

Appendix C

Project Team Curricula Vitae

Ansel Bather, P.Eng.

Education

M.A.Sc., Civil and Environmental Engineering, University of Toronto

B.S., Chemical Engineering, University of The West Indies

Professional Registrations

Professional Engineer: Ontario (1998, 90497751)

Distinguishing Qualifications

- Over 25 years of experience managing and leading process and facility design of major wastewater facility expansions and upgrades including planning, design, construction, commissioning on active plant sites in Ontario.
- Proven management and design and construction delivery experience in the GTA on some of the largest upgrade and expansion projects, including the ongoing \$200 million Liquids Expansion project at the Highland Creek Treatment Plant and the \$740 million Duffin Creek WPCP Stages 1&2 Upgrades and Stage 3 Expansion Projects.
- Experience managing wastewater facility upgrade projects in the GTA that involved significant relocation of plant processes and the development of construction sequencing strategies to allow uninterrupted plant operations.

Relevant Experience

Ansel Bather is a senior project manager and chemical engineer in CH2M's Toronto office with 25 years of experience in the design, construction, and commissioning of municipal wastewater treatment plant upgrades and retrofits in Ontario. He has 20 years of experience leading multi-disciplinary teams to complete large and complex wastewater treatment facility retrofit and expansion projects on time and on budget. He is proficient in applying project management techniques including schedule and risk management tools.

Taking an active role from planning to commissioning stages, Ansel provides technical expertise during technical activities including process design, site layouts, equipment selection, technology evaluation, and design decisions. He routinely works with project stakeholders and regulators and participates in value engineering and risk management workshops. A highly regarded treatment process specialist, he has completed process optimization and pilot studies for wastewater treatment and biosolids facilities throughout Ontario.

Relevant Project Experience

Project Manager; Highland Creek Treatment Plant (HCTP) Liquids Process Trains Rehabilitation and Upgrades; City of Toronto; Toronto, Ontario; 2016 to Present. Currently managing as 12-year project including engineering design and construction services to address maintenance and redundancy limitations at the 219 ML/d HCTP. The project includes design and construction of a new 73 ML/d primary and secondary treatment plant, new substation, new Toronto Hydro feed, new flow distribution chamber, and major upgrades to the existing three treatment plants and requires staged construction to minimize facility capacity, performance, safety, accessibility, environmental and community impacts.

Experience Prior to CH2M

Project Manager and Design Lead; HCTP Retrofit and Upgrade Projects; City of Toronto; Toronto, Ontario. Served as project manager and lead process designer for six retrofit and upgrade projects at

Ansel Bather, P.Eng.

HCTP, four within the past 10 years, totaling \$198 million. In this role, Ansel was responsible for managing the project budget, schedule, QA/QC plan, resource allocation plan, risk management plan, and client communications. He also provided technical expertise related to process design, layouts, equipment selection, evaluation of alternatives and design decisions. Projects included:

- **New Preliminary Treatment Facilities; 2008-2015.** \$65 million project to design and construct new 292 ML/d preliminary treatment and odour control facilities, which included major tie-ins to the main influent conduit to divert incoming sewage flows to the new Headworks Facility.
- **WAS Thickening and Sludge Blending Tank Upgrades; 2007-2013.** \$50 million project to design and construct a new centrifuge WAS thickening facility for the 219 ML/d plant including conversion of four old digesters to sludge blending tanks and odour control, and plant-wide retrofits to existing raw sludge, digested sludge and primary scum distribution piping network to provide more flexibility, improve sludge inventory management, and eliminate blockages in the existing primary scum piping network.
- **Dewatering Upgrades; 2007-2015.** \$40 million project to design and construct centrifuge dewatering upgrades at the 219 ML/d HCTP.
- **RAS Screw Pump Replacement, Ferrous Chloride and Old Plant Aeration Upgrades; 2013-2015.** \$40 million project to design and construct a RAS screw pump replacement in NW and SW Plants, new ferrous chloride facility and major retrofits to SE Plant aeration system (including replacement of multi-stage centrifugal blowers with high-speed turbo blowers, new air distribution piping, new aeration control systems, and modification to aeration tanks with anoxic selectors).
- **New Chlorination System; 2009-2011.** \$3 million project to design and construct a new chlorination system including outdoor storage tanks for sodium hypochlorite, dosing pumps, and flow paced control system.
- **Digester Gas Assessment Study and Code Compliance Assessment; 2009-2011.** Digestion facility included four primary digesters, low pressure compressor for gas mixing, high pressure boosters for digester gas transfer to high pressure storage and/or use in hot water boilers, waster gas burners, digester gas drying equipment.

Project Manager and Design Lead; Duffin Creek WPCP Liquid Capacity Upgrades Project; Regions of York and Durham; Pickering, Ontario. Acted as project manager and design lead for upgrades of the then 360 ML/d plant to enable year-round nitrification in existing tankages, and retrofits to existing primary sludge and primary scum pumping and piping network to address operational problems, and upgrades to the existing effluent water pumping station. Nitrification upgrades portion of the project included retrofits of 8 aeration tanks by replacing mechanical aerators with fine bubble diffused aeration system and online DO sensors, conversion to plug flow configuration, and addition of an anoxic selector in each tank. The project also included a new blower building with single stage high speed blowers with automatic aeration control system. Existing secondary clarifiers were modified by addition of Stamford baffles to improve suspended solids removal performance. Project also included major tie-ins to the secondary effluent conduit to divert sewage flows to the new chlorine contact chamber. Work was completed without any environmental spills and without interruption of flows to the Duffin Creek WPCP.

Project Manager and Design Lead; Duffin Creek WPCP Stages 1&2 Upgrades and Stage 3 Expansion Projects; Regions of York and Durham; Pickering, Ontario. Acted as project manager and design lead for multiple upgrade and expansion projects at 630 ML/d Duffin Creek WPCP from 2005-2015. These \$740 million (total) projects included major upgrades to six existing 24 m x 65 m x 4 m deep rectangular concrete primary clarifiers retrofitted with new travelling bridge collector mechanisms and scum skimmers. Led conceptual design of the new effluent pumping station that served the entire plant including the incineration facility rated at 270 dry tonnes/day. For the Duffin Creek WPCP Stage 3

expansion, Ansel also served as project manager and design lead for the design and construction of six new 24 m x 65 m x 4 m deep rectangular primary clarifiers with common wall construction and travelling bridge collector mechanisms. Other major scope of work items included:

- Design and construction of new \$50 million preliminary treatment facilities (310 ML/d)
- Design and construction of new \$150 million primary treatment aeration and secondary clarification facilities (310 ML/d) facilities. The facility included primary clarifiers with travelling bridge mechanism, plug flow aeration tank with anoxic/aerobic swing zone and automatic DO control, single stage high speed blowers with automatic aeration control system, rectangular secondary clarifiers with chain and flight sludge collectors, and RAS and WAS pumping systems with SRT controller.
- Design and construction of new \$70 million biosolids dewatering and storage (630 ML/d)
- Design and construction of a new raw sewage pumping station and preliminary treatment facilities rated at an average daily flow of 370 ML/d and peak flow of 1,295 ML/d.

Senior Process Advisor; Kitchener Water Pollution Control Plant Upgrades and Retrofit Project; Region of Waterloo; Kitchener, Ontario. The purpose of this \$38 million project was to upgrade the 122 ML/d Kitchener WWTP including new preliminary treatment facilities (fine screening and vortex grit removal), chemical phosphorus removal facilities, secondary treatment BNR facilities, air supply system consisting of high speed Turbo blowers complete with fully automatic aeration control system, WAS Thickening facilities using centrifuges, and anaerobic digesters with hydraulic mixing system, dual-fuel boilers, gas holder, and waste gas burners.

Project Manager and Lead Process Engineer; Clarkson WPCP Anaerobic Digestion Facilities Upgrades and Expansion Design and Construction; Region of Peel; Mississauga, Ontario. The purpose of this \$30 million project was to upgrade and expand the existing anaerobic digestion facilities. The project included two new 33.5-m-diameter concrete digesters with steel covers, tube and tube sludge heat exchangers, gas safety equipment, gas boosters, waste gas burners, a digested sludge blending tank, and dewatering feed pumps. The project also included retrofits to existing primary sludge and primary scum collection and pumping systems. Upon completion of the project, the Region had more flexibility with respect to primary sludge pumping and distribution, primary scum pumping and distribution, biosolids reuse options, the treatment process performance was enhanced, and sludge handling was increased to satisfy requirements for plant expansion from 163.5 ML/d to 250 ML/d.

Senior Technical Advisor; Clarkson WPCP Phase I Upgrades and Expansion New Preliminary Treatment Facilities, New Biosolids Facility, Secondary Treatment Upgrades, New Disinfection Systems; Region of Peel; Mississauga, Ontario. The purpose of this expansion program was to provide new headworks facility to improve grit and screenings removal and odour control, to expand the secondary treatment capacity from 163.5 ML/d to 250 ML/d, to provide new biosolids facility (waste activated sludge thickening, sludge dewatering, and cake storage and track loading), and new disinfection facility (chlorination followed by de-chlorination) to satisfy more stringent regulatory requirements. The new preliminary treatment and odour control facilities included major tie-ins to the main influent conduit to divert incoming sewage flows to the new Headworks Facility. This work was completed without any environmental spills and without interruption of flows to the Clarkson WPCP.

Laurie Boyce, MA

Education

M.A., Environmental Resource Analysis and Management, University of Guelph
B.S. (Honours), Physical Geography, McMaster University

Professional Registrations

Director of the Board of Consulting Engineers of Ontario (CEO), The Voice of Engineering Consulting firms in Ontario (2008 -2011)

Member of Water Environment Federation (WEF), Water Environment Association of Ontario (WEAO), American Water Works Association (AWWA), Ontario Water Works Association (OWWA) and Ontario Public Works Association (OPWA)

Distinguishing Qualifications

- Over 30 years of experience in planning and engineering consulting with proficiency in environmental planning, decision-science/impact analysis, approvals, and public consultation related to upgrades, expansions, and new municipal wastewater and water treatment, pumping, storage, and conveyance systems.
- Senior project manager, permitting and approvals specialist, and public consultation specialist experience in both provincial and federal environmental assessments and master planning.

Relevant Experience

Laurie Boyce is a senior environmental planner and project manager in Toronto experienced in environmental planning, strategic and master planning, impact analysis, and public and agency consultation. She has managed some of CH2M's largest multidisciplinary assessment projects, including the Project Proposal for the Interim Works at the FARO mine site (Yukon), an environmental assessment (EA) for Toronto's Ashbridges Bay Treatment Plant, a wet weather flow management master plan study for Toronto, and the Duffin Creek Water Pollution Control Plant Expansion and Outfall Environmental Assessments for the Regions of York and Durham. She also acted as the assistant project manager for the Deloro Mine rehabilitation project for the Ontario Ministry of the Environment and Climate Change (MOECC).

Laurie environmental planning skills have been applied in a variety of areas, including wastewater collection and treatment, water supply and treatment, water resources, site remediation, roads and pipeline siting projects. She is knowledgeable of the requirements of federal and Ontario environmental legislation. In addition, Laurie has presented numerous papers on impact assessment topics at local and international conferences.

Relevant Project Experience

EA Advisor; Mountview Wastewater Treatment Plant and Huntsville Sewage Works Upgrades, Schedule C Class EA; Ontario; 2014. Responsible for providing Environmental Assessment advice and QA/QC of impact assessment and consultation information.

Project Manager; Duffin Creek Water Pollution Control Plant Expansion Schedule C EA; Regional Municipalities of York and Durham; Pickering, Ontario; 2003 to 2007. Responsible for successfully completing EAs (and supporting technical studies) for the expansion of the Duffin Creek Water Pollution Control Plant. Work included detailed receiving water assessment studies, environmental inventories,

Laurie Boyce, MA

odour and air emissions modelling, evaluation of design alternatives, and extensive consultation with the public and government review agencies. Successfully addressed Part II order requests.

EA Advisor; Lagoon Lane WWTP Expansion; Muskoka; Ontario; 2007. Senior Advisor for the upgrade and expansion of the Lagoon Lane WWTP, Schedule C Environmental Study.

Project Manager; Duffin Creek Water Pollution Control Plant, Schedule C Class EA; Regional Municipalities of York and Durham; Ontario; 2007 to 2009. Responsible for successfully completing a Schedule C Environmental Study Report (and supporting technical studies) for the expansion of the Duffin Creek Water Pollution Control Plant; work included detailed receiving water assessment studies, environmental inventories, odour and air emissions modelling, evaluation of design alternatives, and extensive consultation with the public and government review agencies.

Project Manager; Water Pollution Control Centre, Long-Term Wastewater Treatment Strategy, Schedule C Class Environmental Assessment; City of Barrie; Barrie, Ontario; January 2005. Project Manager for completing Environmental Assessment requirements; specific objectives of the project were to minimize impacts on Kempenfelt Bay from wastewater effluent discharges, to meet effluent quality and biosolids treatment and storage requirements, and to expand the capacity of the wastewater treatment system to meet future wastewater treatment needs; public and agency consultation was also a major component of the study; expansion of capacity from 57.1 ML/d to 102 ML/d.

Project Manager/Environmental Planner; Ashbridges Bay Treatment Plant Environmental Assessment; City of Toronto; Toronto, Ontario; 1990 to 1998. Responsible for all aspects of project delivery, including assigning and leading project staff, scheduling, tracking, change management, invoicing, controlling project costs (total project costs approximately \$2.3 million); liaised with client, regulatory agencies, and City's legal department; developed a comprehensive program for the assessment of alternatives, including water efficiency, source control, I/I control, combined sewer overflow (CSO) collection and treatment, plant expansion and effectiveness, site selection; developed and implemented a public consultation program, including a social survey, for the environmental assessment and mediation assistance; prepared the Environmental Assessment document, component study reports, public information bulletins, and technical memoranda.

Senior Advisor; Environmental Impact Assessment; City of St. John's, St. John's, Newfoundland; 2003 to 2004. Senior Advisor for the environmental impact assessment (*Canadian Environmental Assessment Act*) for the St. John's Primary Treatment Plant.

Environmental Planner; Environmental Management System (EMS) for Biosolids Pilot Project; Ontario Ministry of the Environment, City of Hamilton, Region of Halton, and City of Ottawa; Ontario; 2002 to 2003. Environmental planner to help develop a systematic, third-party verified biosolids environmental management program that achieves public support/acceptance of biosolids beneficial use.

Environmental Planner; Upgrades to Wastewater Pumping Station #9, Schedule B Class Environmental Assessment; Regional Municipality of Halton; Ontario; August 2002. The plan included replacement of the existing pumps to increase capacity; building upgrades; and, provision of an underground off-line storage pipe and a standby generator.

Task Coordinator; Environmental Management System Development; Municipalities of Hamilton, Halton, and Ottawa; Ontario; 2002 to 2003. Task Coordinator for the development of an Environmental Management System (EMS) for biosolids management in Ontario.

Senior Advisor; Courtice Water Pollution Control Plant – Canadian Environmental Assessment Act (CEAA) Screening Report; Regional Municipality of Durham; Ontario; 2002 to 2004. Coordinated effort

for meeting CEAA requirements for the new Courtice Water Pollution Control plant and outfall, including reporting on alternatives, environmental inventories conceptual designs, construction methods, impacts, and mitigation; also involved in extensive consultation with federal agencies.

Project Manager; Central Pumping Station Class EA; Regional Municipality of Niagara; Niagara Falls, Ontario; 2002 to 2003. Project Manager for the Central Pumping Station and High Rate Treatment Facility Schedule C Class Environmental Assessment.

Project Manager; Wastewater Treatment Facility Upgrade Study, Schedule C Class Environmental Assessment (Class EA); Town of Smiths Falls; Smith Falls, Ontario; May 2001. The preferred alternative was to re-rate the capacity of the plant from 14 to 19 MLD through operational improvements and upgrades to the existing sludge management process (that is, provide a liquid sludge storage facility for later conversion to a digestion tank).

Task Leader; Biosolids Management Master Plan Update; Region of Ottawa-Carleton; Ontario; 1997 to 1999. Environmental planning Task Leader for a biosolids management master plan update.

Environmental Planner; Hazeldean PS Class EA; Region of Ottawa-Carleton; Ontario; 1999. Environmental Planner for the Hazeldean Pumping Station Schedule B Class Environmental Assessment.

Project Manager; Meeting Federal Approval Requirements for a New Intake; Town of Little Current; Little Current, Ontario; March 1999. Project Manager for meeting federal environmental assessment requirements; the purpose was to prepare information and consult with agencies on the new intakes to meet the requirements of federal legislation (for example, *Fisheries Act, Navigable Waters Act, Public Lands Act, Lakes and Rivers Improvement Act, Canadian Environmental Assessment Act*).

Environmental Planner; Class Environmental Assessment of a Wastewater Treatment Strategy and Plant Expansion, Addendum; City of Peterborough; Peterborough, Ontario; March 1998. Environmental Planner responsible for preparing an addendum to the March 1995 Class EA, which included updating the phosphorus limits and using a chlorination/dechlorination disinfection system at the facility.

Project Director; City of Toronto Port Lands EA; City of Toronto; Toronto, Ontario; 2013 to 2014. This project involves leading all water/wastewater modelling to identify servicing upgrades for significant new development. Developing detailed InfoWater and InfoWorks hydraulic models for service area. Assessing existing conditions and identifying and evaluating water and wastewater servicing alternatives to meet growth needs in accordance with the Class Environmental Assessment process. Providing significant public consultation and stakeholder engagement due to the high level of interest in developing one of the City's last underdeveloped areas.

Project Manager; Wet Weather Management Master Plan (Combined Sewer Overflow Study Area); City of Toronto; Toronto, Ontario; June 2000 to December 2001. Part of a multidisciplinary team of six consulting firms working with the city to assess the wet weather flow problems in the city and develop solutions; responsible for all aspects of project delivery—leading/assigning staff resources, scheduling, tracking, change management, controlling project costs; met with project coordinating committee (city, agency, and other consultants) on a regular basis; presented information and resource to a steering committee (agencies and public interest group representatives) and participating in the City's public consultation program (e.g. workshops, public meetings)

EA Senior Advisor; River Street Pump Station Twin Forcemain Extension and Ravensview Trunk Sewer Twinning EA; Utilities Kingston (with JL Richards); Kingston, Ontario; 2012. Environmental Assessment Advisor responsible for ensuring Environmental Assessment requirements met.

Laurie Boyce, MA

Project Manager, Fletcher's Creek Trunk Sewer Environmental Assessment and Conceptual Design, Region of Peel; Ontario; 2009. The project involved meeting Environmental Assessment requirements for the Fletchers Creek Trunk Sewer located in Peel Region.

EA Senior Advisor; Markham PD6 Water Supply Class Environmental Assessment – Design and Contract Administration; Regional Municipality of York (with Chisholm, Fleming and Associates); Ontario; 2003. The project involved meeting EA requirements for the McCowan Road watermain (1,050 mm in diameter) and the Markham PD 6 Reservoir, a 60-ML in-ground structure.

Project Manager; Wet Weather Flow Management Master Plan; City of Toronto; Toronto, Ontario; 2000 to 2003. Project Manager for a wet weather flow management master plan; study involved the assessment of alternatives to be considered in the hierarchy of source control, conveyance control, and end-of-pipe control within the study area for the control of CSO and storm runoff; developed strategies to meet the targets and objectives set for the city and an implementation plan to address the wet weather/combined sewage issues.

EA Task Leader; FARO Mine Remediation Project Proposal; Yukon Government; 2013 to 2015. Responsible for managing the team responsible for ensuring client and CH2M expectations are met with respect to the territory and federal planning and approval requirements for the Faro Mine remediation works.

Assistant Project Manager; Deloro Mine Rehabilitation Project; Ontario Ministry of the Environment (MOE); Deloro, Ontario; 1998 to 2000. Led project staff, scheduling, invoicing, tracking project costs (total budget in excess of \$2 million); advised project manager of change management techniques and cost control measures; coordinated report preparation and review (responsible for ensuring QA/QC procedures are followed); participated in technical report preparation (e.g. methods of evaluation, alternatives assessment, and mitigation techniques).

M. Kim Fries, P.Eng.

Education

M.A.Sc., Environmental Engineering, University of Toronto
B.Sc, Civil Engineering, University of Manitoba

Professional Registrations

Professional Engineer: Alberta (1986, No. M44572)

Distinguishing Qualifications

- Specialist in applying innovation within the context of large plant design, recognized for his ability to think 'out of the box' and develop solutions that optimize wastewater treatment process operations.
- Extensive design experience with construction planning and design of primary and secondary clarifiers on live sites (Highland Creek Treatment Plant (HCTP), Bonnybrook Wastewater Treatment Plant (WWTP), Duffin Creek Water Pollution Control Plant (WPCP), Skyway WWTP).
- Extensive experience with water effluent systems (Duffin Creek WPCP, Skyway WWTP, Highland Creek Treatment Plant, Bonnybrook WWTP, among others).

Relevant Experience

Kim Fries is a senior wastewater process technologist and designer with considerable experience serving in project manager, technical management, and quality review roles for major plant upgrades and expansions worldwide. In the past 38 years, he has led or participated in WWTP design in more than 150 communities in Canada, the Caribbean, Australia, the Middle East, and the Far East. His major areas of interest include biological nutrient removal, advanced digestion, and odour control. He has taken a technical leadership position in projects from planning and design through to the construction and handover phases, also providing assistance and training to operations staff.

Relevant Project Experience

Senior Technical Advisor; Biogas Enhancement and Sludge Thickening; Woodward Avenue WWTP; Hamilton, Ontario. This project involved the assessment of existing digestion facilities and review of alternatives that would enhance volatile solids destruction and biogas generation. The option exhibiting the best value involved upgrade of one of their older (and currently inoperable) digesters to increase digestion volumes coupled with enhanced sludge thickening to increase sludge retention time in the digesters. As well, the project includes biogas treatment to pipeline standards so that a significant portion of the biogas can be treated and sold to the utility. Refurbishment of the existing digester will ensure that it is compatible with the existing four operating units (similar mixing systems) and that code requirements and structural integrity issues are fully addressed.

QA/QC Reviewer; Duffin Creek WPCP Stage 3 Liquids and Solids Expansion; Regions of York and Durham; Pickering, Ontario. This \$540M project expanded the Duffin Creek WPCP from 420 to 630 ML/d, including expansion of the liquids treatment train led (including an influent pump station with a total capacity of 1,575 ML/d, septage receiving facility, headworks expansion, secondary treatment using step-feed nitrifying activated sludge, and disinfection for final effluent using chlorination/de-chlorination). The scope also included six new 24 m x 65 m x 4 m deep rectangular primary clarifiers with common wall construction and travelling bridge collector mechanisms. Kim served as senior process mechanical reviewer for all design deliverables including the new primary clarifiers and effluent water system.

Senior Technical Advisor; Skyway WWTP Phase 2 Expansion; City of Burlington; Burlington, Ontario. The purpose of this \$160 million retrofit project was to expand the existing plant from 108 ML/d to 140 ML/d

M. Kim Fries, P.Eng.

while ensuring that the facility meets more stringent effluent criteria in future. The work involved major expansions to the existing primary clarifiers and secondary treatment system, decommissioning and replacement of the existing plant effluent water system, expansion of the headworks and sludge management processes, and a new tertiary pumping and treatment facility. Extensive construction sequencing was developed and implemented to realize the works while maintaining plant operations. Kim was responsible for providing senior guidance and review of all design deliverables.

Process Discipline Lead; Bonnybrook WWTP Plant D Expansion; The City of Calgary; Calgary, Alberta.

The focus on this \$540 million expansion is to provide new primary clarifiers (two), new BNR bioreactors (three), new secondary clarifiers (six), new effluent filtration system (cloth media filters), effluent pumping systems, replacement of the existing UV system with a newer technology UV system, a new outfall, a new thermal hydrolysis process (THP) to pre-treat sludge prior to digestion, and the retrofit of existing digesters (six) with new hydraulic mixing systems. The expansion will provide the plant with the ability to treat wastewater from an additional population of 325,000. Kim's responsibilities include coordinating the evaluation of innovative process options for the plant expansion, providing technical direction, and leading decision-making through the project life cycle.

Lead Process Engineer and Technical Director; Pine Creek WWTP; The City of Calgary; Calgary, Alberta.

This project included conceptual, functional, and detailed design of the new \$463 million, 100 ML/d wastewater treatment plant south of Calgary. This project included influent pumping, new headworks, primary treatment, biological nutrient removal in two new bioreactors, four 47-metre-diameter secondary clarifiers, and effluent filtration using fabric filters. Kim was responsible for hydraulic profile development, functional design, equipment procurement and detailed design; participated in construction administration and led commissioning.

Process Lead and Lead Process Mechanical; South End Winnipeg Pollution Control Centre (SEWPCC) Upgrade and Expansion Project; City of Winnipeg; Winnipeg, Manitoba.

The focus of this \$250 million project is project definition, preliminary engineering, detailed design and contract administration during construction and commissioning of the upgrade and expansion of this 100 ML/d secondary treatment plant to provide nitrogen and phosphorus removal all to meet a provincial licence requirement by 2016. The scope includes two new circular secondary clarifiers as part of the upgrade with a diameter of 45.7 m with a side wall depth of 6 m with scum removal. Peak wet weather flows will be treated using a ballasted clarification process and the IFAS fixed film process will be considered for the BNR process. The existing plant will be upgraded throughout after completion of the new BNR facility with a planned project completion by 2019.

Chief Engineer; Gippsland Water Factory Water Reclamation Facility; Morwell; Victoria, Australia. Led the design of a \$200 million wastewater reclamation facility. Responsible for process design and management of the engineering team. For domestic wastewater, the plant included inlet works (primary clarifiers, balance tank, and headworks), membrane bioreactors (MBRs) designed for BNR, reverse osmosis (RO), and conveyance. The treated wastewater is transferred to an Australia paper mill. The plant also receives wastewater from the mill and treats it anaerobically (along with sludge from the domestic treatment train) prior to an MBR and discharge.

This project was an alliance, in which CH2M had a substantial equity position. As such, the alliance procured all materials for the project. Kim provided engineering input and participated in the evaluation of over 40 major equipment packages for this project.

Lead Process Engineer; Bonnybrook Capacity Assessment and Blower Evaluation; The City of Calgary; Calgary, Alberta.

The purpose of this study was to assess existing process air delivery system, considering existing and evolving air blower technologies, requirements for various modes of operation (with nitrification and with nitrification/ denitrification), considering growth and future plant expansions. Kim led the study and also provided senior review and input to the capacity analysis of this major plant specifically in the secondary treatment area.

Senior Process Engineer; Lulu Island WWTP Expansion; Greater Vancouver Regional District; Vancouver, British Columbia. This \$21M project involved design of the expansion of this plant from 70 ML/d to 100 ML/d. Kim provided senior review and input during functional design, equipment procurement, and detailed design; participated in construction administration and commissioning.

Project Role

Senior Consultant

Education

BSCE, Purdue University, 1973

MSCE, Purdue University,
1975

Ph.D., Purdue University,
1979

Professional Registrations

Registered Professional
Engineer, Indiana, #
PE60870309; Arizona, #
47312

Board Certified Environmental
Engineer, American Academy
of Environmental Engineers
and Scientists

Distinguishing Qualifications

Widely Recognized
International Expert with
Broad Experience in Water
Management

More Than 40 Years Practical
Experience, Including Senior
Vice President at Major
International Engineering
Firm

Actively Involved with Over
150 US and International
Water Resource Recovery
Facilities Ranging in Size From
< 1 to >400 mgd

Widely Published Author
Holder of Eleven Patents

Former President of the
International Water
Association, Providing Broad
International Perspective

Member of the National
Academy of Engineering

Dr. Daigger is President and Founder of One Water Solutions, LLC, a professional services firm serving the water sector. Strategic advice and technical analysis of water solutions which protect public health and the environment while delivering added value to the communities and industries served are provided. A strong foundation in science and engineering, coupled with broad and diverse experience, provides the basis for these services. Dr. Daigger is also Professor of Engineering Practice at the University of Michigan. Some select examples of Dr. Daigger's experience illustrate how these features are translated into client benefits.

New York City Department of Environmental Protection (NYCDEP).

For a 12-year period beginning in the mid-1990s, Dr. Daigger served as Chair of the NYCDEP Nitrogen Technical Advisory Committee (NTAC). Composed of seven international experts in nitrogen control from wastewater and water conservation, the NTAC provided guidance, technical review, and advice to the NYCDEP on both their applied research program (PO-55) and the overall development and implementation of their BNR program. Formed initially as a requirement of a consent order, due to the value provided the NTAC continued to serve the NYCDEP for many years following completion of the requirements set forth in the consent order. This assignment also provided Dr. Daigger with the opportunity to become intimately familiar with the NYCDEP, including its plants, personnel, and operating procedures and cultures. During this period Dr. Daigger also served as a member of the Advanced Wastewater Treatment Technical Advisory Committee, providing similar services to the NYCDEP through this vehicle. Following this Dr. Daigger served as technical advisory for PO-88, the continued NYCDEP nitrogen control research activities. He has also participated in numerous evaluations of the New York City plants that are being upgraded to provide nitrogen reductions to the Upper East River and Jamaica Bay, including a recent evaluation of further nitrogen reduction options that could be implemented following completion of the current planned upgrades. Served as senior advisory for a project examining a broad range of options for the Rockaway WWTP. Most recently he has served as Technical Advisory for replacement of the existing SHARON® Demonstration Facility at the 275-mgd Wards Island WWTP with a Moving Bed Biological Reactor (MBBR) process which utilizes deammonification reactions made possible by the anammox microorganisms to treat the majority of the centrate flows produced by the dewatering facility at the WWTP.

ARenew, Alexandria, VA. Strategic advisor to Alexandria Renew (ARenew) since 1992, This 72 mgd Water Resource Recovery Facility (WRRF) has been rehabilitated and sequentially upgraded to meet stringent Chesapeake Bay discharge standards of 8 mg/L Total Nitrogen (TN) and then 3 mg/L TN while maintaining consistent

compliance with stringent effluent Total Phosphorus (TP) requirement of 0.18 mg/L. A building block approach, similar to that used with the Clean Water Services facilities, facilitated sequential upgrade of the facility which is located on a highly constrained site in downtown Alexandria, VA. More recently, a Master Plan for further improvement to the facility anticipated potentially more restrictive future effluent standards while achieving increased sustainability. This Master Plan identified a side-stream partial nitrification/Anammox facility which is currently in start-up (first purpose-built facility in North America), resulting in substantial energy and supplemental carbon addition savings. Further application of partial nitrification/Anammox to the mainstream process is being implemented. In all, more than \$500M in capital improvements have been successfully implemented. Most recently served as Technical Advisor for update of the existing long-range plan to anticipate future more restrictive regional biosolids management options.

PUB, Singapore. PUB is the National Water Company of Singapore, providing the full range of water cycle services to this island nation. Dr. Daigger has been a key advisor to PUB since 1996 as they planned and implemented the water infrastructure resulting in water security and positioned Singapore to become independent of Malaysia for water supply. He served as Senior Consultant on the Deep Tunnel Sewage System (DTSS) Feasibility Study which defined the ultimate development of the Nation's wastewater infrastructure and initiated development and implementation of the now extensive NeWater reclamation system which has become and will remain the major water supply for the Nation. Wastewater infrastructure defined by the Feasibility Study included a series of deep tunnels and two new Wastewater Reclamation Plants, one at Changi near the International Airport and Tuas on the Southwestern side of the island near the industrial area. Dr. Daigger subsequently served as Chief Process Engineer for design, construction, and commission of the 211 mgd (expandable to 633 mgd) Changi WRP. This state-of-the-art facility significantly advanced wastewater treatment practice in Singapore and is one of the first facilities in the world accomplishing mainstream partial nitrification/Anammox biological nitrogen removal. Provided strategic advice on other elements of PUB's system, including the NeWater plant located on the roof of the Changi WRP. Currently a member of the Advisory Panel for the Demonstration Plant and the Integrated Validation Plants operated by PUB to test and validate technologies to be incorporated into their new Tuas Water Reclamation Plant. Options being evaluated include both sidestream and mainstream partial nitrification and anammox.

Fairfax County, VA. Has served the Fairfax County, VA Water Authority since the early 1990's, with specific focus on the Noman M. Cole, Jr. Pollution Control Plant (NMCPCP). In the early 1990's developed a plan to allow expansion of the NMCPCP to 67-mgd at a cost significantly lower than other options using the step-feed biological nutrient removal process. Subsequently served as senior consultant for design, construction, and start-up of these facilities. Served as senior consultant on a number of master plans for the NMCPCP, most recently helping to identify opportunities to upgrade the existing incineration process at the facility, including the addition of energy recovery. Most recently served as a member of the Technical Advisory Group for a long-range visioning workshop and analysis for the NMCPCP.

Louisville and Jefferson County, KY, Metropolitan Sewage District (MSD). Served as a consultant to MSD on a wide variety of assignments, beginning in 1980. Initial work involved process analysis, planning, and conceptual design for the 80-mgd Guthrie Water Quality Treatment Center (WQTC). This facility was subsequently constructed, has been expanded significantly, and is now one of the two principal WQTC's owned and operated by MSD. Significant involvement in planning and design activities at the 100-mgd Morris Foreman WQTC, including evaluation of the capacity and performance of the facility, operational assistance, and evaluation of causes for failure of the media in wastewater treatment biotowers. Most recently served as senior consultant for a long-range plan for the facility considering long-range (50+ year) potentially more stringent effluent discharge requirements, evolving

biosolids management options, and the physical life of existing treatment facilities. Plan recommended steps to acquire additional property to allow significant expansion of treatment facilities, and their potential long-term replacement.

Portland, OR, Bureau of Environmental Services (BES). Has served as senior consultant for improvements to the BES Columbia Boulevard Wastewater Treatment Plant (WWTP) secondary treatment system for more than 20 years. Originally constructed as a complete mixed activated sludge system which experienced severe sludge bulking problems, in the 1990's the facility was converted within the existing bioreactor volume to a plug flow configuration with an initial anoxic selector. While this conversion improved sludge settleability, further improvements were implemented in the early 2010's to increase the peak wet weather capacity of the secondary system. This was accomplished again within the existing bioreactor volume by adding further flexibility to operate in step feed and sludge reaeration modes under wet weather conditions, and to adjust the anaerobic selector configuration as needed. Extensive evaluation of the existing relatively shallow square (squire) peripheral feed secondary clarifiers were conducted, including field testing and computational fluid dynamic (CFD) analysis. Extensive modifications to the return activated sludge (RAS) system to thoroughly blend the individual RAS streams to allow the facility to operate as a "single" biological process rather than eight parallel systems were also implemented. These modifications allowed the reliable peak wet weather capacity to be increased from approximately 100 mgd to as much as 140 mgd. Dr. Daigger also provided significant process support to staff during the first wet weather season of operation.

Salt Lake City, UT, Public Utilities. Engaged with a wide variety of planning, design, and operations assistance activities at the City's 56-mgd Water Reclamation Facility (SLCWRF). Significant efforts evaluating options to upgrade the City's rock media trickling filters, and identified high-density plastic media with speed controlled distributors, coupled with addition of suspended growth bioreactors to convert to a coupled trickling filter/activated sludge (TF/AS) facility. Most recently served on a Technical Advisory Committee (TAC) for development of a Master Plan that contemplates all of Salt Lake City's Water Reclamation Facility current and potential future needs through the conceivable future (50 year design life), and to prepare a Capital Improvement Plan and Pre-Design Documents that will be used by the City to identify the projects necessary to meet the SLCWRF's regulatory, capacity and operational requirements through build-out. The Master Plan provides all information necessary for the Engineer(s) selected to complete the final design to move forward with final design tasks quickly and efficiently. The master plan recommended construction of a new liquid process facility using relatively conventional primary and activated sludge (incorporating biological nutrient removal, BNR) technology but allowing for subsequent expansion using new and evolving technology.

City of Akron, OH, Water Reclamation Facility (WRF). Served as senior consultant for an extensive full-scale evaluation of an approach to increase the peak wet weather secondary treatment capacity of the existing facility from 110 mgd to up to 280 mgd by adding step feed capabilities to the existing activated sludge bioreactors and modifications to the existing secondary clarifiers. Initial dynamic process modeling and computational fluid dynamics (CFD) modeling of the existing secondary clarifiers indicated opportunities for significant peak wet weather secondary treatment capacity increases. A subsequent two-year full-scale demonstration using one of six existing plant treatment trains demonstrated that the actual potential capacity increase significantly exceeded initial estimates. Secondary clarifier overflow rates over 1,800 gpd/ft² were reliably sustain, as long as solids loading rates are controlled below limiting values determined through full-scale testing and/or CFD analysis, in spite of the use of quite shallow secondary clarifiers (10 to 12 side-water depth in 100-foot-diameter units).

Regional Municipalities of Durham and York, Ontario, Canada. Senior consultant for an evaluation of the phosphorus removal capability of the existing 630,000 m³/day (166 mgd) Duffin Creek Water Pollution Control Plant (WPCP), along with options to increase phosphorus removal capability either through minor improvements and optimization of the existing facility or through the addition of tertiary treatment facilities. The existing primary and secondary (activated sludge) treatment facility meets its existing effluent total phosphorus (TP) discharge limits of 0.8 mg-P/L monthly and 0.5 mg-P/L annual average. Monte-Carlos analysis was used to assess the reliability of continued compliance with current consent limits, and what the limits of increased reliable performance with modifications such as dual point addition of ferric chloride and polymer addition. Tertiary treatment options evaluated included tertiary granular media filtration, ballasted flocculation, and tertiary membrane treatment.

City of Toronto, Ontario, Canada, Highland Creek WWTP. Served as a senior consultant for rehabilitation of the 217,000 m³/day (57 mgd) Highland Creek Wastewater Treatment Plant (WWTP). This primary and secondary facility consisting of three roughly equal-sized liquid treatment plants. Biosolids treatment consists of waste activated sludge (WAS) thickening, anaerobic digestion, dewatering, and incineration. With initial facilities constructed in 1956, the existing facilities require significant rehabilitation and/or replacement to serve into the future. A roadmap was developed for the facility reflecting the needs to 2050, including the potential for future expansion to 273,000 m³/day (72 mgd).

City of Akron, OH, Water Reclamation Facility (WRF). Served as senior consultant to upgrade secondary treatment system from 110 mgd peak wet weather flow to nearly 280 mgd by improving existing shallow secondary clarifiers (100 foot-diameter, 10 and 12 feet deep) and converting to step feed. An initial investigation, consisting of process modeling of the secondary treatment system and computational fluid dynamics (CFD) was followed by full-scale testing which documented capacity improvements. One of the existing six treatment units at the WRF was modified, and an extensive two-year testing program testing program was conducted to determine the total peak wet weather secondary treatment capacity achievable. Excellent sludge settling characteristics are routine experienced at the City of Akron WRF, raising concerns that the identified peak wet weather secondary treatment capacity could not be maintained should sludge settling characteristics deteriorate for some reason. CFD analysis indicated that the impact of the deterioration of sludge settling characteristics could be mitigated and the identified peak wet weather secondary treatment capacity maintained by further use of the step feed capability provided to further reduce secondary clarifier solids loading rates at the identified high surface overflow rates. The results also demonstrated that effluent limits not only for total suspended solids (TSS) and five-day carbonaceous biochemical oxygen demand (cBOD₅) could be maintained, but also for ammonia-nitrogen and total phosphorous (TP).

Philadelphia Water Department (PWD). Served as senior consultant for an evaluation to convert spare high purity oxygen (HPO) tankage at the PWD Southwest water pollution control plant to provide nitrogen removal from the recycle stream from the adjacent biosolids processing facility. A wide range options were evaluated, including both fixed film and suspended growth options. A plan to implement the selection suspended growth option was developed.

Blue Plains Advanced Wastewater Treatment Plant, DC Water, Washington, DC. Has provided a wide range of serves to Blue Plains. Beginning in 1996 served as senior consultant and peer reviewer for the addition and subsequent upgrade of nitrogen removal for this the largest advanced wastewater treatment plant in the world. This full-scale test used half of the plant to test an innovative nitrogen removal option which was subsequently implemented to the entire plant. Served as senior consultant for subsequent upgrade of the system to meet the stringent Chesapeake Bay effluent total nitrogen limit

of 3 mg-N/L. Assisted with numerous the investigation of numerous process options, including novel system for treating solids handling recycle streams.

San Jose/Santa Clara Water Pollution Control Plant (WPCP). Has provided a wide variety of services since 1979. Analyzed causes for a major plant upset occurring in the summer of 1979 and developed corrective action plan. Served as Process Engineer for implementation of interim improvements to bring the plant into compliance with discharge standards and subsequently for permanent improvements to expand treatment capacity to 167 mgd. Then, in the late 1980's/early 1990's served as Senior Consultant for a series of projects addressing effluent heavy metals issues, including identification of major sources (water supply and domestic use), control measures at the WPCP), and the implementation of clean sampling and analysis procedures which more precisely defined actual mass discharges. More recently served as External Advisory Committee for development of a Master Plan for sustainable upgrade and rehabilitation of the facility.

Upper Occoquan Sewage Authority (UOSA), Centreville, VA. Dr. Daigger has been serving UOSA consistently for more than 30 years. He has been a key member of essentially every major planning, study, and design effort over this period, and has consistently provided assistance when issues have arisen. During this time UOSA has invested more than \$500M in capital as it expanded from 7.5 to 54 mgd (in two major and several minor steps), continued to produce high-quality near-potable quality water which drought-proofs the regional water supply, and has been upgraded to provide nutrient removal consistent with Chesapeake Bay requirements. Planning activities have anticipated future requirements, technology changes, and opportunities to create flexibility for UOSA to successfully manage its capital investments and operating costs over time.

Clean Water Services, Hillsboro, OR. Dr. Daigger has provided a wide range of planning, design, and operational assistance services to Clean Water Services since 1983 at their Rock Creek, Durham, and Hillsboro Advanced Wastewater Treatment Facilities. An innovative approach to facility planning facilitated management of capital investments during periods of high growth. The ultimate development of the plant site (for example, to 110 mgd for Rock Creek) was regularly updated and remained the guiding vision for the facility. At the same time, the specific details of plant upgrades over shorter time periods (5 to 10 years) were defined, consistent with the ultimate development plan. This approach provided the flexibility to manage shorter term (5 to 10 years) capital investments while ensuring that the facilities implemented are consistent with long-term facility needs. A "building block" approach to facility layout anticipated potential future treatment requirements and technology changes, thereby providing the flexibility to meet future requirements and capitalize on the opportunities created by emerging technologies.

VCS, Odense, Denmark. VCS is the third largest water utility in Denmark and provides integrated urban water services (water supply, drinking water delivery, wastewater collection and treatment, and stormwater management) for most of the population of Funen Island. Provided strategic advice to master planning activities targeted to improve water service while reducing resource requirements and producing more sustainable outcomes. Input resulted in a redirection of stormwater management efforts to more distributed methods using natural treatment options in preference to more conventional conveyance and treatment options. At the same time, management of organic matter and nutrients is centralized to achieve greater efficiency and economy of scale. Master planning for the consolidation of several small wastewater treatment plants into a new, energy positive facility also achieving nutrient removal and recovery has been initiated.

Loudoun Water, Leesburg, VA. Senior Consultant for planning, process development, design, start-up, and optimization of the Broad Run Water Resource Facility (WRF). This 12 mgd (expandable to 24 mgd) WRF is designed to produce near potable quality reclaimed water and also to comply with stringent

Chesapeake Bay discharge requirements. Effluent discharge requirements include nutrient limits of 3 mg/L total nitrogen (TN) and 0.1 mg/L total phosphorus (TP) and 10 mg/L of chemical oxygen demand (COD) and non-detectable fecal coliforms. The facility pioneered the use of membrane bioreactor (MBR) technology for nutrient removal and includes upflow-downflow activated carbon contactors for water reclamation. A nine-month pilot study demonstrated the nutrient removal capability of MBR technology and its contribution to effluent COD and pathogen control for more effective water reclamation. More recently served as member of a Technical Advisory Panel assisting with the development of a long-range master plan (through 2070) for the Broad Run WRF, considering evolving treatment requirements, water reuse and resource recovery opportunities, evolving and emerging technologies, and other factors that could affect treatment facilities and practices.

Gippsland Water, Traralgon, Australia. Senior consultant for planning, design, construction, start-up, commissioning, and optimization of the 8.5 mgd Gippsland Water Factory. This \$300M grassroots facility, completed in 2012 and implemented using an alliance model over a seven-year period, reclaims domestic wastewater to near-potable standards using membrane bioreactor (MBR) and reverse osmosis (RO) technology to provide water supply for the adjacent Australian Paper (AP) pulp and paper factory and receives industrial wastewater from AP which is treated in an anaerobic lagoon followed by MBR prior to discharge to the Regional Outfall Sewer (ROS) for transport to ocean discharge. Designed for maximum sustainability, the facility incorporates numerous features to minimize energy requirements and greenhouse gas emissions. It is one of the most advanced water reclamation facilities in the world.

City of Sunnyvale, CA. The City of Sunnyvale Wastewater Treatment Plant has a unique configuration, consisting of influent pumping, preliminary treatment, conventional primary treatment, lagoon-based secondary treatment, followed by dissolved air flotation, nitrifying trickling filters, effluent filtration and disinfection. Solids processing consists of conventional anaerobic digestion and air drying. While in compliance with its current effluent discharge standards, the facility was faced with upgrades needed to comply with future requirements and also significant operating liabilities associated with aging plant infrastructure. Peer review of a Master Plan prepared by others revealed several alternatives that could reduce cost, facilitate phased construction, address liabilities associated with sea level rise and long-term use of the lagoon area for wastewater treatment and biosolids management, and create more sustainable outcomes. This review significantly affected the direction of plant improvements made by the City.

Tahoe-Truckee Sanitary District, CA. Constructed initially as a high purity oxygen (HPO) activated sludge plant, this 9.6 mgd facility has been upgraded to provide biological phosphorus and nitrogen removal. This facility faces a number of challenges, including significant seasonal variations in plant loadings and adverse operating conditions due to its location in a widely known and attractive winter sports area. Phosphorus removal was first required, and the facility was converted to the Phostrip™ process and has become one of the most successful applications of this technology. Upgrade to meet stringent effluent total nitrogen (TN) requirements (2 mg/L TN) was accomplished by adding nitrifying aerated filters followed by denitrifying filters. Final polishing in a leach field receiving plant effluent provides a further compliance margin of safety. On-line now for several years, the plant has demonstrated an outstanding record of compliance with discharge requirements.

City of Redding, CA. Faced with a capital improvement plan that was not affordable, a Value Engineering exercise led by Dr. Daigger successfully reduced project costs without sacrificing achievement of City goals and resulted in a plan which was affordable for the City compared to the previous one. Modification of the project delivery approach allowed early construction of facilities urgently needing rehabilitation and not subject to CEQA review, thereby meeting critical needs and avoiding the cost of inflation for those elements. These immediate improvements addressed existing

odor sources, improved safety, and increased throughput in the primary treatment train. Design and construction of other improvements was phased to accommodate more rigorous environmental review and permitting requirements. Through continuous value engineering during preliminary design and final design, further cost reduction measures were identified that would not increase risk to the City or compromise the WWTP's basic functionality or capacity.

Olivehurst Public Utility District, CA. Senior Process Engineer for expansion of the Olivehurst Wastewater Treatment Plant (WWTP) to 3 mgd and improvements to comply with future discharge requirements. The \$39.4M project provided fine screening, grit removal, oxidation ditch biological nutrient removal plant, constructed wetlands, effluent filtration, followed by ultraviolet disinfection.

City of Tracy, CA. Has served as process engineer, process consultant, and senior consultant for projects at the wastewater treatment plant (WWT) since the early 1980's. More recently assisted with facilities planning and preliminary and final design of a major plant expansion. The final design and construction plans were completed in nine months. The implemented solution incorporated reuse of old and abandoned facilities which resulted in approximately \$3M in construction cost savings.

Orange County Sanitation District (OCSD), CA. Working with OCSD staff, evaluated and upgraded the performance of the District's 80 mgd high purity oxygen (HPO) activated sludge plant. Performed desk-top facility evaluation and full-scale plant stressing testing which identified high sludge volume index (SVI) values and their negative impact on existing secondary clarifier capacity as the principal capacity-limiting factor. Retrofit of selectors was evaluated and found to be feasible. However, on-going operational assistance and plant testing identified changes to plant operating conditions which resolved high SVI issues and maximized plant capacity. The capacity demonstrated was further incorporated into a strategic plan to treat increased urban runoff flows.

Wastewater Master Planning. More than 30 years of experience assisting utilities develop and implement master plans based on sustainability principals. Frequently utilizes the building block approach which allocates space for plant expansions and upgrades and for technology changes to not only improve plant performance and reduce cost but also increase resource efficiency and product production. Has advised the "Concept Wastewater Treatment Plant Design" process on-going in the People's Republic of China, among many other world-class utilities.

Nutrient Removal. A leader in the development of nutrient removal technology for more than 30 years with significant experience developing and implementing (full-scale) biological nutrient removal (BNR) technology for mainstream nitrogen and/or phosphorus removal, chemical phosphorus removal, and side-stream biological nitrogen removal (partial nitrification and anammox). Developed novel BNR processes, including the Virginia Initiative Plant (VIP) and various step feed processes. Engaged in the planning, design, and operation of well over 100 full-scale nutrient removal facilities. Widely published author.

Wet Weather Treatment. Wide and varied experience upgrading existing wastewater treatment plants to increase wet weather treatment capacity. Highly experienced with assessment of the treatment capacity of existing units, and analyzing existing units to identify performance improvement opportunities. Upgrades to implement chemically enhanced primary treatment (CEPT), improve existing secondary clarifiers, and modify activated sludge flow pattern (step feeding) to significantly increase wet weather flow capacity. Designed facilities to accommodate an average:peak flow peaking factor of more than 10:1, for example for the 40 mgd (average dry weather capacity) Blue Valley Wastewater Treatment Plant, Missouri. Identified options to increase the capacity of the Akron, OH, Water Reclamation Facility from a peak flow of 110 mgd to nearly 280 mgd. The importance of associated systems, such as plant headworks and solids handling, is crucial to achieving "whole plant" solutions that

will function successful is emphasized. Other significant efforts include for the Cities of Indianapolis, IN; Philadelphia, PA, Portland, OR (Columbia Boulevard Wastewater Treatment Plant), and Eugene-Springfield, OR.

Coupled Trickling Filter/Activated Sludge Processes. Leader and developer of numerous advances in the use of trickling filter and coupled trickling filter/activated sludge (TF/AS) processes globally, having been lead process engineer for projects throughout North America and abroad. Pioneered the concept of nitrification in coupled TF/AS processes by appropriately loading the trickling filter and completing treatment in the downstream AS system through full-scale applications in Garland, TX (Duck Creek and Rowlett Creek plants) and Kearney, NB. Extensive experience evaluating trickling filter media performance. Developed and demonstrated relevant process design criteria, and incorporated into process models which allow system trade-offs to be accurately assessed. Direct and relevant experience with over two dozen relevant plants.

Steven A. Robson

Process Operations Technologist



Education

Undergraduate Studies, Engineering, University of Waterloo (1974)

Distinguishing Qualifications

- More than 36 years of specialized experience in wastewater process design, treatment plant operations, operator training, process commissioning and start-up, and operations manual preparation.

Relevant Experience

Steve Robson has over 36 years of experience as a process operations technologist, with specialized experience in Wastewater Treatment Plant operations, operator training, process start-up, and troubleshooting. Steve has been involved with the commissioning, start-up and operator training at various national and international facilities, treating both municipal and industrial wastewater. He completed related MOE operating courses and worked as a wastewater treatment plant operator for several years in the Regional Municipality of York prior to joining CH2M HILL in 1980. Steve Robson is an Associate Member of the Ontario Association of Certified Engineering Technicians and Technologists.

In addition, he has been involved with the CH2MHILL UMS initiative for detailed operations manual development, including EOMS development for major facilities in the US and Canada. Steve is a member of the CH2M HILL Plant Analysis Technologies (PAT) technical team. He has extensive experience in setting up and carrying out full and bench scale treatability studies and field sampling/analysis programs. He is well versed in sampling and laboratory protocol, and he is certified in confined space entry procedures and OHS standards.

Steve has is a certified trainer with the Environmental Operators Certification Program (EOCP) training registry in the province of British Columbia.

Representative Projects and Dates of Involvement

Senior Technical Lead for Phosphorus Reduction Action Plan Study, Duffin Creek WPCP, Pickering, On.; On-site operations support and technical lead for a major process study to achieve reduced effluent phosphorus loading on Lake Ontario

Technical Trainer, Iona WWTP, Vancouver, B.C.; Provided operator training/support for new solids handling including sludge screening/grit removal processes.

Operations Training, North West Langley WWTP, Langley, B.C.; Commissioning activity technical lead for a major process upgrade at the NWLWWTP; also, provided operations assistance and start-up services, QC review of the operations manual, CDAC development support, operator training/support for new processes.

Steven A. Robson

Construction Management Support and Commissioning, North Toronto WWTP CSO Facility Upgrade, Toronto, ON; assistance to the CSM for a major CSO facility improvement including site supervision on an as needed basis; commissioning currently underway

Construction Management Support/Commissioning Lead, Non Quon WWTP, Port Perry, ON; assistance to the CSM for construction of a green field WWTP servicing the city of Port Perry, ON.; operator training, start-up and commissioning through the winter 2016/2017

Commissioning Lead, Skyway WWTP, Burlington, Ontario; On-going commissioning activity lead for a major process upgrade touching all areas of a site constrained facility and including a new tertiary filtration facility; also, providing operations assistance and start-up services, QC review of the operations manual, SCADA development QC and support, operator training/support for new processes. Completed conceptual design of multiple laboratories for an operations/lab facility for the regional municipality as part of a larger design team.

Startup, and Commissioning, Amherstburg WWTP, Amherstburg, Ontario; Provided operations assistance, start-up, and commissioning services for a new BNR facility serving the Town of Amherstburg; responsible for start-up and commissioning of new equipment, development of the operations manual and operator training/support.

Operations Assistance, Startup, and Commissioning, Lagoon Lane WWTP, Bracebridge, District of Muskoka; Operations support for a municipal facility treating wastewater from the Town of Bracebridge consisting of an activated sludge process with tertiary filtration supplemented by lagoon treatment of flows in excess of the WWTP capacity. Provided operations assistance, start-up, and commissioning services for a new MBR facility as replacement for the activated sludge plant serving the Town of Bracebridge; responsible for start-up and commissioning of new equipment, development of the operations manual and operator training/support.

Operations Assistance, Startup, and Commissioning, MBR Facility, Great Blue Heron Casino, Port Perry. Provided operations assistance, start-up, and commissioning services for the MBR facility serving the Great Blue Heron Casino; responsible for start-up and commissioning of new equipment, development of the operations manual and operator training/support.

Operations Assistance, Startup, and Commissioning, Tertiary Treatment Facility, City of Barrie, On.; Startup, and commissioning services for a major capacity expansion of a complex activated sludge facility with tertiary treatment (RBCs, flocculation, filtration) in the City of Barrie, ON; responsible for operator training, start-up recommendations, OM development and process assistance during the initial operating period.

Operations Assistance, Startup, and Commissioning, MBR Facility, Traverse City, Michigan. Provided operations assistance, start-up, and commissioning services for the MBR facility at the Traverse City WWTP; responsible for start-up and commissioning of

new equipment, development of the operations manual, and integration of the new facilities with the existing facilities.

Project Manager/Technical Lead; Operations Assistance, Design Services, etc.;
Cablebridge Enterprises; Alliston, Ontario; Implementation of a long-term operations assistance program at a small activated plant with tertiary treatment (effluent filtration) treating domestic wastewater for a growing private residential/recreation community; implementation of sample collection and report preparation to meet the requirements of the Certificate of Approval for wastewater effluent discharge (river, irrigation), as well as two water treatment systems (groundwater); ongoing recommendations for process modification and improvement, including equipment selection, for treatment plant upgrades to handle the requirements of the growing serviced community.

Technical Lead; Operations Review and Support; Casino Rama WWTP, Orillia;
Operations assistance, document development, field studies and training to assist the operations staff with the operation and control of an SBR activated sludge treatment system with tertiary filtration.

Technical Lead; Operations Assistance Program; City of Guelph, Ontario; Operations assistance to meet the requirements of a recent temporary re-rating for a conventional activated sludge plant with tertiary treatment (RBC, filtration), including more stringent C of A compliance parameters, for the interim period leading up to design and construction of the plant expansion; on-site assistance to the operations supervisory staff to develop operating procedures and protocols, technical advice for equipment/operating improvements and maintenance procedures; completion of a field study/pilot unit operation to investigate the effectiveness of UV disinfection; assistance with laboratory analysis/development to upgrade the laboratory operation, including training of new laboratory personnel; and assistance in the development of data handling reporting procedures for routine operating parameter and analytical data.

Operations Assistance, Startup, and Commissioning; District Municipality of Muskoka; Port Severn, Ontario. Provided operations assistance, start-up, and commissioning services for the SBR facility with tertiary filtration at the Port Severn Lone Pine Road WWTP; responsible for start-up and commissioning of new equipment, development of the operations manual, operator training, etc.

TMBR Pilot Plant Operation, Hamilton, ON: Technical lead for the development, commissioning start-up and operation of a pilot scale TMBR facility at the Woodward WWTP; including operation supervision, vendor liaison.

Operations Assistance and Operator Training, Residue Management Facility, City of Toronto, R.L Clark WTF, 2008-2009. Operator training and assistance during start-up for a new residue management facility, including dewatering with centrifuges, to handle water treatment residue prior to discharge.

Technical Lead; Duffin Creek WPCP; 2008. Bench scale testing and development of process requirements for dual point chemical addition for enhanced phosphorus removal; development of equipment requirements and process design for full scale implementation

Steven A. Robson

of enhanced phosphorus removal systems; preparation of operations manuals for expanded treatment plant facilities.

Operations Assistance, Startup, and Commissioning, Ashbridges Bay Treatment Digestion Upgrades; City of Toronto, Ontario; 2006 to present. Ongoing assistance to the project manager for process assistance during start-up, training and operations manual preparation for the upgrades to Digesters 1 – 8.

Startup and Commissioning, City of Toronto, Ontario; 2006 - 2008. Preparation of commissioning and start-up documents for anaerobic digester upgrades at the Humber TP.

Technical Lead; City of Ottawa, Ontario; 2007. Preparation of commissioning and start-up documents for anaerobic digester upgrades including two new digestion tanks.

Technical Lead; Process Control Systems; City of Toronto, Ontario; 2006 to 2007. Process design assistance for the design and implementation of the Plant Services portion of the Process Control Systems program at the Highland Creek and Ashbridges Bay Treatment Plants.

Process Design Lead; Ashbridges Bay Treatment Plant Process Control Systems Program; City of Toronto, Ontario; 2002 to 2005. Process design lead for the design and implementation of the Process Control Systems program at the Ashbridges Bay Treatment Plant; SCADA operations training lead, operations manual development, and ongoing support to the Project Manager/Lead Engineer.

Process Design Lead; Process Control Systems; City of Toronto, Ontario; 2001 to 2002. Field verification team lead and process design lead for the design and implementation of process control systems at the Ashbridges Bay Treatment Plant; including development of control strategies, narrative, and operating manual preparation.

Technical Lead; Process Evaluation Study; City of Garland, Texas; 2001. Implementation of Process Analysis Techniques to determine process efficiency and identify hydraulic bottlenecks for the City of Garland, Texas; including flow pattern and stress testing of Primary Clarifiers and an evaluation of existing trickling filters; comprehensive report development for the lead engineer recommending design/operations improvements based on study outcome.

Technical Process Lead; EOMS Development and Implementation; Alexandria Sanitation Authority AWT FIM; Alexandria, Virginia; 2001. Technical process lead for the preparation of an online operation manual for the Alexandria Sanitation Authority AWT.

Technical Lead; Process Evaluation Study; Upper Trinity Regional Water District; Texas; 2000. Implementation of Process Analysis Techniques to determine process efficiency and identify hydraulic bottlenecks for the Upper Trinity Regional Water District at the Lakeview WRP in Texas; including OTE testing of an existing AT, flow pattern, and stress testing of Secondary Clarifiers, and mixing characteristics of aerobic digestion tanks; comprehensive report development for the lead engineer recommending design/operations improvements based on study outcome.

Technical Lead; City of Toronto, Ontario; 1999. Instrumentation and process equipment verification for adequacy with respect to Y2K compliance for the City of Toronto.

Process Design Lead; City of Toronto WBPP Systems Integration; City of Toronto, Ontario; 1996 to 1998. Process design lead for the preliminary design phase of the City of Toronto WBPP systems integration at the Highland Creek TP, as well as providing assistance to the process lead at the Ashbridges Bay TP in support of the system design leads; preparation of Process Control Narratives to effect developed control strategies and standards implementation.

Technical Lead; Western Beaches Tunnel CSO System Design; City of Toronto, Ontario. Development of sampling protocols and procedures for the design and implementation of the City of Toronto, Western Beaches Tunnel CSO system.

Project Manager; O&M MANUAL Development; City of Greater Sudbury; Chelmsford, Ontario. Operation Manual preparation for the Chelmsford WPCP, an NDN facility in Chelmsford, Ontario.

Technical Lead; Process Evaluation; City of Guelph, Ontario. Implementation of Process Analysis Techniques to complete a full scale performance evaluation of an installed RBC tertiary treatment system including sample collection and report preparation; evaluation of diurnal fluctuations through the plant through onsite data and sample collection; in-situ measurement of oxygen transfer efficiency (OTE) in a newly installed fine bubble aeration system to evaluate the system with respect to performance guarantees; site work as a field crew supervisor and data reduction for report directed to the project engineer; in-situ measurement of OTE in a newly retrofitted system to evaluate the system with respect to improved transfer and to compare the results with test work performed in a twin plant prior to retrofit; and, site work as a field crew supervisor along with data reduction for report preparation.

Technical Lead; Process Development and Training; Confidential Client; Canada, Europe, and South America. Equipment specification and layout of a treatment plant laboratory for a new installation; onsite assistance to a project engineer during the construction, equipment testing, and complete process start-up of a variety of newly constructed and/or modified older facilities; operations assistance/support and operator training at a recently modified, multi-process treatment plant; training of personnel in laboratory analysis necessary for process operations monitoring at a variety facilities in Canada, as well as Europe and South America.

Technical Lead; Process Evaluation; City of Barrie, Ontario. Implementation of Process Analysis Techniques to investigate short circuiting in clarifiers (primary and secondary), data interpretation, and report preparation; onsite study to document phosphorous removal in the treatment process through intensive sampling and analysis of the various streams in the plant; observation of a pilot sand filter operation to evaluate the effectiveness of a full-scale filter installation for effluent polishing; witness to the acceptance testing of a newly installed pure air aeration system performed by the supplier's representative and preparation of a report to document the test performance and results; and, setup of supervision and operation of a pilot RBC unit for tertiary treatment (nitrogen removal) of secondary clarifier effluent to develop full-scale design criteria at the Barrie WPCP.

Steven A. Robson

Wastewater Treatability

Senior Technical Specialist; City of Toronto ABTP Wet Weather Pilot Study; City of Toronto, Ontario; 2006. Provided senior technical assistance for a pilot project to evaluate the effectiveness of alternative treatment for storm water flow.

Technical Lead; Process Evaluation; Ford Motor Company of Canada; Oakville, Ontario. Investigation of co-treatment of municipal wastewater with industrial wastewater in a conventional activated sludge water pollution control plant and assistance in the daily operation of bench-scale aerobic reactors.

Technical Lead; Process Evaluation; Omstead Foods; Wheatley, Ontario. Treatment of fish processing wastewater, using conventional activated sludge (aerobic) process and assistance in the daily operation of bench-scale aerobic reactors.

Technical Lead; Conventional Activated Sludge Waste Treatment Process Assessment; Ontario Hydro; Tiverton, Ontario. Assessment of co-treatment of an industrial byproduct in conventional activated sludge (sanitary) waste treatment process and assistance in the daily operation of bench-scale aerobic reactors, for Ontario Hydro, Bruce Nuclear Power Development.

Technical Lead; Process Evaluation; Ontario Clean Water Agency; Mississauga, Ontario. Anaerobic treatability of high strength decant liquor from a thermal oxidation unit treating sludge from the Lakeview water pollution control plant; construction/modification, preparation, start-up, and daily operation of bench-scale reactors to assess the degree of treatability to be expected as well as the limitations of the process with respect to loading (hydraulic/organic) rates.

Technical Lead; Treatability Study; Celanese Canada Inc.; Millhaven, Ontario. High strength emulsified oil waste treatment using conventional aerobic technology in a bench-scale treatability study; assistance in the daily operation of bench-scale aerobic reactors; high strength emulsified oil waste treatment using hybrid anaerobic (HYAN) technology in a bench-scale treatability study; design, preparation, start-up, and daily operation of a bench-scale reactor to assess the feasibility of the process for this application, the degree of treatability to be expected, and limitations of the process with respect to loading (hydraulic/organic) rates; and, preparation of a technical report summarizing the operation and tabulated data for the study.

Technical Lead; Process Evaluation; CASCO; Port Colborne, Ontario. Existing treatment process assessment with respect to sewer use bylaw requirements; onsite operation of a bench-scale aerobic treatability unit, and performance of analysis to determine the process options for clarification of the aerobic mixed liquor prior to discharge; onsite operations assistance during the operation of a pilot clarification unit to assess the viability of a full-scale installation of this type.

Technical Lead; Tien Chu MSG Plant Treatability Study; CIDA; Shanghai, China. Treatment of a simulated monosodium glutamate factory wastewater using hybrid anaerobic (HYAN) technology in a bench-scale treatability study; preparation, start-up, and daily operation of a bench-scale reactor to assess the feasibility of the process for this application, the degree of treatability to be expected, and limitations of the process with

respect to loading (hydraulic/organic) rates; assistance in the setup and operation of a bench-scale aerobic reactor (extended air activated sludge) for further treatment of the anaerobic effluent; and, preparation of an anaerobic bench-scale reactor (HYAN) for shipment to the overseas site for further study.

Technical Lead; Brockville Water Pollution Control Plant Anaerobic Digester Study; City of Brockville, Ontario. Bench-scale anaerobic digester study investigating the effects of surfactant (LAS) on digester operation; bench-scale reactor design, construction, and maintenance; and, development of procedures for daily operation of the reactors and assistance with data assimilation.

Technical Lead; Guelph Landfill Leachate Study; City of Guelph, Ontario. Guelph landfill leachate study involving bench-scale anaerobic study employing the hybrid anaerobic (HYAN) reactor technology for the treatment of high strength leachate from a municipal landfill; technical assistance and supervision of reactor maintenance, operation, and data collection; pilot-scale anaerobic study at the Guelph landfill site to determine the feasibility of and design parameters for a full-scale installation; equipment specification, ordering, layout, and setup of the pilot facility; and, technical support to the project engineer during the pilot plant operation.

Technical Lead; Process Evaluation; Bowater Mersey Paper Mill; Halifax, Nova Scotia. Toxicity reduction and aerobic treatment of pulp mill wastewater; technical assistance during a bench-scale aerobic study employing flow through aerobic (activated sludge) reactors with respect to reactor operation, maintenance, and data collection; evaluation of options for ultimate clarification and dewatering of the aerobic sludges using Buchner funnel (filtration) testing, capillary suction time (CST) testing, and dissolved air flotation (DAF) testing; and, evaluation of polymer conditioning as a clarification aid.

Technical Lead; Treatability Study; Ault Foods; Winchester, Ontario. Treatability studies to optimize suspended solids and phosphorous removal in an industrial waste treatment plant to meet discharge requirements as support to the project engineer; treatability studies to optimize phosphorous removal in an industrial waste sidestream as pretreatment before discharge to the waste treatment plant; subsequent testing of the sludge produced with respect to dewatering characteristics involving polymer screening and selection and use of capillary suction time testing, centrifuge spin down tests, and the Buchner funnel test; and technical report preparation as support to the project engineer.

Technical Lead; Process Evaluation; St. Mary's Paper; Sault Ste. Marie, Ontario. Pilot-scale activated sludge treatment plant operations to develop full-scale design parameters; equipment specification for a complete conventional activated sludge pilot plant; pilot plant setup, construction, and process start-up; operations supervision (including onsite analysis for operating parameters) during the six-month operating period; and, sample collection and handling for additional analysis.

Wastewater Field Services

Technical Lead; Process Evaluation; Region of Halton; Georgetown, Ontario. Automatic wastewater sampler installation, operation, and maintenance for a long-term, full-scale investigation into treatment plant performance; development and installation of a

Steven A. Robson

temporary flow measurement device for confirmation of recycle stream flows; and, daily collection of samples for laboratory analysis for process characterization.

Technical Lead; Oakville South-West Water Pollution Control Plant Evaluation; Regional Municipality of Halton; Oakville, Ontario. Evaluation of the effectiveness of iron salts as compared with aluminum salts for phosphorous removal at the Oakville South-West WPCP, sample collection, operator liaison, as well as data collection and report preparation.

Technical Lead; Wellington, Ontario. Start-up, onsite operator training, and operations assistance, as well as operation manual preparation for a small municipal WPCP.

Technical Lead; City of Brockville, Ontario. Operations assistance and training of laboratory analyst to meet analytical requirements for operation of the Brockville Water Pollution Control Plant, as well as sewer use investigation.

Technical Lead; O&M Manual Development Regional Municipality of York; Keswick, Ontario. Preparation of an operations manual for a newly-constructed, medium-sized WPCP.

Technical Lead; Lakeview Water Pollution Control Plant Onsite Investigation; Ontario Clean Water Agency; Mississauga, Ontario. Extensive onsite investigation into the effects of fouling on fine bubble diffusers through operation of columnar reaction vessels under various conditions at the Lakeview WPCP.

Technical Lead; Dual Point Phosphorus Removal Chemical Addition Study at the Clarkson Water Pollution Control Plant; Ontario Clean Water Agency; Mississauga, Ontario. Onsite bench-scale investigation into the use of polymer as a settling aid to improve SS capture in the secondary clarifier, jar testing, and onsite investigation for a dual point phosphorus removal chemical addition study at the Clarkson WPCP.

Technical Lead; Woodstock Water Pollution Control Plant Assessment; City of Woodstock, Ontario. Assessment of mixing characteristics in a newly-installed complete-mix design aeration basin using Rhodamine dye and fluorometry in an onsite investigation; interpretation of data produced and preparation of an internal report; and, assistance with performance testing of a newly installed sludge dewatering facility (belt press) at the Woodstock WPCP.

Technical Lead; Process Optimization; City of Toronto, Ontario. Evaluation of the effectiveness of raw sludge pumping practices in the removal of sludge and clarifier performance through onsite sampling and observation; preparation of recommendations with respect to improved operation; evaluation of the effectiveness of grit removal in the treatment plant through onsite investigation and sample collection; evaluation of fine bubble diffuser systems for future expansion and/or retrofit in multiple pass spiral roll aeration cells; and, sample collection of building material during the decommissioning of a sludge incinerator for disposal purposes at the Ashbridges Bay Treatment Plant.

Technical Lead; Operations Start-up/Performance evaluation; City of Cornwall, Ontario. Performance testing/start-up of a newly installed dewatering facility, including analysis of samples to document performance operator training/assistance and liaison with the equipment supplier's representative at the treatment plant site.

Technical Lead; Atlantic Avenue Water Pollution Control Plant Feasibility Study; City of Thunder Bay, Ontario. A full-scale study to document the feasibility of polymer use to improve suspended solids capture and, therefore, phosphorous removal in a primary treatment plant; onsite operation and maintenance of automatic sampling equipment, sample collection and onsite sample preparation, supervision of onsite analysis, client liaison, polymer feed system installation supervision, and operation, as well as operator training; and, performance testing/start-up of a newly installed dewatering facility, including analysis of samples to document performance operator training/assistance and liaison with the equipment supplier's representative at the treatment plant site at the Atlantic Avenue WPCP.

Technical Lead; Chelmsford Water Pollution Control Plant Pilot Study; Confidential Client; Chelmsford, Ontario. Operations assistance and supervision of a pilot study using polymer to improve effluent quality from a municipal WPCP, including assistance in laboratory analysis procedures and data tabulation for report purposes.

Technical Lead; O&M Manual Development; Town of Wallaceburg, Ontario. Preparation of operations and maintenance manual for the Sydenham River WPCP.

Technical Lead; O&M Manual Development; Region of Ottawa-Carleton, Ontario. Preparation of an operations and maintenance manual for a sludge thickening and dewatering facility, and performance testing/start-up of a newly installed thickening and dewatering facility; including analysis of samples to document performance operator training/assistance, and liaison with the equipment supplier's representative at the Robert O. Pickard Environmental Centre.

Technical Lead; Process Evaluation Study; Ault Foods; Eganville, Ontario. Onsite investigation, including installation of automatic sampling equipment and a complete site inspection to identify the various waste streams to determine the plant piping layout, and to develop an as-built site plan for use by the project engineer in the development of recommendations for improvement to meet the compliance regulations.

Technical Assistant; Waste Treatment Facility Evaluation; Pillsbury Canada Ltd.; Tecumseh, Ontario. Technical assistance to the project engineer via an onsite evaluation of the waste treatment facility through historical data collection, treatability testing, biological sludge dewatering operations, operations assistance, as well as acceptance testing (witness) of dewatering equipment (bailer).

Technical Lead; Process Evaluation Study; Gay Lea Foods; Guelph, Ontario. Investigation into the various waste streams through onsite sample collection and data accumulation as support to the project engineer.

Technical Lead; Process Evaluation Study; Gay Lea Foods; Teeswater, Ontario. Investigation of in-plant waste streams (quantity and quality) through onsite sample collection and data accumulation as support to the project engineer; operations assistance at the wastewater treatment facility (activated sludge plant) to improve the treatment process and provide upgrade recommendations.

Steven A. Robson

Technical Lead; Process Evaluation Study; Beatrice Foods; Oshawa, Ontario. Investigation into the various waste streams through onsite sample collection and data accumulation as support to the project engineer.

Technical Lead; Process Evaluation Study; Field Fresh; Oakville, Ontario. In-plant investigation into the various waste streams through onsite sample collection, flow measurement, and data collection as support to the project engineer.

Technical Lead; Process Evaluation Study; Farmers Dairy; Truro, Nova Scotia. In-plant investigation into the various waste streams through onsite sample collection and data accumulation as support to the project engineer and effluent discharge monitoring (quality and quantity) and characterization.

Technical Lead; Onsite Sampling Program; Confidential Client. Onsite sampling program for quarterly investigation of targeted sewer use bylaw parameters, using automatic sampling equipment and quarterly report preparation; sampler installation, sample collection and submission, and data tabulation and reporting to the client; and, technical assistance to the client during an in-house wastewater characterization study, including operation of pH recording equipment.

Technical Lead; Operations Assistance and Training; Confidential Client. Operations assistance/support for a newly appointed supervisor and onsite troubleshooting of existing operating problems in an anaerobic lagoon treatment system; evaluation of sludge accumulation in the anaerobic lagoon; and, support to the project engineer with respect to recommendations for disposal.

Technical Lead; Operations Assistance and Training; Confidential Client. Operations assistance/support for a newly appointed supervisor and onsite troubleshooting of existing operating problems in a multi-process treatment plant; evaluation of odour problems and written recommendations for improved operation; and, support to the project engineer.

Technical Lead; Operations Assistance and Training; Confidential Client. Equipment specification and layout of a treatment plant laboratory for a new installation; local (Canada) training of the newly appointed Manager of Environmental Protection for the facility; assistance onsite at an international location to a project engineer during the construction, equipment testing, and start-up of a newly constructed waste treatment facility; operations assistance/support and operator training, including training of personnel in laboratory analysis required for monitoring the daily operations; and support to the project engineer on an ongoing basis.

Technical Lead; Process Evaluation; Ford Motor Company; Oakville, Ontario. Sludge sampling in a lagoon treatment system for evaluation of sludge inventory and to provide data with respect to recommendations for removal and disposal as support to the project engineer.

Technical Lead; Process Evaluation; Ford Motor Company; St. Thomas, Ontario. Sludge sampling in a lagoon treatment system for evaluation of sludge inventory and to provide data with respect to recommendations for removal and disposal as support to the project engineer; and, a characterization study to develop improvement design criteria for

production-specific processes and the wastewater treatment process as support to the project engineer.

Technical Lead; Wastewater Sampling Program; General Motors; Oshawa, Ontario.

Supervision of an extensive (12-station) wastewater sampling program, including sampler installation, servicing, and data collection.

Technical Lead; Process Evaluation; Black Diamond Cheese; Belleville, Ontario. Sludge sampling in a lagoon treatment system for evaluation of sludge inventory and to provide data with respect to recommendations for removal and disposal as support to the project engineer.

Technical Lead; Operations Assistance; GreenBriar Residential Retirement Community; Alliston, Ontario. Development and implementation of a long-term operations assistance program at a small activated plant treating domestic wastewater utilizing the Sutton process; assistance in sample collection and report preparation to meet the requirements of the Certificate of Approval for effluent discharge; recommendations for process modification (eliminate effluent handling in the Sutton process polishing pond) and improvement, including equipment selection, for treatment plant upgrade to include an effluent handling facility (filtration/UV disinfection).

Technical Lead; Process Assistance; Petro-Canada Products; Mississauga, Ontario.

Treatment process characterization (stress testing) for a refinery wastewater treatment facility (activated sludge) designed for phenol removal from the daily production wastewater, as well as stormwater treatment, and preparation of task-specific procedures and operating manuals for modifications for stormwater handling facilities.

Technical Lead; Tertiary Treatment Evaluation; City of Peterborough, Ontario. Set up and provided supervision for the operation of several pilot scale tertiary filters to develop performance criteria for a full scale facility to meet the effluent phosphorus requirements at the Peterborough WWTP.

Technical Lead; Peterborough Wastewater Treatment Plant Phosphorus Removal Pilot Study; City of Peterborough, Ontario. Set up and data interpretation of a pilot study to assess dual point chemical addition for phosphorus removal at the Peterborough WWTP.

Technical Lead; Process Evaluation; City of Peterborough, Ontario. Installation and monitoring of various fixed media to assess acceptability for in a full-scale installation and to provide data for the development of design criteria at the Peterborough WWTP.

Water Treatment Field Services

Technical Lead; Lakeview Water Treatment Plant Backwash Optimization Study; Ontario Clean Water Agency. Backwash optimization studies to evaluate the effectiveness of backwash rates through observation and sample collection/analysis at the Lakeview Water Treatment Plant.

Technical Lead; Process Evaluation; City of Trenton, Ontario. Preparation and installation of a pilot chemical addition system for an investigation into options for improved turbidity removal at the Trenton WTP.

Steven A. Robson

Water Resources Field Services

Technical Lead; Water Systems Field Study; Region of Ottawa-Carleton, Ontario.

Training of field staff in the performance of current direction study procedures using rhodamine dye and fluorometry, as well as a variety of drogue and surface marking devices.

Technical Lead; Water Systems Field Study; City of Barrie, Ontario. Training of field staff in the performance of current direction study procedures using rhodamine dye and fluorometry, as well as a variety of drogue and surface marking devices.

Technical Lead; City of Toronto, Ontario. Current directional studies in Lake Ontario to evaluate the effect of stormwater and combined discharge in the Eastern Beaches area of Toronto; data collection and reduction using a variety of methods, including rhodamine dye addition and fluorometry; use of marine tracking devices, as well as a knowledge of boat operations required ; current directional studies in Lake Ontario to evaluate the effect of stormwater discharge to the lake in the Humber River and the Western Beaches areas in Toronto; data collection and reduction using a variety of methods, including rhodamine dye addition and fluorometry; involved use of marine tracking devices, as well as a knowledge of boat operations; current directional studies in Lake Ontario to evaluate the effect of the Ashbridges Bay Treatment Plant effluent discharge to the lake; data collection and reduction using a variety of methods, including rhodamine dye addition and fluorometry; marine tracking device use and a knowledge of boat operations required.

Technical Lead; Lakeview Water Treatment Plant; Ontario Clean Water Agency; Mississauga, Ontario. Current directional studies in Lake Ontario to evaluate the effect of the current patterns in the lake at the treatment plant intake and area as related to wind direction; monitoring of lake conditions and water temperature in the study area; bottom profiles were produced during the study as an initial investigation into intake relocation; responsible for data collection and reduction using a variety of methods; use of marine tracking devices, as well as a knowledge of boat operations.

Technical Lead; City of Cornwall, Ontario. Current directional studies in the St. Lawrence River to evaluate the effect of the current patterns in the river on a proposed water intake; Monitoring of river conditions and temperature in the study area; bottom profiles were produced during the study as an initial investigation into intake location; data collection and reduction using a variety of methods; use of marine tracking devices, as well as a sound knowledge of boat operations.

Technical Lead; City of Belleville, Ontario. Current directional studies in the Bay of Quinte to evaluate the effect of the current patterns in the bay with respect to water quality; monitoring of general conditions and temperature in the study area; samples were collected to assess the overall water quality in the bay; data collection and reduction using a variety of methods; use of marine tracking devices, as well as a sound knowledge of boat operations.

General Field Services

Technical Lead; Ford Motor Company; Oakville, Ontario. Investigation into possible ground contamination in the vicinity of a waste oil handling facility; sample collection, observation of work performed by hydrogeological contractor, and technical support to the

project engineer; technical report preparation for submission to the client; soil sampling for decommissioning and lagoon closure purposes; and design, equipment specification, and installation of a pH monitoring station.

Technical Lead; Ford Motor Company; Windsor, Ontario. Sampling and classification of waste materials stored in a waste drum field for ultimate transportation and disposal, and, recommendations for improved drum handling procedures.

Technical Lead; Dry Weather Outfall Study; Ministry of Transportation; Ontario. Dry weather outfall study involving flow measurement and sample collection in stormwater maintenance holes.

Technical Lead; Southam-Murray; Weston, Ontario. Extensive soil sampling for site decommissioning as support to the project engineer.

Experience Prior to CH2M HILL

Field Technician; Regional Municipality of Peel, Ontario. Field studies concerning traffic control, traffic flow patterns, signing, and signal light installations.

Field Technician; Regional Municipality of York, Ontario. Field technician with the Traffic and Transportation Department carrying out studies concerning traffic control, flow patterns, traffic signs and signals, and intersection design.

Wastewater Treatment Plant Operator; Regional Municipality of York, Ontario. Operator in a municipal water pollution control plant working at the Operator Two level (pre-certification) for three years; subsequent year as a treatment plant operator in a rotation through four municipal water pollution control plants varying in design and capacity and as a technician responsible for regional biosolids disposal with the Regional Technical Support.

Professional Organizations/Affiliations

Associate Member of the Ontario Association of Certified Engineering Technicians and Technologists (OACETT)

Water Environment Association of Ontario (WEAO)

Water Environment Federation (WEF)

Additional Training

Advanced Wastewater Operator Training Correspondence Program California State University, Sacramento (1992)

Critical Environmental Sampling and Analysis Strategies, American Chemical Society (ACS), Short Course (1991)

Confined Space Entry, Environmental Training Institute (1989)

Laboratory Skills Workshop, Ontario Ministry of the Environment (1984)

Sludge Digestion Process Workshop, Ontario Ministry of the Environment (1984)

Digester Gas System Maintenance Workshop, Ontario Ministry of the Environment (1984)

Activated Sludge Process Workshop, Ontario Ministry of the Environment (1978)

Basic Gas Chlorination Workshop, Ontario Ministry of the Environment (1978)

Basic Water Pollution Control Plant Operation Workshop, Ontario Ministry of the Environment (1977)

Steven A. Robson

Languages

English

Supplemental Information

Years Experience Prior to CH2M HILL: 4

CH2M HILL Hire Date: 12/01/1980

Employment History

CH2M HILL, Project Consultant, 1980 to Present

Regional Municipality of York, 1976 to 1980

Adrienne Willoughby, P.Eng.

Testing and Performance Evaluation

Years of Experience: 6

Education

B.E.Sc., Biochemical Engineering, Western University Canada

Professional Registrations

Professional Engineers Ontario (2011, No. 100172515)

Distinguishing Qualifications

- Wastewater characterization and whole plant process modeling
- Facility design and optimization
- Wastewater treatment plant performance analysis including laboratory work and data analysis
- Project management tasks including scheduling, budgeting, invoicing and reporting

Relevant Experience

Adrienne is a process engineer with six years of consulting experience in municipal wastewater treatment. Through many local and international projects, Adrienne has gained valuable experience and knowledge in wastewater process modelling, wastewater characterization, process optimization, and nutrient removal technologies. Adrienne is proficient in planning and executing field studies and pilot demonstrations for new wastewater treatment processes and technologies including sampling and analytical plans, laboratory techniques, and coordination between utilities and academic partners.

Representative Projects and Dates of Involvement

Wastewater Parametric Design Lead; CH2M Parametric Cost Estimating System (CPES); Toronto; 2014 - Present. The CPES tool is a Microsoft Excel-based proprietary cost estimating tool that generates quick, relatively accurate, and detailed project cost estimates at the conceptual stage of a project. Responsibilities include creating, updating, and maintaining wastewater treatment project cost estimation models, in addition to developing new model features and enhancements for end-users.

Process Engineer; Duffin Creek Water Pollution Control Plant Phosphorous Removal Study; Durham Region; Ontario; 2016 - Present. This study is investigating the plant's ability to reliably meet low effluent total phosphorous limits. The study includes an assessment of optimizing the existing chemical phosphorous removal system as well as tertiary treatment alternatives. Process modeling using SUMO is used in combination with a Monte Carlo statistical analysis to determine the performance reliability of phosphorous removal in dynamic scenarios at design flows and loads.

Process Engineer; Upper Occoquan Service Authority (UOSA) Sludge Granulation Pilot Study; Centreville, VA; 2017 – Present. UOSA is undertaking a pilot study of induced sludge granulation by implementing hydrocyclones in the Waste Activated Sludge (WAS) system. The study involves design and construction of pilot facilities and planning and executing thorough sampling program to assess performance implications of the hydrocyclones.

Process Engineer; VCS Denmark Ejby Mølle Wastewater Treatment Plant Mainstream Deammonification; Odense, Denmark; 2014 - Present. This project involves performance assessments of waste activated sludge hydrocyclones for granule retention and promotion of mainstream deammonification. Specific activities include cyclone sample analysis to conduct kinetic testing, genetic

Adrienne Willoughby, P.Eng.

characterization of bacteria, image analysis for particle counting and sizing, and analysis of sludge volume indices to characterize settleability.

Process Engineer; AlexRenew Water Resource Recovery Facility Mainstream Deammonification; Alexandria, Virginia; 2014 - Present. Performed baseline testing and analysis prior to commissioning of a mainstream deammonification process. Ongoing analysis will include optimization of the mainstream deammonification system and assessing performance impacts of waste activated sludge hydrocyclones on biological nutrient removal and sludge settleability.

Process Engineer; West District Wastewater Treatment Plant Conceptual Design; Miami, Florida; 2015 - Present. This project involves the conceptual design of a 120 MGD greenfield membrane bioreactor WWTP. Specific tasks include development of a basis of design using historical flow and contaminant data from existing sewersheds, developing cost estimations, site layouts, and treatment configurations, and process modeling to provide design for biological nutrient removal and tank and equipment sizing.

Process Engineer; Woodward Wastewater Treatment Plant Expansion; Hamilton, Ontario; 2016 - 2017. This study involves steady state whole plant process modeling using Pro2D to determine plant performance in terms of clarifier loading and effluent concentrations under varying influent parameters. A Monte Carlo statistical analysis is used to determine plant performance reliability.

Process Engineering Support; Region of Halton Skyway Wastewater Treatment Plant Sidestream Deammonification Treatment Conceptual Design; Ontario; 2014 - 2015. Completed a review of numerous ammonia removal treatment technologies available for sidestream treatment at a 140 MLD WWTP. The selected sidestream treatment technology will utilize anammox bacteria for deammonification, which provides ammonia removal, effluent pH management, and energy savings. A conceptual design of the improved sidestream treatment was completed, making best use of existing infrastructure and equipment.

Process Engineering Support; Conestogo and Wellesley Wastewater Treatment Plants Tertiary Filtration Upgrades, Regional Municipality of Waterloo, Ontario; 2014 - 2015. Completed an evaluation of tertiary treatment technologies for two small wastewater treatment plants in Waterloo, Ontario. The evaluation resulted in completing conceptual designs of two cloth media filtration systems, which are retrofitted into existing tanks that were previously used for granular media filtration.

Process Engineering Support; Regional Municipality of Muskoka Mountview Wastewater Treatment Plant Class Environmental Assessment and Conceptual Design, Ontario; 2012 - 2014. Completed a review of historical flow, raw water quality, and contaminant loadings to determine the design basis for a wastewater treatment plant and conveyance system expansion/upgrade. Completed various flow projection scenarios based on population projections and high/low flow scenarios. Completed a conceptual design for the wastewater treatment plant expansion.

Project Consultant and Modeler; City of London Pollution Prevention and Control Plan Class Environmental Assessment; Ontario; 2012 - 2015. Completed a background review of historical water quality and benthic sampling of the Thames River and its tributaries in order to prioritize sewer system overflows, pumping station bypasses, and wastewater treatment plant bypasses. Created a plan for hydraulic flow monitoring and modeling for all sewersheds within the City to assess the priority of all sewer system overflows.

Project Consultant; City of Guelph Wastewater Treatment Plant Sidestream Anammox Treatment; Ontario; 2012 - 2014. Developed financial status reports to manage the project budget and technical deliverables. Technical tasks included completion of an ECA amendment application for the sidestream treatment, as well as review of shop drawings and contractor submittals.

Project Consultant; City of London Greenway Wastewater Treatment Plant Expansion, Ontario; 2012 - 2014. Conducted a hydraulic analysis of the new headworks facility.

Project Consultant and Modeling Support; City of London Pall Mall Street Sewershed Hydraulic Modeling, Ontario; 2011 - 2014. This project involves a thorough analysis of the sewer system overflow (SSO) locations within the City of London's Pall Mall Street sewershed. Project work has included rainfall data analysis, SSO characterization and flow monitoring data analysis, and development of an all-pipe hydraulic and hydrologic model of the sewershed using InfoWorks. The project also includes an analysis of the sewer system performance related to MOECC's Procedure F-5-5, as well as providing recommendations to the City for future upgrades to mitigate sewage overflows to receiving streams.

Project Consultant and Modeling Support; City of Ottawa Clegg Street CSO Study, Ontario; 2014 to 2015. This project has involved rainfall data and flow monitoring data analysis at the Clegg Street combined sewer overflow (CSO). A model of the Clegg Street sewershed was developed which included several complex flow diversion structures and a varying boundary conditions. The project involves the development of an overflow mitigation strategy at the Clegg Street CSO.

Modeling Support; City of Toronto Basement Flooding Prevention Program; Ontario; 2012 - 2015. Refined hydraulic and hydrologic models for storm and sanitary sewersheds and contributed to the preliminary and detailed design phases of sewer system upgrades in order to meet stringent basement flooding criteria, including provision of adequate hydraulic freeboard and minimum surface ponding depths.

Modeling Support; Town of Lakeshore Sanitary Sewer Study; Ontario; 2012 - 2013. Developed a hydraulic model of the sanitary sewer system within the Town of Lakeshore which included twelve pumping stations. Specific project tasks included rainfall and flow monitoring data analysis, model calibration and verification, and identification of areas of concern. The Town's long-term growth plan was modeled and the associated impacts on the sanitary trunk sewers and the overall network were assessed.

Process Engineering Support; City of Guelph Calico Well Upgrades, Ontario; 2012 - 2013. The project involved a preliminary design of upgrades at the Calico well to improve operations. The design included a new chlorine contact chamber configuration, piping upgrades, improved accessibility, and replacement of the vertical turbine high lift pump and instrumentation.

Modeling Support; City of St. Catharine's Sewershed Hydraulic Model Update; Ontario; 2011 - 2012. This project involved updating the hydraulic model for the City of St. Catharine's sanitary sewer. The bulk of the project was completed using XPSWMM modeling software, with GIS information and data collected from the City. Rainfall data analysis was also conducted in order to run simulations of the sewer performance during wet weather events.

Project Consultant; Town of Amherstburg Land Holdings Demolition Plan; Ontario; 2012 - 2012. Created a storm and surface water monitoring and management plan as part of a site demolition plan for decommissioned chemical manufacturing facilities. The report included the development of recommended monitoring parameters and threshold values for presentation to the MOE.

Project Consultant; Region of Peel Lakeview Water Treatment Plant Expansion; Ontario; 2011 - 2012. Conducted quality assurance/quality control for SCADA programming logic and process and instrumentation diagrams. Edited drawings and instrumentation labels to conform to the Region's standards.

Project Consultant; Town of Amherstburg Wastewater Treatment Plant and Pumping Station Upgrades; Ontario; 2011 - 2012. Reviewed history of plant operation, influent flow, and rainfall data to determine the

Adrienne Willoughby, P.Eng.

operational differences once plant and pumping station upgrades are complete; the review study was done to ensure compliance with the MOE's regulations and an amended ECA.

Project Consultant; Region of Waterloo Kitchener Wastewater Treatment Plant Upgrades; Ontario; 2011 - 2013. Responsible for writing the operations and maintenance manual for a new addition to the wastewater treatment plant and several upgrades.

Project Consultant; Town of Leamington Pollution Control Center Design and Upgrades; Ontario; August - September 2011. Assisted in the site acceptance tests (SAT) and commissioning of the upgraded wastewater treatment plant. Responsible for creating a test plan, monitoring and documenting test results of major equipment at various operational conditions, and summarizing results for the client and contractor's review.

Process Engineering Support, Northern and Marlin Coast Wastewater Treatment Planning Study, Cairns, Australia; January - May 2015. This project involved development of BioWin™ process models to analyze plant performance and to analyze the potential impact of growth and development scenarios within the sewersheds.

Project Consultant; Government of Yukon Faro Mine Remediation; Yukon Territory; January - March 2014. Conducted a literature review of climate change predictions and the associated hydrologic impacts to arctic environments. The literature review also included an assessment of the impacts of climate change on the mining industry and outlined adaptive measures that will be required for the Faro Mine complex and the neighboring watershed.

Experience Prior to CH2M

Engineering Intern; Chicago Biosolids Management Facility; Veolia Water North America; Chicago, Illinois; May - August 2010. This facility manages 1/3 of the solid waste from the largest wastewater treatment plant in North America. Tasks during this co-op position included conducting a thorough energy balance of major vessels, statistical analyses of the dried biosolids for marketing purposes, and creating several Standard Operating Procedures and safety training presentations for employees and contractors.

Research Assistant; Multifunctional Nano-Composites Group; The University of Western Ontario; London, Ontario; 2010 - 2011. An independent study which involved synthesizing and characterizing fluorescent microscopic particles with a non-toxic, biocompatible outer layer, which may eventually be used in medical imaging.

DAVID JENKINS

Professor Emeritus
Department of Civil and Environmental Engineering
University of California at Berkeley

Education

B.Sc. Applied Biochemistry, Birmingham University, England, 1957
Ph.D. Public Health (Sanitary) Engineering, Kings College, University of Durham, England, 1960

Honors and Awards

Foyle Prize, Birmingham University, 1957
Post Doctoral Research Fellow, Harvard University, 1969 -1970
Harrison Prescott Eddy Medal, Water Environment Federation (WEF), 1974, 1985 and 1988
Engineering-Science Award, Assoc. of Environmental Engineering and Science Professors (AEESP), 1978, 1982
Distinguished Service Award, WEF, 1981
Japan Society for the Promotion of Science Fellowship, 1982
Thomas Camp Medal, WEF, 1988
Honorary Life Member, WEF, 1988
Simon Freeze Award and Lectureship, American Society of Civil Engineers, 1988
Distinguished Lecturer in Environmental Engineering, AEESP, 1988
George Bradley Gasgoine Medal, WEF, 1989 and 2001
National Research Council Fellow, Chinese Taiwan, 1992
Samuel H. Jenkins Medal, International Water Association (IWA), 1992
Honorary Life Member, IWA, 1994
Gordon Maskew Fair Medal, WEF, 1995
Outstanding Publication Award, AEESP, 1995
Berkeley Citation (Honorary Degree), 1999
CH₂M Hill Award, AEESP, 1999
Member, National Academy of Engineering, 2001- present
Presidential Award, California Water Environment Association (CWEA), 2001
Arden-Lockett Award, IWA, 2001
Distinguished Lecturer, AEESP/WEF, 2007
Distinguished Visiting Professor, University of Newcastle, England 2009 - 2013
Global Water Award, IWA, 2010
Frederick Pohland Medal, AEESP/American Academy of Environmental Engineers and Scientists (AAEES), 2010
Fellow, WEF, 2011
Honorary Member, UC Berkeley Academy of Distinguished Civil/Environmental Alumni, 2012
Honorary Member, AAEES, 2014
Distinguished Fellow, IWA, 2014

Professional Service

Member, Joint Editorial Board, *Standard Methods for the Examination of Water and Wastewater*, 1974 - 1981
Member, California Water Resources Control Board, Operator Certification and Advisory Board, 1980-1997

Director, AEESP, 1972-1975 and 1983-1986
Member, Governing Board, IWA, 1990 -1992
Member, Program Committee, IWA, 1987-1992
Chair, Specialist Group on Nutrient Removal, IWA, 1980 -1990
Member, Research Council, Water Environment Research Foundation, 1989 -1991, 2009 - present
Director, Board of Control, WEF, 1989-1992
Chair, USA National Committee to IWA, 1990-1992
Member, Editorial Board, Water Environment Research, 1992-1997
Member, Editorial Board, Water Quality 21, 1997- present

Research and Professional Practice

Wastewater and Solids Treatment Processes and Operation
Wastewater Treatment Microbiology
Activated Sludge Bulking and Foaming
Nitrogen and Phosphorus Removal from Wastewater
Water and Wastewater Chemistry

Biographical Sketch for David Jenkins

David Jenkins is Professor Emeritus of Civil and Environmental Engineering at the University of California at Berkeley. He was born and educated in the United Kingdom. He holds a B.Sc. in Applied Biochemistry from Birmingham University and a Ph.D. in Public Health Engineering from the University of Durham, King's College. He conducted research and taught environmental engineering at Berkeley from 1960 until 1999. He served the CEE department as Chair of the Environmental Engineering Group and Vice-chair of the Department. He was Director of the Environmental Engineering and Health Sciences Research Laboratory. Upon retirement he was awarded the Berkeley Citation. He continues to be professionally active in wastewater treatment plant research, teaching and practice in the USA, Great Britain, Singapore, Italy, China and Brazil.

Professor Jenkins has researched and published widely in environmental engineering. His major areas of research are biological wastewater and sludge treatment processes, water and wastewater chemistry and microbiology. In these areas he has focused on the causes and controls of activated sludge solids separation problems and the chemical and biological methods of nutrient removal. In his professional work Dr. Jenkins specializes in the upgrading and troubleshooting of wastewater treatment plants and in environmental and process problems involving his expertise in chemistry and microbiology.

David Jenkins is the author of more than 250 publications and reports and the co-author of four texts. He is a member of the US National Academy of Engineering and an Honorary Life Member of the Berkeley Academy of Distinguished Civil Engineering Alumni and of the American Academy of Environmental Engineers and Scientists. He has received the Water Environment Federation (WEF) Eddy Medal for research (three times), the Camp Medal for contributions to wastewater treatment practice, the Fair Medal for wastewater engineering education, the Gasgoine Medal for wastewater treatment plant operations research (two times). He is an Honorary Life Member of WEF and the International Water Association (IWA) and a recipient of the IWA Sam Jenkins Medal, the Ardern and Lockett Award and the Global Water Award.