidation Retrofit Program (ORP)

Sanitary Engineering Associate (2003)

Applied Research Division, Hyperion Treatment Plant, City of Los Angeles - Bureau of Sanitation

- Coordinated with Hyperion treatment plant for technical support. R&D projects included
 - ✓ Process optimization of high purity oxygen activated sludge (HPOAS) with anaerobic selector
 - ✓ Tertiary treatment of HPOAS secondary effluent

Post-Doctoral Research Associate (2002 - 2003)

Department of Civil and Environmental Engineering, USC

- Involved in a project for biological sulfate reduction of reverse osmosis brine with anaerobic fluidized bed reactor.

Research Assistant (1997 - 2002)

Department of Civil and Environmental Engineering, USC

- Involved in all aspects of research projects including organization, experimental setup, analyses, and technical paper preparation. Major research projects included the following:
 - ✓ Modeling and design of ultraviolet radiation-hydrogen peroxide decomposition in water treatment
 - ✓ Nanofiltration of natural and synthetic organic compounds with pre-coagulation and pre-oxidation

Graduate Teaching Assistant (1998 - 2002)

Department of Civil and Environmental Engineering, USC

Performed TA discussion session and lab session, constructed tests, and provided timely and lucid solution sets for graduate courses.

Research Engineer (1995 - 1996)

Research Institute for Environmental Technology and Sustainable Development, Korea

- Responsible for project management including preparing proposal, budgeting, scheduling, negotiating research scope with clients, and preparing project report. Major research projects included:
 - ✓ Water quality forecasting of Jin-Yang reservoir for water treatment plants around Nam-River Dam
 - ✓ Production rates and characteristics of water treatment plant sludge

Commissioned Research Scientist (1993 - 1994)

The Institute of Environmental Technology, Seoul, Korea

- Interpreted raw plant data for optimizing wastewater treatment performance. Major projects included:
 - ✓ Nutrient removal from the side-stream of municipal wastewater treatment plant
 - ✓ Improving biological nutrient removal from wastewater by incorporating anaerobic selector.

Lab Coordinator/Teaching Assistant (1991 - 1992)

Department of Civil and Environmental Engineering, Korea University, Seoul, Korea

- Performed lab session, constructed tests, and provided solution sets for courses

Research Assistant (1989 - 1991)

Department of Civil and Environmental Engineering, Korea University, Seoul, Korea

- Involved in research projects including conducting laboratory- and pilot scale experiments, sample analyses, data interpretation, and technical report preparation.

EDUCATION**Ph.D.: Environmental Engineering (2003); GPA: 3.98**

Department of Civil and Environmental Engineering, USC

Dissertation: "Nanofiltration of Natural and Synthetic Chemicals with H₂O₂/UV Pretreatment"

M.S.: Environmental Engineering (1995); GPA: 3.8

Department of Civil Engineering, City University of New York, CCNY

Master's Report: "Cometabolic Biotransformation of Chlorinated Aliphatic Hydrocarbons"

M.S.: Environmental Engineering (1991)

Department of Civil and Environmental Engineering, Korea University

Thesis: "Water Treatment Sludge Production Rates and its Thickening Characteristics"

B.S.: Civil Engineering (1989)

Department of Civil and Environmental Engineering, Korea University

LICENSE, HONORS, AWARDS, ACTIVITIES,

- California Civil Professional Engineer License #71557
- Chi Epsilon (1999 – present) the National Civil Engineering Honor Society.
- Outstanding Teaching Assistantship Award (Spring 1999) USC.
- Outstanding Achievement as a Graduate Student (Feb. 1996) City University of New York,

PROFESSIONAL AFFILIATION

- American Academy of Environmental Engineers (AAEE)
- American Water Works Association (AWWA)
- American Society of Civil Engineers (ASCE)
- American Institute of Chemical Engineers (AIChE)
- American Chemistry Society (ACS)
- Water Environment Federation (WEF)
- California Water Environment Association (CWEA)

SPECIAL SKILLS

- Proficient in computer programs including AutoCAD, WaterCAD, MathCAD, Microsoft Office (Word, Excel, PowerPoint, and Access), Microsoft Project, Corel Draw, EndNote, and Photoshop
- Proficient in programming languages including MATLAB, C++, FORTRAN
- Proficient in dynamic modeling programs including GPS-X 4.1.2, BioWin V5

GRADUATE LEVEL COURSES

Environmental Chemistry/Microbiology; Fluid Mechanics; Hydrodynamics; Numerical and Computer Methods; Statistical Methods in Environmental Engineering; Physical/Chemical/Biological Processes; Air Pollution Control System Analysis; Applied Environmental Engineering Biotechnology; Industrial/Hazardous Waste Treatment and Disposal; Advanced Water/Wastewater Treatment Plant Design; Instrumental Methods for Environmental Analysis; Systematic Research Writing, etc.

PUBLICATIONS AND PRESENTATIONS

Song, W.; Munakata, N.; Ackman, P.; Melitas N.; Sullivan, M.; Malik, A. “Pilot-Scale Comparison of Synthetic Biotrickling Filter Media for Hydrogen Sulfide Removal at the Los Coyotes Water Reclamation Plant”, Presented at the Odors and Air Pollutants Conference 2023.

Song, W.; Ackman, P.; Melitas N.; Tremblay, M.; Sharp Z. “Optimizing Hydraulic Efficiency of Anoxic Zones in Activated Sludge Systems Using Computational Fluid Dynamics Modeling”, Presented at the WEFTEC 2018.

Mansell B., Song, W.; Ackman, P.; Melitas N.; Tremblay, M.; Caliskaner O., Dyson, J., Paez, C., Reid, T. “Evaluation of the Primary Filtration Process at the Lancaster Water Reclamation Plant”, Presented at the WEFTEC 2018.

Song, W.; Bachtel, D., Mireles, L “Brawley Wastewater Treatment Plant Improvements: Secondary and Tertiary Treatment Alternatives” Presented at the CWEA Annual Conference, Palm Springs, California, April 18, 2013.

Kim, D.; Song, W.; Lu, J. “Interdisciplinary Investigation of Contaminants Fate and Transport at a Former UST site (10-year case study)”, *Environmental Earth Sciences*, 64(1), 277-291, 2011

Song, W.; Ravindran, V.; Pirbazari, M. “Optimization of the Ultraviolet Radiation-Hydrogen Peroxide (UV-HP) Oxidation Process for the Decomposition of Natural and Synthetic Organic Compounds”, *Chemical Engineering Science*, 63(12), 3249 - 3270, 2008.

- Song, W.; Ravindran, V.; Pirbazari, M. "Pretreatment Strategies for Nanofiltration of Natural Organic Matter in Groundwater" Presented at the American Institute of Chemical Engineers Annual Meeting, Philadelphia, Pennsylvania, November 7, 2008.
- Badriyha, B.N.; Song, W.; Ravindran, V.; Pirbazari, M. "Advanced Oxidation Processes For Destruction Of Endocrine Disrupting Chemicals in Water Treatment: Kinetic Modeling and Free Radical Reaction Mechanisms" Presented at the American Institute of Chemical Engineers Annual Meeting, Philadelphia, Pennsylvania, November 9, 2008.
- Song, W.; Ravindran, V.; Pirbazari, M. "Reaction Engineering of the Ultraviolet-Hydrogen Peroxide Process in Water Treatment Applications" Presented at the American Institute of Chemical Engineers Annual Meeting, Salt Lake City, Utah, November 5, 2007.
- Pirbazari, M.; Tu, S.; Ravindran, V.; Song, W. "Membrane Fouling, Surface Characterization, And Transport Models In Water Treatment Applications", Presented at the American Institute of Chemical Engineers Annual Meeting, Salt Lake City, Utah, November 6, 2007.
- Badriyha, B.N.; Song, W.; Ravindran, V.; Pirbazari, M. "Advanced Oxidation Processes For Destruction Of Endocrine Disrupting Chemicals In Water Treatment: Comparison Of Free-Radical Reaction Mechanisms, Pathways And Kinetics" Presented at the American Institute of Chemical Engineers Annual Meeting, Salt Lake City, Utah, November 5, 2007.
- Song, W.; Ravindran, V.; Pirbazari, M. "Modeling Free-Radical Reactions for Hydrogen Peroxide/Ultraviolet (H_2O_2/UV) Oxidation: Optimizing Membrane Process Efficiencies in Drinking Water Treatment" Presented at the American Institute of Chemical Engineers Annual Meeting, San Francisco, CA, November 16, 2006.
- Song, W.; Ravindran, V.; Pirbazari, M. "Optimization of Hydrogen Peroxide/Ultraviolet Decomposition of Pesticide in the Presence of Natural Organic Matter: Modeling Reaction" Presented at the 229th American Chemical Association Annual Conference, San Diego, CA, March 15, 2005.
- Song, W.; Ravindran, V.; Koel, B. E.; Pirbazari, M. "Nanofiltration of Natural Organic Matter with H_2O_2/UV Pretreatment: Fouling Mitigation and Membrane Surface Characterization", *Journal of Membrane Science*, 241(1), 143-160, 2004.
- Song, W., Ravindran, V.; Pirbazari, M. "Free-Radical Reaction Model for the H_2O_2/UV Decomposition of Alachlor", presented at the American Institute of Chemical Engineers Annual Meeting, San Francisco, CA, November 19, 2003.
- Pirbazari, M.; Tu, S.; Ravindran, V.; Song, W. "Performance of Membrane Filtration Processes in Removing Natural Organic Matter: Predictive Modeling and Evaluation of Fouling Potential", presented at the American Chemical Society Annual Conference, New York, NY, September 9, 2003.
- Song, W.; Ravindran, V.; Pirbazari, M. "Nanofiltration of Natural and Synthetic Organic Compounds in Water Supplies: Fouling Control by Advanced Oxidation (hydrogen peroxide/UV) Pretreatment and Chemical cleaning", presented at the American Institute of Chemical Engineers Annual Meeting, Indianapolis, IN, November 4, 2002.
- Song, W.; Pirbazari, M. "Advanced Oxidation Processes: A Kinetic Model for Decomposition of Organics by UV/Hydrogen Peroxide in Aqueous Systems", presented at the American Institute of Chemical Engineers Annual Meeting, Los Angeles, CA, November 15, 2000.
- Song, W.; Tu, S.; Ravindran, V.; Pirbazari, M.; Koel, B. "Surface Characterization of Membranes in Water Treatment Applications", presented at the American Chemical Society Annual Conference, San Francisco, CA, March 30, 1999.

REFERENCE

Available upon request

Doug Youngblood, PE, PMP

Project Manager

Mr. Youngblood is one of CDM Smith's national experts specializing in sewer inspection, condition assessment and rehabilitation / replacement. As a former NASSCO-certified trainer, Mr. Youngblood has leveraged his field experience to provide engaging pipe and manhole inspection training to over 200 public works professionals throughout the country.

Mr. Youngblood has project experience spanning the entire design and construction cycle. Relevant experience includes providing training, implementing inspection and rehabilitation projects, developing utilities' asset management programs and facilitating strategic asset planning.

Technical Lead, KCMO Blue River Central Collection System Rehabilitation and I/I Reduction Program – Area 2 (BRC-2), Kansas City, Missouri. Mr. Youngblood served as the technical lead for Consent Decree-mandated evaluation and rehabilitation of the KCMO BRC-2 project area. Mr. Youngblood conducted the analysis of flow meter data to identify areas of excessive rainfall derived inflow and infiltration (RDII) over a 1,320 ac sewershed. In addition, he led the team that evaluated 37 miles of closed-circuit television (CCTV) inspection video. Mr. Youngblood then applied a calculation procedure that estimated I/I quantities based on observed structural defects in the sewers. This quantification was the basis for a cost-effectiveness evaluation to select rehabilitation options. Once the rehabilitation strategy was optimized, Mr. Youngblood prepared bid documents.

Project Engineer, Sanitary Sewer Defect Smoke Testing, Minneapolis, Minnesota. Mr. Youngblood planned and coordinated smoke testing for sewer defects in two watersheds in northwest Minneapolis. Planning and coordination included developing a procedure manual and work plan; assisting with public information sessions and managing field crew progress. After the fieldwork was complete, Mr. Youngblood analyzed raw data, associated inspection video and prepared a recommendations report.

Technical Lead, Duluth Flow Monitoring/Modeling Program, Duluth, Minnesota. Mr. Youngblood worked with the City of Duluth to meet Consent Decree requirements by developing and implementing a sanitary sewer flow monitoring and modeling program. The first task was flow meter evaluation. Mr. Youngblood completed flow data review, analysis and modeling. Data review and analysis was conducted using the USEPA SSOAP program to quantify infiltration / inflow (I/I) volumes in each of the City's sewersheds. I/I parameters were used as input to the USEPA SWMM 5 model developed by CDM Smith. Mr. Youngblood calibrated the SWMM model and used it to evaluate the system during a 60-year continuous simulation and an actual 100-year rain event that occurred in the 1950s. The second task was to evaluate pre- and post-rehabilitation flows to quantify the effectiveness of the City's I/I source reduction program. Source reduction activities included sewer main rehabilitation, lateral lining and foundation drain disconnection. This evaluation assessed I/I reduction, as well as the City's technical and fiscal capabilities to sustain the program. Due to the measured success of the source reduction program, the USEPA concluded the consent decree obligations two years early.

Education

MS Environmental Engineering,
University of Nebraska, 2005

BS Civil Engineering,
University of Nebraska, 2003

Registration

Professional Engineer,
Minnesota, 2008 – 2023

Certifications

Project Management Professional 2019 - 2023

NASSCO Pipe Assessment, Manhole Assessment and Lateral Assessment Certified, 2009 – 2023

NASSCO Pipe Assessment, Manhole Assessment and Lateral Assessment Certified Trainer, 2023

NASSCO Inspector Certification Training Program, 2023

SWPPP Certified (Design of Construction Stormwater Pollution Prevention Plans), 2023

Technical Lead, Duluth Sewer Overflow Analysis, Duluth, Minnesota. Mr. Youngblood completed flow data review, analysis, and modeling for the Duluth sewer overflow project. Data review involved quality checks and analysis of raw flow data through the USEPA SHAPE program and wet weather inspection video to identify areas with high infiltration/inflow. Modeling tasks involved developing and calibrating USWPA SWMM 5.0 models of the system to determine overflow risk during design storms and over a 60-year continuous simulation period. CDM Smith modeled rain events and identified storage tank sites and volumes along seven interceptors throughout the city. The city conducted a previous study which indicated that 8.9 MG of storage must be constructed along the most critical interceptor. CDM Smith's study confirmed that the city only needed to construct a total of 4.4 MG of storage.

Project Manager and Technical Lead, Lake County Public Works Sanitary Sewer and Potable Water Pipe System Assessment and Capital Programming – Lake County, Illinois. Mr. Youngblood served as the project manager and lead engineer for a risk assessment of 693 miles of water main and sanitary sewer pipes. This risk assessment involved using ArcGIS assessment tools to assign a consequence of failure and probability of failure rating for 21,669 pipe assets. High risk assets were then organized into a series of 45 rehabilitation and replacement projects. Capital projects were developed to include cost estimates, project maps and narrative descriptions of project scope. The projects were then scheduled into a 5-year capital improvement program.

Technical Lead, Bloomington Water Main Asset Management – Bloomington, Illinois. Mr. Youngblood served as the lead engineer for risk assessment of 539 miles of potable water pipes in Bloomington, Illinois. This risk assessment integrated hydraulic model results with staff observations and pipe proximity to critical features (e.g., highways, water resources) to assign a risk rating to all pipes in the system. Once the risk evaluation is complete, a capital improvement program will be developed to address system deficiencies and high-risk areas.

Technical Lead, Village of Oak Lawn Transmission Main Asset Management – Oak Lawn, Illinois. The Village of Oak Lawn, Illinois operates and maintains a regional transmission main system that includes two booster stations, two pump stations and eleven point of delivery structures. The Village is responsible for over 1,200 individual assets. The Village is required to maintain an asset management program that is consistent with the International Infrastructure Management Manual (IIMM) protocols. Mr. Youngblood worked with Village leadership to develop an asset management program that meets IIMM requirements. In addition, he developed an MS Access-based system that Oak Lawn staff could use to track inspection and maintenance work on the transmission main system.

Project Engineer and Technical Lead, Western Lake Superior Sanitary District (WLSSD) Interceptor Rehabilitation and Replacement, Duluth, Minnesota. Mr. Youngblood worked to complete a 10-year capital and O&M plan for a 74 mile interceptor system owned and operated by WLSSD. CDM Smith compiled and evaluated condition assessment data using a suite of CDM Smith-developed, computerized asset management tools. The asset management tools introduced quantitative data and inspection video documenting condition and criticality of sewers throughout the District. Asset data was

then used to develop inspection, maintenance, rehabilitation, and replacement costs and 10-year plans for the District. CDM Smith's work helped to establish a plan to manage the condition of the District's sanitary sewer assets over its designed life; as opposed to instituting potentially premature replacements of the system.

Trainer, ArcGIS User Training for Wastewater Collection System Applications, Duluth, Minnesota. Mr. Youngblood developed a 10-hour training program for the Western Lake Superior Sanitary District to train staff in using ArcGIS to support inspection and management of collection system assets. This training program was accredited to provide 10 professional development hours. The training seminar included an overview presentation to management, eight 1-hour training modules and support documents.

Project Engineer, Assessment of Revenue Collection from Service Meters, Minneapolis Water Works, Minnesota. Mr. Youngblood participated in a review and evaluation of the Minneapolis Water Works' service meter data collection process, summarized findings and provided recommendations to increase revenue from service meter readings. Upon implementation, recommendations are expected to reduce uncollected water revenue from 17 percent to the industry standard of 12 percent (approximately a \$3 million per year savings).

Technical Lead, Sanitary Sewer Inspection and Rehabilitation Program, Oak Lawn, Illinois. Over the past eight years, Mr. Youngblood assisted the Village of Oak Lawn in developing and implementing a sanitary sewer inspection and rehabilitation program. The program prioritized rehabilitation of sewers exhibiting high I/I or structural deficiency. Mr. Youngblood reviewed inspection video and developed contract documents to maintain 174,000 ft and rehabilitate 77,000 ft of sanitary sewer (8-in to 18-in). Mr. Youngblood also provided field supervision, conducted MACP-compliant manhole inspections and developed annual regulatory reports to document rehabilitation activities.

Project Engineer, Post-Flood Storm and Sanitary Sewer Inspections, City of Minot, North Dakota. Mr. Youngblood planned for and developed contract documents to procure a contractor to clean and inspect 30,000 ft of storm and sanitary sewer (12-in to 60-in) damaged in the 2011 Minot flood. Inspections were particularly challenging, as the sewer system was expected to be in poor condition and infrastructure (e.g., roads / water service) was still out of service in parts of the City. Mr. Youngblood also provided field supervision services and developed an inspection summary report following inspection activities.

Technical Lead, KCMO Blue River Central Collection System Rehabilitation and I/I Reduction Program - Area 2 (BRC-2), Kansas City, Missouri. Mr. Youngblood served as the technical lead for the KCMO BRC-2 project from project inception through design. He provided the team with technical guidance as they completed the project's evaluation tasks and then developed a bid set. Mr. Youngblood reviewed CCTV video and developed design documents for sewer and manhole rehabilitation. Mr. Youngblood's guidance coupled with efficient project management resulted in a project that was completed on schedule and under budget.

Project Engineer, Milwaukee Metropolitan Sewerage District Gas Pipeline Conversion, Milwaukee, Wisconsin. The Milwaukee Metropolitan Sewerage District

(MMSD) is in the process of purchasing and converting an existing 6.1-mi liquid petroleum pipeline to landfill gas service. Mr. Youngblood developed alternatives, preliminary design, and final design to rehabilitate and convert the pipeline. Improvements include repair of known structural defects and construction of two pigging stations.

Project Manager and Technical Lead, 2012 Flood Reconstruction – Hermantown Interceptor, Western Lake Superior Sanitary District, Minnesota. Mr. Youngblood planned for, developed contract documents and provided engineering services to procure a contractor to reconstruct 110 ft of 15-in sanitary sewer pipe that washed away following a historic flood in the region. This project was particularly challenging due to difficult access, tight deadlines and complex regulatory coordination. This project was completed on-schedule and with fewer than 2% change orders.

Project Engineer, Minneapolis Flood Control Area 21 & 22, Minneapolis, Minnesota. Mr. Youngblood conducted storm sewer modeling and analysis work for a flood-prone, residential area near Lake Hiawatha. He attended citizen advisory committee meetings to work with the neighborhood and the city to develop five flood control alternatives. The five flood control alternatives were then modeled using XP-SWMM. A triple-bottom-line analysis was completed on the alternatives and the optimal flood control solution was selected. The selected alternative will protect public and private property during the 10- and 100-year, 24-hour rain events.

Trainer, Pipe Assessment and Manhole Assessment Certification Program Training. Mr. Youngblood provides two and three-day National Association of Sewer Service Companies (NASSCO) Pipe Assessment, Manhole Assessment and Lateral Assessment (PACP / MACP / LACP) Certification Program trainings for municipalities throughout the country. As of Fall 2019, Mr. Youngblood has trained and certified over 200 students. Mr. Youngblood has also prepared and presented supplementary training modules on condition-based asset management, enhanced inspection technologies and storm conveyance structure assessment.

Trainer, Comprehensive Sewer Asset Management Seminar (Cali Colombia). Mr. Youngblood provided two, four-hour training seminars to the Asociacion Colombiana De Ingenieria Sanitaria Y Ambiental (ACODAL) in Cali, Colombia. The seminar presented sewer system best practices to an audience of forty engineers and utility managers. Topics that were discussed include inspection best practices, common inspection technologies, an overview of common rehabilitation methods, O&M program development, risk-based asset management and capital programming for sewer systems.

Project Manager and Technical Lead, Scanlon Fiberglass Reinforced Pipe Rehabilitation, Esko, Minnesota. WLSSD owns approximately 4,767 ft of 42-in fiberglass reinforced pipe that was at risk of failure due to conveyance of high-temperature industrial wastewater. Mr. Youngblood served as the project manager and technical lead for the design of an interceptor rehabilitation system that used CIPP liners with temperature-resistant vinyl ester resin. This project is notable for the use of a non-traditional resin system and the large-scale rehabilitation of FRP pipe. Mr. Youngblood also served as the project manager and lead engineer during the construction phase. This project was

completed on-schedule and on-budget to provide WLSSD with a system that can better accommodate industrial flows.

Project Manager and Technical Lead, Rice Lake, Woodland, Cloquet and West Interceptor Rehabilitation, Duluth / Hermantown / Cloquet, Minnesota. Mr.

Youngblood served as the project manager and lead engineer during the design of cured-in-place pipe liner rehabilitation for 10,200 lf of interceptor pipe. Interceptor pipes that were rehabilitated were 15-in to 36-in diameter. This rehabilitation project involved coordination of work in a variety of locations such as wetlands, heavily wooded areas, on the University of Minnesota – Duluth property and along City of Duluth streets. In addition, Mr. Youngblood was the project manager and lead for engineering services during construction.

Project Manager and Technical Lead, Green Bay Siphon Inspection Planning, Green Bay, Wisconsin. Mr. Youngblood served as the technical lead and project manager for the

development of a detailed inspection plan for four siphons and a 108-in sanitary sewer tunnel in the NEW Water sanitary district. Three of the siphons convey wastewater under the Fox River and are very difficult to access. As such, the inspections need to efficiently collect data that will help to drive future maintenance and rehabilitation decisions. The plan identified laser profilometry, sonar, closed-circuit television and panoramic camera inspections as ideal inspection technologies for the five difficult-to-inspect pipelines. In addition, a technical specification was prepared and will be used to procure these enhanced inspection services.

Publications

Youngblood, D.J. “Implementing a Cost-Effective Infiltration and Inflow Reduction Program through Prioritized Sewer Inspection and Rehabilitation” Central States Water Environment Association 2020 Conference Proceedings (St. Paul, Minnesota 2020).

Youngblood, D.J. “Practical Recommendations when Installing Cured-in-Place Pipe Liners in Elevated Temperature Sanitary Sewer Applications” Water Environment Federation 2019 Conference Proceedings (Chicago, Illinois 2019).

Youngblood, D.J, Meyer, W., Gallagher, J., Wagle, M. and Wendorf J. “Sustainable infiltration and inflow reduction program through prioritized sewer rehabilitation in Oak Lawn, IL” Water Environment Federation Collection Systems Conference Proceedings (Cincinnati, Ohio 2015).

Youngblood, D.J., Schroeder, J and Kunay J “Cost effective inflow and infiltration reduction programs with robust and comprehensive sewer system rehabilitation” Trenchless Technology Magazine (November 2014).

Youngblood, D.J., Clement C. “Efficient asset management planning: condition – criticality based assessments of WLSSD assets” Water Environment Federation Collection Systems Conference Proceedings (Saint Louis, Missouri 2012).

Youngblood, D.J. "Using computer asset management tools to prioritize distribution line inspections" American Water Works Annual Conference and Exposition (Dallas, Texas 2012).

Youngblood, D.J., Clement C. "Asset management at the WLSSD: A condition/criticality based approach to support collection systems CMOM programming" Central States Water Environment Association Conference Proceedings (Brooklyn Center, Minnesota: 2011).

Youngblood, D.J. "Condition and criticality based asset management for collection systems" Minnesota Conference on the Environment (Brooklyn Center, Minnesota: 2010).

Youngblood, D.J, Mathews, D, "Gravity interceptor asset management using computerized decision tools", *Conference Proceedings: Midwest Society for Trenchless Technologies Seminar*, Rochester MN, 2009.

Youngblood, D.J., "Moorhead solids treatment upgrade: Thickening & anaerobic digestion process improvements", *Conference Proceedings: Minnesota Conference on the Environment*, Brooklyn Center MN, 2009.

Youngblood, D.J., Dvorak, B.I., Hawkey, S.A., "Indirect benefits of pollution prevention technical assistance estimated using fuzzy set theory", *The Journal of Cleaner Production*, Vol. 16 (2008).

Youngblood, D.J., Dvorak, B.I., Hawkey, S.A., Hygnstrom, J.R., Woldt, W.E. "Quantifying and comparing a pollution prevention program's benefits: pollution prevention technical assistance in Nebraska", *The Journal of Cleaner Production*, Vol. 16 (2008).

Youngblood, D.J., Dvorak, B.I., Hygnstrom, J.R., Woldt, W.E., Hawkey, S.A. "Lessons learned concerning impact assessments: pollution prevention technical assistance in Nebraska", *The Journal of Cleaner Production*, Fall, Vol. 16 (2008).

Youngblood, D.J. "Quantifying Pollution Prevention Technical Assistance Success in Nebraska" Nebraska Water Environment Association Conference Proceedings (Kearney, Nebraska: 2004).

Youngblood, D.J. "Esko Pump Station: Designing for Flexible Operations and Maintenance" Minnesota Water Operators Association Conference Proceedings (Grand Rapids, Minnesota: 2016).

Youngblood, D.J. "Standardized Sewer Inspection: An Overview for Users" Minnesota Water Operators Association Conference Proceedings (Grand Rapids, Minnesota: 2016).

Youngblood, D.J. "Enhanced Culvert Inspections: Overview of the Best Practices Handbook" Youtube.com Presentation for the Minnesota Department of Transportation (<https://www.youtube.com/playlist?list=PLY1b5k2L-2v0jSUTLaIPx99SHY1nQhqmc>, 2017).



Tina Whitfield

Hydraulic Modeling

Tina has over 20 years of experience with hydraulic modeling and master planning coupled with a strong foundation in boots on the ground design, permitting and construction of conveyance and treatment plant projects. This unique combination lends itself to understanding how to select and implement flow monitoring, develop and calibrate hydraulic models to achieve sound hydraulic data to drive decisions, as well as the importance of right-sizing infrastructure.

RELEVANT EXPERIENCE

EDUCATION

Bachelor of Science, Civil Engineering, Georgia Institute of Technology, 1997

REGISTRATIONS

Professional Engineer, Georgia, United States, No. 27424

Professional Engineer, Montana, United States, No. 16439

Professional Engineer, North Carolina, United States, No. 041277

INDUSTRY TENURE

23 years

HDR TENURE

20 years

OFFICE LOCATION

Winston-Salem, NC

PROFESSIONAL MEMBERSHIPS

American Water Works Association, 2003-Present

American Water Works Association, Montana Section, Chair, 2010

American Water Works Association, Engineering Modeling and Applications Committee, 2011-Present

Comprehensive Wastewater Master Plan, Charlotte Water, NC, QA/QC

HDR is completing an overarching and holistic master plan, across all basins and facilities, to integrate previous planning and provide a long-term vision for Charlotte Water's entire wastewater system. In addition to the planning that has already been completed for the wastewater system, there are numerous factors that will influence the system over the next 30 years ranging from growth and development to new regulatory requirements and the potential impact of climate variability. In addition to capital improvement needs, the WWMP also focuses on the following areas:

HDR developed a dynamic simulation model that reflects the major system components of the wastewater collection (major pump stations) and treatment system, integrating the system dynamics including the ability to transfer wastewater flows between treatment facilities, the import and export of wastewater flows from outside the service area, as well as effluent discharge constraints (ex. water quality limitations, IBT). Basin hydraulic modeling was completed in InfoWorks ICM SE.

Based on the outcomes of these evaluations, HDR has worked to identify the timing for implementation of the recommended improvements and identify triggers to support Charlotte Water's decision process on the timing for the implementation of the future projects related growth, future regulatory requirements, or operational changes. Project identification has focuses on needs over the next 5-years and major capital projects (large capital costs) that need to be planned for in the future (ex. treatment process changes due to regulatory requirements, regional solutions, IBT management, O&M strategies).

Mooreville Master Plan, Mooreville, NC, QA/QC

HDR has worked with the Town of Mooreville Public Utilities Department to develop a comprehensive utility-wide master plan that identifies and prioritizes expansion, improvement, rehabilitation, and replacement projects for Mooreville's water and wastewater treatment facilities, collection system pump stations, water distribution system and sanitary sewer collection system to accommodate continued service area growth, meet future regulatory requirements, enhance resilience, and maintain reliability.

This master plan provides a roadmap for water and wastewater infrastructure improvements over the short-term (within five years) as well as the long-term (30-year) planning horizon. The project included the following primary elements:

- Evaluation of trends and patterns in customer demand and discharges
- Development of spatially distributed water demand, wastewater flow, and interbasin

transfer forecasts based on regional planning studies and current development proposals

- Development of hydraulic models of the wastewater collection and water distribution systems
- WWTP review, including process modeling, to assess plant performance, capacity, biosolids management, regulatory compliance, and the level of redundancy and reliability at the facility

Broken Arrow Municipal Authority, Broken Arrow Wastewater Master Plan, OK, Modeling Lead

The project included 90 days of collection system flow monitoring services, development of a collection system model, evaluation of the collection system capacity and future improvements, evaluation of the wastewater treatment capacity and future improvements, and development of a final master plan report which includes a 5-year and 20-year capital improvements program for the Broken Arrow Municipal Authority (BAMA). The development of the collection system model was from the ground up, and included significant GIS updates and data collection. The existing GIS had significant connectivity issues, including long segments of gravity main that extended through multiple manholes, lacked unique identifiers for pipe and manhole assets, and lacked physical attributes. Between BAMA obtained survey and HDR review of as-built information, the hydraulic model was constructed in InfoWorks CS (and then converted to InfoWorks ICM) to include all pipes 10-inch and larger. HDR developed a grid schema for creating manhole identifiers and provided this information to BAMA. Accurate connectivity for the pipe network was then created that included physical attributes including length, diameter, material, slope and age. Where asbuilts were not available, and slope information was assumed, the GIS layer also included a notation that the information needs to be confirmed. Data also provided to BAMA included the results from the hydraulic model, both for existing flows and depths, as well as buildout conditions. This will enable BAMA to enhance their capacity assurance program and right-size for current and future conditions.

Norman Utilities Authority, Flow Monitoring and Modeling, Norman, OK

HDR will provide a system model of the collection system to the City of Norman using the Infoworks software platform. The model will be developed based on information from the City such as sewer system attributes (GIS database import), lift station data (pump run times, float elevations, pump curves), historical plant flow, and load allocation (existing system and FBO 2030). The model will to include all pipelines 10-inch in diameter and larger, with a selected amount of smaller pipes.

Role: Modeling

Charleston Water System, Wastewater Collection System Hydraulic Assessment, Modeling QC – Charleston, SC

HDR is providing engineering services for Charleston Water System (CWS) in advance of their upcoming collection system master plan. Work includes providing a review of available hydraulic modeling software and recommendations, a summary of the success of the recommended software and its' long term sustainability, and CWS needed hardware, software and IT support. A large portion of the project includes a data gap analysis of CWS GIS, flow monitoring and rain gauge network, pump curve information, customer meter data and record drawing system, as well as developing the workflow needed to develop the hydraulic model and update and maintain the model long term.

Unified Govt. Of Kansas City, Kansas Wastewater Master Plan, KS

HDR provided services related to development of a Wastewater Master Plan for the Basins West of Muncie Creek as identified in the Unified Government's Overflow Control Plan. The Wastewater Master Plan considered the ultimate development of these basins. The master planning effort included the development of alternatives for the ultimate development of the facilities. Consideration was given to wastewater treatment and conveyance needs.

Role: QA/QC

Enprotec/Hibbs & Todd Inc., Abilene WW MasterPlan, Abilene, TX

HDR teamed with Enprotec-Hibbs & Todd on this important collection system project for the City of Abilene. Abilene had not previously conducted an evaluation of its existing collection system utilizing a hydraulic model. Extensive flow monitoring was conducted as part of this analysis in order to set a baseline for the system. Model construction included manipulating existing GIS data, CAD atlas maps and surveyed field data. Prior to the start of the project, the City and the HDR Team discussed which model platform would best suit the City's needs. After discussing numerous options, HDR recommended and the City chose to use H2OMAP SWMM. After calibration, the model was used to quantify the carrying capacity of the existing interceptors for current and projected flows, determine capacity of future interceptors and its impact on carrying capacity of the existing interceptors, and determine planning level construction costs for Abilene's Capital Improvements Plan. Our analysis also included a Satellite Plant Evaluation including impacts to the collection system and existing treatment plant. The HDR team also provided training on the model.

Role: Collection System Modeling

College Station Collection System Planning Evaluation, College Station, TX

The Collection System Planning Evaluation project included: determining wastewater flows; developing and calibrating a collection system model using InfoSewer; perform flow monitoring; quantify carrying capacity; determine capacity of future interceptors; determine planning level construction costs; train City staff onsite on model implementation; and review and revise the Wastewater Demand Analysis and Wastewater Facilities Planning.

John Weiland, PE

SENIOR PROJECT MANAGER



EDUCATION

- » MS, Civil Engineering, Emphasis on Water Resources Engineering, University of Missouri-Rolla
- » BS, Civil Engineering, University of Missouri-Rolla

REGISTRATION/CERTIFICATION

- » Professional Engineer: MO, NE, IL

QUALIFICATIONS

- » 24 years of experience in wet weather planning and collection system improvements in Detroit, Omaha, Cincinnati, and St. Louis
- » Skilled in alternative evaluation, hydraulic design, pump station design and project startup
- » Effectively maintains ongoing communication with clients and all stakeholders

FIRM/COMPANY

Wade Trim

PERTINENT PROJECT EXPERIENCE

Saddle Creek CSO Retention Treatment Basin (RTB), City of Omaha Public Works Department, NE. Design Manager for the City's first CSO treatment facility, with a construction value of \$90 million (in 2018). Services include a basis of design report, preliminary and final design, as well as bidding services and construction management of a 160-MGD RTB with a minimum 30-minute disinfection detention time, and 320-MGD hydraulic and disinfection capacity. Led all aspects including hydraulics, technical memo preparation, and design document development. All combined sewage entering the RTB will receive grit and screenings removal, disinfection, solids settling, and dechlorination before being discharged to the Little Papillion Creek. The captured volume in the tank will be pumped into the Papillion Creek Interceptor and conveyed to the WWTP for full secondary treatment. Led the project design revision from a 315-MGD to a 160-MGD facility in order to meet the City's budget limitations from 2017-2018, as well as

bidding phase services in 2018, and services during construction from 2019-present, including field observation, and construction management. Remaining services include preparation of operations and maintenance manual, start-up assistance, and closeout documentation. Substantial completion is scheduled for winter 2023 and final completion is scheduled for summer 2023.

Gravois Trunk Sanitary Storage Facility, Metropolitan St. Louis Sewer District (MSD), MO. As a subconsultant, led the hydraulics evaluation, preliminary and final design, construction, and start-up of an 8.0-MG wet weather sanitary storage facility with two, 4.0-MG above-ground tanks (AWWA D110 Type III with domed covers) and a 52-MGD influent pump station. Design included civil, structural, process, and electrical/I&C design of a tank cleaning system consisting of a cistern and pumping system to deliver reclaimed stormwater or potable water to spray nozzles inside wet weather sanitary storage tanks. Construction value is \$24 million (in 2018 dollars).

University City Storage Facility (Hafner Court), City of University City, MO. Project Manager from 2014-2018 for Wade Trim's services for a 9-MG wet weather wastewater storage facility within the University City watershed of the MSD Lemay Sanitary Service Area. Managed and performed design engineering for planning and preliminary design which included options for a 30-foot-diameter, 1,250-foot-long storage cavern to fill by gravity using new consolidation sewers, and discharge by gravity to the existing Skinker-McCausland Tunnel, a deep, 6.5-foot diameter conveyance tunnel. Led the development of alternative options for sanitary storage including above- and below-ground storage tanks, including performance and review of preliminary layouts, cost estimates, and site evaluations. Also managed performance of hydraulic evaluations to confirm storage sizing, as well as design of structural, process, and mechanical aspects of the storage cavern, drop shafts, and connecting tunnels.

Kingsland Sanitary Storage Facility, Metropolitan St. Louis Sewer District (MSD), St. Louis, MO. Project Manager for the 1-MGD storage facility in the University City watershed of the MSD Lemay Sanitary Service Area. Led hydraulic evaluation to confirm storage sizing, as well as alternative development for above- and below-ground storage options, prepared and reviewed reports, developed preliminary layouts and cost estimates, and developed documents used by the MSD for Design-Build procurement.

SOIA Lift Station Improvements Design, City of Omaha Public Works Department, Omaha, NE. Project Manager for study and design of various improvements to the existing 17.4-MGD lift station to improve facility operations. These improvements included upgrades to odor control, grease, and grit management, and process piping and valves. Currently managing services during construction.

Licking River Equalization Basin, Sanitation District No. 1 of Northern Kentucky, Fort Wright, KY. Deputy Project Manager for the design of Type II/III EQ storage tanks including circular, pre-stressed concrete tanks (AWWA D110) with domed covers. The size is a 17.7-MG tank with a 26-MGD pump station. The storage system will have a "pump in" and "gravity out" arrangement. During wet weather events excessive sewage flow will be diverted from adjacent sewers and into a new wet weather pump station.

Creve Coeur Creek (L-52) Pump Station and Force Main, Maryland Heights, MO. Project Manager during construction and start-up of the \$24 million (in 2008) pump station and force main. The 60-MGD wastewater pump station was designed to replace a 37-MGD station and accommodate planned future flows. The pump station included a self-cleaning wet well design with 5 non-clog vertical pumps with variable frequency drives (VFDs), biofilter, and ferrous chloride feed system. The 17,000-foot, 42-inch-diameter force main from the new pump station to the Missouri River WWTP was installed parallel to an existing 42-inch force main and designed to accommodate the future flows.

Regional Water Reclamation Facility (RWRF) Disinfection System, City of Jefferson City, MO. Project Manager for design of UV disinfection for the 11-MGD average,

60-MGD peak sequencing batch reactor system to meet new Missouri Department of Natural Resources effluent quality requirements. The \$6-million (in 2010) modifications included design for the outfall of the effluent line to the Missouri River and new mechanical bar screen and associated improvements in the plant headworks facility. Managed civil design from planning through construction and start-up of the RWRF.

Caulks Creek Force Main, Metropolitan St. Louis Sewer District, MO. Project Manager for design of 11,000 feet of 30-inch force main and 900 feet of 10-inch force main as well as 1,000 feet of 36-inch gravity sewer to provide redundancy and improve system hydraulics. Performed hydraulic evaluations of 5 major pump stations within the manifolded system to properly size the new redundant force mains. Included construction phasing and permitting with multiple agencies for crossings of railroads, creeks, levees, interstate highways, and wetlands.

Systems Planning Technical Support Services, Great Lakes Water Authority, Detroit, MI. Project Engineer assisting with development of a questionnaire used to survey other owners in various locations throughout the U.S. on their experience with existing CSO netting facility installations. This information will be used to assess the track record of performance and number of existing installations for purposes of evaluating feasibility of additional installations.

Minot Flood Disaster Recovery Management, City of Minot, ND. Project Engineer managing tasks associated with damage assessment and documentation, project scope development, funding assistance with FEMA and other agencies, project design, and bidding for the City's infrastructure damaged by the June 2011 Souris River flood. Projects included repair of streets, storm and sanitary sewers, sanitary lift stations, bike paths, pedestrian bridges, and public building facilities.

Spencer Creek WWTP Solids Processing Improvements, City of St. Peters, MO. Project Engineer for construction and startup of a new waste solids processing facility including belt filter presses. The facility produces dewatered waste solids that are added to the City's waste composting facility.

Laura Locke, P.Eng, M.Eng.

Process Engineer

| Education | Professional Affiliations | Licenses/Registrations | Years of Experience |
|---|--|---|--------------------------------------|
| M.Eng, Water Resource Management, University of Melbourne, 2010 | Engineers and Geoscientists BC Water Environment Federation | Professional Engineer, British Columbia | With AECOM: 9 With Other Firms: 3 |
| BASc, Chemical and Biological Engineering, University of British Columbia, 2009 | British Columbia Water & Waste Association | | |

Relevant Experience

Laura is a project manager and process engineer in the Burnaby office with twelve years of experience in wastewater, biogas and odour control systems. She has worked on assignments involving feasibility and planning, design, construction, and commissioning of wastewater treatment facilities, biogas system upgrades, pump station upgrades, solids handling, and odour control projects. Laura is currently involved in various wastewater treatment plant expansion, odour control, biogas, and solids handling projects throughout British Columbia.

Project Experience

Lulu Island WWTP Biogas Cleanup Project, Richmond, BC. Project manager, project engineer and contract administrator for the construction of a new sludge gas treatment system to upgrade surplus digester biogas to pipeline quality biomethane. Responsibilities include technology evaluation, preparation of design drawings and reports, production of technical specifications, construction monitoring and oversight, commissioning support, review of record drawings, and contract management. [February 2018 – ongoing]

Regional District of Nanaimo, French Creek Pollution Control Centre, Stage 4 Expansion, Parksville, BC. Project manager and process engineer for the design and construction of the Stage 4 expansion of the French Creek Pollution Control Centre. The project includes a new effluent pump station designed for 600 L/s, four combined treatment unit (CTU) style bioreactors / secondary clarifiers, a 750 m³ equalization tank, and renovations to the existing treatment plant. [November 2022 – ongoing]

National Water and Wastewater Benchmarking Initiative, Various Municipalities across Canada. Technical Lead for Wastewater Collection & Utilities for the National Water and Wastewater Benchmarking Initiative. Responsibilities include data analysis and facilitating annual review sessions with member utilities. [February 2014 – ongoing]

Iona Island WWTP Biosolids Dewatering Facility, Richmond, BC. Project engineer involved in the design and construction of the new Iona Island WWTP Biosolids Dewatering Facility to mechanically dewater biosolids using three centrifuges. Involved in the development of the process and instrumentation diagrams for the facility and writing technical specifications for the project agreement. Current involvement includes owner's engineering support for the design-build construction contract, which includes resident engineering, contractor submittal reviews, and commissioning lead. [January 2018 – ongoing]

City of Prince George Sanitary Lagoon Feasibility Review, Prince George, BC. Project manager for a feasibility review of four sanitary lagoons to identify options for capital improvements that will meet the federal Wastewater Systems Effluent Regulations (WSER) by 2030. Deliverables will include a final report of the assessment findings, concept drawings, Class D capital and lifecycle cost estimates, and proposed implementation timelines. [November 2021 – ongoing].

Metro Vancouver Ammonia Conceptual Study, Richmond and Delta, BC. Project manager for a study to quantify the projected regulatory risk associated with effluent ammonia discharged to the Fraser River under various operating scenarios. [November 2021 – ongoing]

Greater Nanaimo Pollution Control Centre Secondary Upgrade – Municipal Wastewater Regulation Registration, Nanaimo, BC. Project manager and engineer for the application to register the effluent from the Greater Nanaimo WWTP under the Provincial Municipal Wastewater Regulations. Responsibilities included identification and coordination of the required documents for the MWR application, verification that the contents met requirements, development of the Operating Plan, and assembling the MWR Application package for submission to the BC Ministry of Environment. [May 2019 – September 2020]

8th Avenue Interceptor Air Management, Vancouver, BC. Deputy project manager and project engineer for the design and construction of two air management facilities on the 8th Avenue Interceptor, which services a major portion of the City of Vancouver. The facilities will be designed to maintain negative pressure and mitigate odours in the 8th Avenue Interceptor and Highbury Interceptor. [February 2015 – August 2022].

Iona Island WWTP Project Definition, Richmond, BC.

Project engineer involved in the Project Definition phase of the Iona Island Wastewater Treatment Plant Secondary Upgrade. Responsibilities included identification of user and stakeholder requirements, summarizing the regulatory framework as it relates to federal, provincial and regional requirements, and developing the operations and maintenance plan. [October 2018 – October 2020].

Annacis Island WWTP Stage 5 Upgrade Project

Management Support Services, Delta, BC. Project engineer involved in providing project management support services for the Stage V Expansion of Annacis Island WWTP, Metro Vancouver's largest treatment plant. Responsibilities include support services for the Metro Vancouver Project Delivery Team to review consultant submissions and identify potential process limitations in the design. [March 2014 – January 2020]

Regional District of Nanaimo, Greater Nanaimo Pollution Control Centre Energy Study, Nanaimo, BC.

Project engineer for the evaluation of potential energy conservation measures, as outlined by BC Hydro's Guidelines for an Industrial Energy Efficiency Feasibility Study. As part of this study, wastewater treatment processes were reviewed and options were developed to improve energy efficiency as part of the secondary treatment expansion of the facility. Energy conservation opportunities were identified in the aeration system, facility lighting, and various pumping processes. Responsibilities included review of historical data and relevant background information, establishing energy use baseline, calculation of WWTP energy consumption, identification and analysis of potential energy saving opportunities, and reporting. [November 2015 – October 2017]

Highbury Interceptor Air Management Facility, Vancouver, BC.

Project engineer for the design and construction of a 13,000 cfm odour control facility to maintain negative pressure and mitigate odours in the Highbury Interceptor. Involved in the detailed design of the facility, including process equipment sizing & selection as well as construction engineering support services. [March 2014 – December 2019]

Gilbert Trunk Sewer and Lulu Island WWTP Air Management Strategy, Richmond, BC.

Project engineer for the Gilbert Trunk Sewer and Lulu Island Air Management Strategy project. Responsibilities include: odour sampling, evaluation of appropriate technology options to mitigate the odours, preparation of design drawings and report, determining the facility footprint size and assessing any potential land-use issues, production of technical specifications, and tendering services. [June 2014 – ongoing]

South Surrey Interceptor Air Management and Odour Control, Surrey, BC.

Process engineer involved in the detailed design of two odour control facilities (Highway 91 & King George) on the South Surrey Interceptor. Responsibilities included: evaluation of appropriate technology options to mitigate the odours, preparation of design drawings and report, determining the facility footprint size and assessing any potential land-use issues,

production of technical specifications, and construction engineering services. [February 2015 – March 2021].

Manpower Assessment for Wastewater Treatment Plants, Vancouver, BC.

Project engineer for the review of current operations and maintenance staffing at Metro Vancouver's five wastewater treatment plants and development of a forecast of the future 15-year O&M staffing requirements. [January 2018 – July 2018]

Regional District of Nanaimo, Sedimentation Gear Drive Replacement Study, Nanaimo, BC.

Project engineer providing technical review of available primary sedimentation tank gear drives and a recommendation for the purchase of replacement gear drives. [October 2017 – January 2018]

Denver Public Works, Delgany Interceptor and South Platte River Study, Denver, CO.

Project engineer involved in performing a screening level analysis for implementing sewage heat recovery (SHR) at the National Western Center campus in Denver, Colorado. Responsible for identifying and evaluating various types of SHR systems as well as analyzing the potential energy supply from the Delgany Interceptor. [February 2017 – July 2017]

District of West Vancouver, Odour Assessment and Mitigation for Dufferin A Sanitary Lift Station, West Vancouver, BC.

Project engineer for the evaluation of hydrogen sulphide and odour generation at a sanitary lift station in West Vancouver. Responsible for conducting odour monitoring at site, reviewing monitoring results, assessing treatment technology options, and providing a recommendation for consideration by the District to mitigate odours at the lift station. [July 2015- November 2015]

Regional District of Kitimat-Stikine, Thornhill Lift Station Design, Thornhill, BC.

Project engineer for the design and construction of a pre-packaged FRP lift station. Responsible for the detailed design, tender document preparation, and technical support for the construction and commissioning of the lift station. [June 2015 – March 2016]

City of Revelstoke, Revelstoke STP Odour Control, Revelstoke BC.

Project engineer for the design and construction of an odour control package for the Revelstoke Sewage Treatment Plant (STP). Responsibilities included writing the specification for the carbon scrubber odour control system and preparing the pre-purchase RFQ package. [June 2014 – September 2014]

Publications and Presentations

"Sewer Air Management in Vancouver's Kitsilano Area", WEFTEC, New Orleans, Louisiana, October 2018

"Odour Control in Sewer Systems", BCWWA Operator Continuing Education Day, Vancouver, BC, December 2017

Narasimman Lakshminarasimman, B.Tech. (Honors), M.S.

PhD Candidate in Civil & Environmental Engineering, University of Waterloo
243-350, Columbia Street West, Waterloo, ON, Canada – N2L 6P2.

Email: barathanarasimman@gmail.com nlakshmi@uwaterloo.ca || Mobile: +1 (226) 792-6802

Summary of Skills



Process modeling

Optimizing wastewater treatment processes in BioWin, SIMBA# platforms. Modeling GHG emissions.



Performance Testing

Designing test plans, coordinating sampling campaigns, and diagnosing and solving process upsets.



Project Management

Managing partnerships, identifying resources needed, adapting to dynamic constrains.



Communication Skills

Effective writing at all levels, delivering presentations, facilitating workshops and discussions.

Technical Expertise

Municipal wastewater treatment, sludge treatment, GHG emissions estimation, and emerging contaminants.

Career Progression



Relevant Experience

Membrane aerated biofilm reactor (MABR) upgrades at the Hespeler WRRF, Cambridge, Ontario.

PhD Dissertation Project (2019 – Present)

Team: Region of Waterloo, Veolia Water Technologies and Solutions, Ontario Clean Water Agency, InCtrl Solutions, University of Waterloo

Process Engineering Experience:

- Designed and executed a performance testing and optimization plan to minimize electricity consumption and enhance effluent quality.
- Benchmarked key performance indicators related to electricity consumption and pollutant removal before and after MABR upgrade.
- Developed an excel dashboard combining lab analysis and SCADA data to visualize, track, and troubleshoot the plant performance.
- Modeled the full-scale MABR process SIMBA# and predicted the plant performance limits and optimal operational conditions.
- Monitored and modeled the greenhouse gas emissions (N₂O) by the biological process under varying operations.

Relevant Experience (Continued)

Membrane aerated biofilm reactor (MABR) upgrades at the Hespeler WRRF, Cambridge, Ontario (Continued).

Project Management Experience:

- Actively participated in weekly project meeting to advice on the plant operations and optimization.
- Engaged with multidisciplinary collaborators in microbiology, analytical chemistry, and microscopic imaging to further our understanding of the full-scale MABR process. Translated the research findings into practical recommendations for optimal plant operations during summer and winter conditions.
- Organized and facilitated annual Stakeholders Advisory Group (SAG) meetings to update project progress and seek collaborative inputs.
- Supervised undergraduate co-op students. Delegated research tasks, oversaw progress, and provided constructive feedback.
- Coordinated project activities with stakeholders to ensure operational changes, sampling campaigns, and monitoring equipment deployment are carried out in a timely manner.
- Drafted update reports and data summaries for the project partners and funding agencies.

Monitoring the removal of PFAS, PBDEs, and phenolic contaminants in Canadian sludge treatment plants.

Independent Project during PhD Study (2019- Present)

Team: Environment and Climate Change Canada, University of Waterloo

- Collected operational data from 12 sludge treatment processes across Canada.
- Constructed mass balances and performed Monte-Carlo simulation to estimate contaminant removal efficiency.
- Published peer-reviewed journal articles and presented the findings in WEFTEC and WEAO meetings.

Testing and evaluation of point-of-use water treatment devices, PAA and UV disinfection systems, on-line sensors, and pilot-scale water and wastewater treatment sludge systems.

Full-time Job Experience (2017-2019)

Team: US Environmental Protection Agency, APTIM Federal Services, Cincinnati Metropolitan Sewer District (MSD)

Technical Experience:

- Optimization of combined peracetic acid (PAA) and UV disinfection of secondary effluent.
- Pilot-scale operation of an activated sludge system and wastewater collection system test beds to study the fate of surrogate contaminants for biological threats.
- Pilot-scale evaluation of different filtration media for removal of nutrients, pathogens, radiological contaminants, and petroleum hydrocarbons in storm water detention pond retrofit devices.

Occupational Health and Safety

- Conducted risk assessment for various tasks involved in different projects and drafted Health and Safety Plans. Performed regular on-site health and safety inspections.

Project Management:

- Managed the research partnership between US EPA, APTIM, and Cincinnati MSD
- Estimated time and labor requirements for different task orders and managed the budget.
- Drafted project proposals with the program manager.
- Drafted Quality Assurance Project Plans for projects of different categories and.
- Liaised with project partners during regular update meetings and advised on the next steps.
- Oversaw subcontractor tasks such as sample analysis at commercial labs and equipment repairs and installation

Relevant Experience (Continued)

Feasibility of a full-scale anaerobic digestion plant utilizing municipal food waste

Independent Project during Masters's Study (2014-2015)

Team: University of Cincinnati, Rumpke Waste and Recycling, Cincinnati

US Small Business Institute Project of the Year Award – First Runner up (2016).

- Led a team of 4 undergrad students to survey anaerobic digestion technology providers across North America.
- Gathered process details, formulated a multi-criteria vendor selection methodology and forecasted the project costs for a full-scale anaerobic digester utilizing food waste from southwestern Ohio.

Involvement in Professional Organizations

Magazine Committee, YP Editor, Water Environment Association of Ontario (WEAO)

2020-

Present

- Managed article submissions from the WEAO YP committee for Influent, a quarterly trade magazine.
- Supported the magazine editor in proofreading the submissions. Delegated review tasks to the YP volunteers.

Chair, Students of the Water Institute Graduate Section (SWIGS)

2021-2022

The Water Institute (WI), University of Waterloo

- Managed a team of 8 students in the effective delivery of the various academic, social, and outreach programs for the graduate student body in the university.
- Participated in the WI Strategic Program Committee meetings and actively provided student perspectives on the design and implementation of new initiatives.
- Served as the Meeting Secretary for the External Advisory Board Review of the WI. Assisted the Chairperson of the Board with drafting their findings.

Selected Publications and Presentations

(For complete list, please refer to [Google Scholar](#) page)

Peer-reviewed Publications (6 papers with over 85 citations)

- Lakshminarasimman, N., Gewurtz, S.B., Parker, W.J., Smyth, S.A., 2021. Removal and formation of perfluoroalkyl substances in Canadian sludge treatment systems – A mass balance approach. *Science of The Total Environment* 754, 142431. <https://doi.org/10.1016/j.scitotenv.2020.142431>
- Lakshminarasimman, N., Quiñones, O., Vanderford, B.J., Campo-Moreno, P., Dickenson, E.V., McAvoy, D.C., 2018. Biotransformation and sorption of trace organic compounds in biological nutrient removal treatment systems. *Science of The Total Environment* 640–641, 62–72. <https://doi.org/10.1016/j.scitotenv.2018.05.145>

Conference Presentations (7 conference presentations)

- Lakshminarasimman, N.; Gewurtz, S.; Smyth, S.A; and Parker, W. Insights into emerging organic contaminants behavior in different full-scale sludge treatment systems. **Water Environment Federation Residuals and Biosolids Conference 2021** – A Virtual Event, May 2021.
- Lakshminarasimman, N.; Gewurtz, S.; Smyth, S.A; and Parker, W. Behavior of Perfluoroalkyl Substance (PFAS) in Sludge Processing at Nine Canadian Sludge Handling Facilities. **WEFTEC 2020** – 93rd Water Environment Federation Annual Technical Exhibition and Conference, New Orleans, October 5-9, 2020.
- Lakshminarasimman, N.; Vanderford, B.; Campo, P.; Dickenson, E.; and McAvoy, D. Biotransformation of Trace Organic Compounds in Biological Nutrient Removal Treatment System. **WEFTEC 2016** - 89th Water Environment Federation Annual Technical Exhibition and Conference, New Orleans, September 24-28, 2016.



SUSAN GUSWA, PE

NATIONAL PRACTICE LEADER

Professional Profile

Sue is a Senior Principal with over 25 years of experience and serves as Woodard & Curran's Municipal Wastewater Practice Leader. As a Practice Leader, she works directly with clients to implement solutions to some of the most challenging wastewater issues. Sue provides technical leadership to our municipal infrastructure projects and helps to drive innovation in the firm's municipal wastewater practice. She is an active leader in Water Environment Federation (WEF) and New England Water Environment Association (NEWEA). Sue currently serves on Woodard & Curran's Board of Directors.

Related Experience

Wastewater Design & Construction Support

North of River Sanitary District, CA – Wastewater Treatment Plant Expansion and Upgrade. Technical Advisor responsible for technical input and review of the planning and design of upgrades and expansion to accommodate community growth and meet new regulatory requirements. The current 7.5 mgd trickling filter plant, which serves the communities of Shafter, Oildale, and North Bakersfield, will be expanded to a 12 mgd biological nutrient removal plant with production of Title 22 recycled water to serve neighboring agricultural irrigation demands. The plant upgrades will also incorporate new solids process facilities and biogas utilization for energy recovery.

Public Water Supply District No. 2, St. Charles, MO – Wright City WWTF Planning & Design. Technical Advisor responsible for technical input and review of the WWTF upgrades, including decommissioning existing unit processes and lagoons and construction of a new WWTF adjacent to the existing to support growth and a new industrial discharger. The upgraded and expanded facility is designed with biological nutrient removal via 4-stage activated sludge with side stream enhanced biological phosphorus removal (S2EPBR) and densification and tertiary filtration.

City of Northampton, MA – Phase 1 WWTP Upgrades. Senior Technical Manager on Phase 1 upgrades responsible for overall technical design execution, aeration system calculations, and process design review. The project includes upgrades to the 8.65-MGD WWTP to renew aging

Education

- Masters, Civil & Environmental Engineering, Stanford University
- Bachelors, Civil & Environmental Engineering, Duke University

Registrations

- Professional Engineer - CA, C57341
- Professional Engineer - CT, 25287
- Professional Engineer - MA, 46594 Civil

Professional Associations

- New England Water Environment Association (NEWEA)
- Water Environment Federation (WEF)

Technical Expertise

- Nutrient Removal
- Aeration System Design and Optimization
- Facilities Planning and Capital Improvement Planning
- Wastewater Treatment, Biosolids Management, and Collection Systems
- Optimization & Process Support

equipment, electrical systems, and buildings. The upgrades to the biological treatment system include flexibility to be able to switch from plug flow for biological nitrogen removal to step feed and/or contact stabilization for short durations during peak wet weather and compatibility with expected future nitrogen limits.

City of Northampton, MA – Phase 2 WWTP Upgrades. Technical Advisor on Phase 2 upgrades responsible for overall design input and review. The project includes upgrades to the 8.65-MGD WWTP to renew aging equipment, electrical systems, and buildings, and include replacement of their BFP dewatering system with screw presses.

Town of Enfield, CT – WPCF Upgrade Design. Designed upgrades to the solids handling systems for the 10 MGD Enfield Water Pollution Control Facility, including new gravity thickeners, rotary press dewatering, scum mixing, grinding, and pumping systems, and sludge grinding and pumping systems. The design included particular focus on wet weather management of the biological nitrogen removal system, headworks upgrades, odor control, and sludge processing as well as the rehabilitation of an aging WPCF.

City of O’Fallon, MO – WWTP Ammonia & High Flow Discharge Upgrades. Senior Technical Advisor responsible for biological nitrogen removal calculations and process design review. The project includes upgrades to the 11.25-MGD WWTP for ammonia removal, odor control, electrical, structural and building improvements and wet weather management including a new effluent pump station and effluent outfall. The upgrades to the biological treatment system include flexibility to be able to switch from plug flow for biological nitrogen removal to step feed and/or contact stabilization for short durations during peak wet weather and compatibility with expected future nitrogen limits.

City of Troy, MO – Southeast WWTF Upgrades. Senior Technical Advisor responsible for coordinating the design basis report, biological treatment system design, and project reviews. The \$17M project includes decommissioning of the Highway 47 WWTF, installation of a two-mile interceptor sewer to the Southeast WWTF and a comprehensive upgrade and expansion of the Southeast WWTF to 1.87 MGD that includes new influent fine screening, a new activated sludge treatment process for biological nitrogen removal, secondary clarification, tertiary filtration, UV disinfection. Key design aspects include effective screening, energy efficient hybrid blowers, most open-valve control dissolved oxygen controls, and wet weather clarifier capacity management protocols.

City of Starke, FL – WWTF Upgrades. Senior Technical Advisor responsible for technical design direction and reviews for upgrades to the 1.25-mgd WWTF to replace aging equipment and improve nutrient removal and permit compliance. The design included upgrades to the entire facility and unit processes, including headworks, an oxidation ditch with 5-stage configuration, secondary clarifiers, tertiary filters, UV disinfection, solids handling, pumping systems, chemical feed systems, buildings, and electrical and controls. The project included funding and permitting support.

City of Newberry, FL – Biosolids Permit and Nutrient Management Plan. Prepared the Biosolids Site Permit Application and Nutrient Management Plan for land application of the biosolids from the 0.35-MGD Wastewater Treatment Plant for the City of Newberry. The project included data collection and analysis, nutrient application and crop uptake analysis, coordination with Florida DEP, and permit application and plan development and submission.

City of Westfield, MA – Biosolids Resiliency Study. Senior Technical Advisor responsible for scope development and technical review of a Biosolids Resiliency and Building Programming Study focused on

development of a dynamic tool for screening possible disposition options and recommendations for disposition management for the 6.1-mgd WRRF. Additionally, conceptually evaluated the space needed not only for biosolids management options but also separate operator and data storage space in a new building.

Confidential Client, Transaction Support (United States/Canada) – Technical Due Diligence. Senior technical leader responsible for evaluating capital and operating expenditures (capex and opex) for a large biosolids processing acquisition. Due diligence support also included condition assessment and construction performance review of 24 facilities as well as two service businesses, and development of recommendations for future capex and opex planning.

City of Westfield, MA – Ammonia-Based Aeration Control Upgrades and Optimization. Led grant from the Massachusetts Clean Energy Center (MassCEC) in partnership with the City of Westfield and Hach to demonstrate benefits of ammonia-based aeration control (ABAC) from both an energy savings and nutrient removal standpoint. The project included a pilot test, data collection and analysis, SCADA modification recommendations, and operational recommendations to support improved performance. Energy and alkalinity adjustment chemical savings were achieved during the pilot test demonstration.

Town of Plymouth, MA – ABAC Process Optimization. Technical Advisor ammonia-based aeration control pilot test at the 3.0-mgd WWTF responsible for review of data and results. The goal was to maximize the removal of total nitrogen in the sequencing batch reactors (SBRs) and reduce overall aeration energy.

Regional Water Quality Control Plant, Palo Alto, CA – Program Management. Sue serves on a team of engineers that provide program management for the rehabilitation of the Palo Alto Regional Water Quality Control Plant. Work includes consultant procurement, design review, budgeting, and scheduling for the major rehabilitation of the primary and secondary plant processes, nutrient upgrades, and a variety of capital improvement projects throughout the plant.

Town of North Attleborough, MA – WWTF Nitrogen & Phosphorus Removal Upgrade. Designed a 5-Stage Bardenpho process for biological nitrogen and phosphorus removal for the 4.6 MGD wastewater treatment facility. With tertiary cloth filters, the WWTF is designed to meet stringent nitrogen limits of 5 mg/L and phosphorus limits of 0.1 mg/L. The preliminary process evaluation included 5-Stage Bardenpho, membrane bioreactor (MBR), Biomag ballasted flocculation, integrated fixed film activated sludge (IFAS), and various tertiary phosphorus treatment processes including ballasted flocculation/clarification, cloth filters and deep bed sand filters. Analysis included process modeling using GPS-X software and pilot testing of tertiary phosphorous removal processes. Provided commissioning support to optimize biological phosphorus removal, chemical addition, and process monitoring.

Great Barrington and Erving, MA – Nitrogen Removal Evaluations and Designs. Evaluated nutrient removal upgrades for the 3.6 MGD Great Barrington WWTF and the 1.0-mgd Erving WWTF to meet anticipated future total nitrogen requirements of 8 mg/L, including process modeling with GPS-X software. Recommended conversion to a Modified Ludzack-Ettinger (MLE) process for Great Barrington. Designed aeration improvements utilizing cyclic aeration with on-line instrumentation and automatic system controls for Erving.

Palmer and Easthampton, MA – Nitrogen Removal Optimizations. Evaluated operational modifications to increase nitrogen removal at the 5.6 MGD Palmer Water Pollution Control Facility and the

3.8 MGD Easthampton WWTF to meet NPDES permit requirements for nitrogen optimization to maintain effluent mass loadings below 2004-2005 levels. For Easthampton, analysis included process modeling with GPS-X software of recommended interim cyclic aeration operation.

South Hadley and Adams, MA – Treatment Plant Upgrades. Designed process upgrades for the 4.2 MGD South Hadley wastewater treatment facility and the 4.6 MGD Adams wastewater treatment facility, including mechanical aeration systems, secondary clarifiers, and chemical feed systems including sodium hypochlorite, sodium bisulfite, and alum.

City of Westfield, MA – Blower Replacement and Aeration Control System Upgrade. Analyzed past blower operations, projected future air requirements and recommended replacement of existing blowers and aeration control system to improve energy efficiency and process operations. Designed upgrades through a design-build process.

Confidential Client – Aeration System Upgrade and Operations Support. Served as project manager for replacement of an activated sludge aeration system for an industrial client. Tasks included an alternatives analysis, development of the basis of design for the replacement system, and operations support.

City of Millbrae, CA – WWTP Schematic Design. Developed process and hydraulic models, oversaw stress testing, estimated capacity, recommended treatment alternatives, and developed a phased expansion plan to increase the wastewater treatment capacity from 2 MGD to 3 MGD. Developed schematic design for influent pump station, aeration basins, thickening, effluent pump station, and in-plant piping.

Town of Los Osos, CA – WWTF Design. Designed headworks and UV disinfection system for new 1.3 MGD wastewater treatment facility.

Wastewater Planning, Permitting and Funding

Town of Suffield, CT – Wastewater Facilities Planning. Serving as technical manager and leading the technical tasks for the facilities planning project that includes evaluation of the collection system condition and capacity, a Phase 1 Infiltration/Inflow Study, condition assessment of the pumping stations, evaluation of energy efficiency and green energy generation opportunities at the wastewater treatment facility, and recommended improvements for the solids handling and odor control processes. The project will culminate in updates to the system mapping that serves as a basis for their asset management program and preparation of a facilities plan.

San Andreas Sanitary District, San Andreas, CA – Wastewater Treatment Plant Capacity Analysis and Master Plan Update. Technical advisor responsible for review of wastewater flows and loads, development of flow and load projections, desktop analysis of plant capacity, and identification of capital project needs and planning level cost estimates.

Town of Barre, MA – WWTP Capital Improvement Planning & Funding Support. Senior technical advisor responsible for overseeing completion of an engineering report/capital improvement plan and funding applications to the Massachusetts SRF Program and USDA Rural Development for improvements to the 0.3-mgd WWTP to replace aging infrastructure, improve nutrient removal performance, and reduce impact of ragging.

Union Sanitary District (USD), CA - Effluent Management Plan. Served as technical manager to identify long-term nutrient upgrade options, including innovative technologies, to meet future anticipated nitrogen limits and evaluated short-term alternatives for nitrogen removal including sidestream treatment utilizing the Annamox technology, and parallel nitrogen removal via an MLE configuration with conventional activated sludge and membrane bioreactors. Woodard & Curran is also currently assisting the District in developing a master plan for the WWTP to address growth and anticipated nutrient limits.

Town of Southington, CT – Wastewater Facilities Planning. Managed the facilities planning project that included evaluation of the collection system capacity and Phase 1 Infiltration/Inflow Study, 10 pumping stations, and the Water Pollution Control Facility. Evaluated alternatives for meeting the stringent, new total phosphorus limit for the 7.4 MGD WPCP. Analysis included GPS-x modeling and consideration of biological, chemical, and tertiary treatment options. The project included needs analysis, future flow projections, capacity assessments, and energy and condition evaluations, development of a phased recommended plan with identified funding opportunities.

Town of Redding, CT – WWTP Upgrade and Expansion. Prepared planning, permitting, and funding documents for this wastewater treatment plant expansion from 0.075 MGD to 0.245 MGD and conversion to a membrane bioreactor (MBR) to meet stringent nutrient discharge requirements. The process evaluation included comparison SBR and MBR upgrade alternatives to meet nitrogen limits of 4 mg/L and stringent noise, odor and aesthetic considerations due to close proximity of neighbors. Developed deliverables including the Norwalk River Study evaluating impact of future effluent on water quality, Facilities Plan, NPDES permit application materials, and funding application for USDA Rural Development.

Groton Utilities, CT – Wastewater Treatment Facility Evaluation. Managed the development of a Capital Improvement Plan (CIP) for the Wastewater Treatment Facility. Scope includes condition evaluation, corrosion evaluation, and development of phased, prioritized short-term CIP as well as evaluation of process upgrades for longer-term improvements including conversion to UV disinfection and grit removal upgrades.

Town of Canton, CT – WPCF Facilities Planning. Conducted facilities planning for the 0.8 MGD Water Pollution Control Facility (WPCF). Developed hydraulic models, evaluated upgrade alternatives, and developed short-term expansion plan.

Town of Sturbridge, MA – Comprehensive Wastewater Management Plan Update and Draft Environmental Impact Report. Prepared report to enable the wastewater treatment plant to be re-rated from 0.75 MGD to 1.3 MGD and receive a favorable 0% interest loan through the MassDEP SRF program. Important components of the project included an update to the future flow projection, alternatives analysis for discharge options, greenhouse gas analysis and growth management plan.

Town of Swansea, MA – Comprehensive Wastewater Management Plan. Prepared Phase 1 and 2 of the plan and associated Environmental Notification Form (ENF). Town was served solely by on-site systems and a significant need for alternative solutions to mitigate groundwater contamination with nutrients and pathogens due to development density, soil and groundwater characteristics, and environmental constraints.

Town of Charlton, MA – Comprehensive Water Resources Management Plan. Prepared wastewater component of the plan that integrated planning for wastewater and drinking water. Prepared a Needs Analysis/Alternative Screenings Report that recommended a combination of decentralized, centralized

and regional wastewater alternatives and new drinking water supply wells. A significant study component was limiting phosphorus loadings to impacted surface water features.

Great Barrington, MA – Comprehensive Wastewater Management Plan. Prepared plan that includes a needs analysis, evaluation of existing collection system and WWTF infrastructure, upgrade alternatives analysis, and development of a recommended capital improvement plan that includes improvements to the wastewater treatment facility to meet new nitrogen limits.

Town of Bourne, MA – Wastewater and Nutrient Management Study. Prepared study recommending design and construction of a 0.2 MGD wastewater treatment and groundwater discharge facility in initial implementation phase. Evaluated potential funding and financing alternatives, and identified substantial grant opportunities. The project drivers include redevelopment of Buzzards Bay Village and assessment of the need for nutrient management in other areas of Town largely due to the results of the Massachusetts Estuaries Project (MEP).

Cape Cod, MA – Wastewater Treatment Technology Evaluation. Evaluated wastewater treatment technologies for their ability to meet stringent treatment standards suitable for groundwater discharge on Cape Cod, including nitrogen removal to 5 mg/L, for small-community systems between 10,000 and 100,000 gpd.

Bourne Development Campus – Wastewater Flow Projections and Master Plan. Developed wastewater flow projections and master plan documents for the Bourne Development Campus, a green technology park currently in the planning and permitting stages of project development. The documents will support environmental permitting reviews through MEPA and CCC.

Town of Palmer, MA – WPCF NPDES Permit Compliance Support. Provided NPDES permit compliance support for the 5.6 MGD Water Pollution Control Facility, including preparation of an Infiltration/Inflow Control Plan.

Chicopee, Warren, Ipswich, and Fairhaven MA – NPDES Permit Review Comments. Developed technical content for public comment letter on the draft NPDES permits. Reviewed Massachusetts Estuary Project (MEP) Report and developed technical content for public comment letter on the draft NPDES permit for Fairhaven which contained a nitrogen limit of 3 mg/L.

Webster, MA and Charles River Pollution Control District – Value Engineering. Provided Value Engineering services for the 30% design for a biological and chemical phosphorus upgrade to the 4 MGD wastewater treatment facility in Webster, and for the project planning for nutrient upgrades at the 4.5 MGD Charles River Pollution Control District wastewater treatment facility.

Wastewater Collection Systems and Pump Stations

City of Portland, ME – Back Cove CSO Storage Facility Design-Build Project. Senior Technical Advisor responsible for technical design reviews for a new 3.5-million gallon off-line, below grade storage tank, effluent pumping and force main, and new diversion regulators from three combined sewer overflows (CSOs). The design includes site/civil, environmental, structural, hydraulic/conveyance, mechanical, electrical, and instrumentation and controls.

Town of Pepperell, MA – Pump Station Evaluation and Upgrade. Managed the Facilities Evaluation Project for 10 water and wastewater pump stations in the Town's drinking water and wastewater system.

Developed a phased capital improvement plan for upgrades to the stations and a Preventive Maintenance Plan to assist in maintenance management. Managed the replacement of the pumping system, control panel and emergency generator for the Sheffield Pump Station. The project included evaluation of submersible and suction lift pumping alternatives; vacuum-prime suction lift pumps were selected for the upgrade.

The Metropolitan District, Hartford, CT – Granby 3 Sewer Separation. Managed the design of the Granby 3 sewer separation project for the Metropolitan District to reduce combined sewer overflow (CSO) intervals, eliminate basement backups, and alleviate street flooding in the project area. The project includes 16,000 feet of combined sewer, sanitary sewer, and stormdrain piping, 12,000 feet of water main replacement, lateral replacement, and a backwater valve/private inflow disconnect program.

Town of Great Barrington, MA – Main Street Pipe Lining. Managed design and construction support of pipe lining project for approximately 1,000 feet of sanitary sewer.

East Palo Alto Sanitary District, East Palo Alto, CA – Sewer Master Plan. Updated Master Plan for the East Palo Alto Sanitary District. Built mathematical model using HYDRA software to quantify impact of rapid growth and redevelopment on collection system and developed capital improvement recommendations. Coordinated comprehensive manhole survey using GPS, TV, and physical inspection of manholes and pipelines, and district-wide flow monitoring of the sewer system, which includes approximately 30 miles of gravity pipelines ranging from 6 to 24 inches.

East Palo Alto Sanitary District, East Palo Alto, CA – Sewer Rehabilitation. Designed and provided construction support for the 1999/2000 Capital Improvement Project including manhole rehabilitation and replacement of approximately 2.75 miles of 8, 10, and 12-inch PVC and HDPE pipe using open cut and pipe bursting techniques.

Leprino Foods Company, Tracy, CA – Pump Station and Forcemain. Served as project engineer for the design of pump station modifications and a new 12-inch HDPE forcemain for wastewater for the Leprino Foods Company. Forcemain alignment included bore and jack beneath a railroad crossing.

Town of Los Osos, CA – Sewer System. Designed over five miles of new gravity and low pressure sewers for a proposed wastewater collection system.

Water Reuse

Millbrae Water Pollution Control Plant, Millbrae, CA – WPCP Water Reuse Study. Investigated treatment alternatives for the production of unrestricted use recycled water (California Title 22) at the Millbrae Water Pollution Control Plant.

San Jose/Santa Clara, CA – SWBR Phase II Reclaimed Water Project. Evaluated San Jose/Santa Clara Water Pollution Control Plant's tertiary system with respect to current and pending California recycled water regulations for the production of 30 MGD of recycled water. Prepared conceptual design of urban pipeline extensions of the South Bay Water Recycling (SBWR) distribution system in San Jose.

Town of Middleborough, MA – Massachusetts Reclaimed Water Evaluation and Permit Support. Evaluated upgrades to the 2.16 MGD wastewater treatment facility to produce Class A reclaimed water for landscape irrigation and cooling water use. Assisted in development of a reclaimed water permit

application, including evaluation of treatment requirements and review of existing data, for the University of Massachusetts.

Stormwater

Stormwater Technology Evaluations. Supported technology commercialization for the Massachusetts Strategic Envirotechnology Partnership (STEP) between the University of Massachusetts, and the Executive Office of Environmental Affairs. Evaluated stormwater treatment technologies, prepared performance reports, and provided outreach to regulators.