Because all wastewaters are different, it is necessary to work with a team that can combine comprehensive knowledge with practical experience in the fields of chemistry, biology, hydraulics, mechanical processes/equipment, instrumentation and control, materials handling and plant layout.

Identifying needs
Our clients recognise that the ability to preserve our precious resources is paramount. We have developed leading edge solutions that allow wastewater to be treated to a standard that minimises its impact on the environment.

Our changing climate is dictating a more urgent approach - from nutrient removal to resource recovery, water reuse compatibility is at the forefront of our minds. We also understand the pressures surrounding capacity expansion and the impacts of population growth and regulatory limits from government and councils.

Energy reduction and recovery is important to you - as are solutions that allow wastewater water to be reused, recycled or discharged. Our people can help deliver improved operability, reduced maintenance and lifecycle costs through solutions that are innovative, reliable and flexible.

Services
We harness extensive capability from project initiation to startup and optimisation:

- Feasibility studies and pilot tests
- Facility plans
- Concept and detailed designs
- Alternative delivery services including P3, Design-Build, CM at Risk, and Owner’s Engineer
- Construction phase engineering construction management and commissioning support
- Asset management and financial planning

We have direct experience in facility planning, design, and construction of enhanced nutrient removal facilities for municipal and industrial clients. Some of the technologies that we have worked with include:

- Conventional and short-cut nutrient removal
- Activated sludge including multi-stage plug flow processes, enhanced oxidation ditches, and sequencing batch reactors (SBR)
- Membrane bioreactors (MBR) and membrane aerated biofilm reactors (MABR)
- Biologically aerated filters (BAF) and denitrification (DN) filters
- Moving bed biofilm reactors (MBBR)
- Granular activated sludge
- Magnetically enhanced separation systems
- Sidestream nutrient removal and recovery systems

Benefits
Engage GHD and benefit from project-specific solutions that align with new environmental regulations, reduce operating costs, and/or expand treatment capacity. Our teams have a solid understanding of the changing regulatory environment. We’re proud to own a depth of solid, reliable minds, headed up by world-class technical leaders who are active in research and technology and understand industry trends and processes. We have particularly strong relationships with contractors and technology providers to deliver an alternative delivery model.
Experience

GHD is a global leader in advanced wastewater treatment and reuse, delivering innovative cost-effective solutions with low ecological footprint to suit a wide range of situations. For each project, GHD applies its client relationship focus and in-depth technical expertise to work closely with client representatives to address key concerns, constraints, and issues. Once identified and analyzed, sound engineering alternatives are developed to provide tailored solutions to suit the project at hand. Using the experience gained from the design of more than 300 wastewater treatment facilities, our diverse staff can deliver project-specific wastewater treatment solutions from facilities planning through start-up.

The following are examples of specific GHD project experience in advanced wastewater treatment, enhanced nutrient removal and recovery, and water recycling and reuse projects.

**Cox Creek Water Reclamation Facility, Maryland, USA**
To implement enhanced nutrient removal to achieve less than 3.0 mg/L TN and 0.3 mg/L TP at the 56.8 ML/d (15.0 mgd) Cox Creek Water Reclamation Facility, GHD conducted an exhaustive comparison of alternative approaches before recommending membrane bioreactors (MBRs). GHD led the subsequent design which included new primary clarifiers, new fine screening facility, bioreactor upgrade and expansion as a 4-stage Bardenpho configuration, new Membrane Facility using GE Zenon™ membranes, and disinfection, solids handling, or odor control improvements. Peak flows greater than 114 ML/d (30 mgd) will be treated by a unique High Flow Management Biological Treatment System using the BioActiflo™ process. GHD also assisted the client with the implementation of a water reuse system to sell up to 24.6 ML/d (6.5 mgd) of treated effluent to nearby power plant. The $112 Million three phase project will be completed in 2018.

**Coffs Harbor Water Reclamation Plant, New South Wales, Australia**
The new 97.4 ML/d (25.7 mgd) Coffs Harbor Water Recovery Plant is an advanced sewage treatment plant capable of producing reclaimed water suitable for reuse in irrigation. GHD was responsible for detailed design of the new facility, which was completed in 2009. After primary screening and grit removal, the plant uses a biological nutrient removal process comprising anaerobic zones, an oxidation ditch, secondary anoxic and aerobic zones, followed by clarification, for the removal of carbon, nitrogen and phosphorus from the wastewater. The secondary effluent is then passed through cloth disk filters and UV disinfection before ocean discharge or further disinfection for irrigation reuse. Storage of the secondary effluent allows optimization of the tertiary treatment process, while maximizing the volume of reclaimed water that may be supplied and minimizing the treated effluent release to the sensitive environment of the nearby Solitary Islands Marine Park.

**Syracuse WWTP, New York, USA**
GHD worked with Onondaga County to design improvements to the 318 ML/d (84.0 mgd) Syracuse Metropolitan WWTP to implement year-round nitrification and enhanced phosphorus removal to reduce the impairment of these nutrients to Onondaga Lake. The scope of work included pilot testing and then later design and construction of tertiary biological aerated filters (BAF) for year-round ammonia removal, along with a 477 ML/d (126 mgd) highrate flocculated settling system (HRFS) for achieving Stage II phosphorus removal. Based on bids received for both the BAF and HRFS technologies, the BIOSTYR® BAF and ACTIFLO® HRFS were selected and final design completed. Construction of the $130 Million project was completed in 2005 and provided year-round complete nitrification and effluent TP less than 0.12 mg/L. GHD is currently implementing a follow-up Phosphorus Removal Optimization project at the facility, scheduled for completion in 2019, which will reduce effluent TP to less than 0.08 mg/L while improving plant operations and reliability.

**Rouse Hill Sewage Treatment and Recycled Water Plant, Australia**
GHD, as part of a design-build team with John Holland, implemented a contract to design and construct the upgrade and expansion of Rouse Hill Sewage Treatment Plant and Recycled Water Plant (RWP) from a capacity of 13.5ML/d (3.6 mgd) to 27 ML/d (7.1 mgd). The Rouse Hill RWP produces high quality recycled water that is sold to customers in northwestern Sydney for outdoor use and for toilet flushing. GHD provided process, civil, mechanical and structural design services to John Holland. The advanced wastewater treatment facility achieves enhanced nutrient removal through four parallel cyclically aerated sequencing batch reactors followed by tertiary clarifiers and deep bed filters. The project was completed in 2008.
Malabar WWTP, Sydney, Australia

Malabar Wastewater Treatment Plant is Sydney Water’s largest, serving an equivalent population of approximately 2.2 million with an average dry weather flow of about 450 ML/d (120 mgd). GHD was retained by Sydney Water for the Malabar WWTP Process, Reliability and Renewal (PARR) Project which replaced coarse and fine screening, upgraded grit removal and primary clarifiers, and upgraded the entire solids handling process from sludge screenings through anaerobic digestion and dewatering. The project delivered significant improvements to the operation and reliability of this large and complex treatment plant. Designed solutions were focused on delivering significant value to Sydney Water while maintaining acceptable risk. The $70 Million project is scheduled for completion in 2018.

Danbury WWTP, Connecticut, USA

GHD was retained by the City of Danbury to determine the most cost effective way of upgrading the City’s existing 58.7 ML/d (15.5 mgd) WWTP to reduce effluent TN from around 25 mg/L to less than 5 mg/L. Denitrification filters had previously been the recommended approach, but the $29 Million price tag was unaffordable for the City. GHD developed a creative cost-effective solution involving modifying the City’s existing nitrification tanks to add post anoxic zones and feed methanol to achieve denitrification. In this manner, performance was greatly improved without the need for additional process tankage. The $3.9 Million project was completed in 2009 and is now online. This low cost modification provides savings of over $600,000 each year and a project payback of just 5 to 7 years. The project won a regional American Council of Consulting Engineers (ACEC) award in 2012.

Ashton WWTW, Manchester, United Kingdom

The Ashton Wastewater Treatment Works (WWTW) is a new £35m, 45 MLD (12 mgd) wastewater treatment works for United Water in Manchester which was built alongside the existing treatment facility. Challenges with maintaining the operation of the existing plant during construction were overcome through detailed interaction with the plant operators. A unique combination of moving bed biofilm reactors (MBBRs) and disk filters were incorporated into the design for tertiary treatment facilities for enhanced nitrogen removal. Given the plant’s proximity to nearby residents, sensitive odor control designs were undertaken to minimize odor at the inlet works, balance tank, selector zones of the SBRs and sludge handling facilities. GHD was responsible for detailed design and construction phase engineering. Construction was completed in 2011.

South Caboolture WWTF, Queensland, Australia

The South Caboolture WWTF involved the upgrade and augmentation of the existing sequenced batch reactor treatment plant to accommodate future sewage loads from projected population growth in the region (estimated equivalent population of 80,000) and to achieve higher environmental standards. Challenges with maintaining the operation of the existing plant during construction were overcome through detailed interaction with the plant operators. A unique combination of moving bed biofilm reactors (MBBRs) and disk filters were incorporated into the design for tertiary treatment facilities for enhanced nitrogen removal. Given the plant’s proximity to nearby residents, sensitive odor control designs were undertaken to minimize odor at the inlet works, balance tank, selector zones of the SBRs and sludge handling facilities. GHD was responsible for detailed design and construction phase engineering. Construction was completed in 2011.

Upper York WRC, Ontario, Canada

GHD led planning and design services for the new 40 MLD (10.5 mgd) Upper York Water Reclamation Center to serve part of the growing Toronto suburbs. The WRC will be one of the most advanced wastewater treatment facilities in the world to produce an ultra-low total phosphorus (TP) concentration of less than 20 µg/L to discharge into Lake Simcoe. Project-specific water quality trading (Phosphorus Off-Setting Program) allows the WRC to discharge over its annual total phosphorus load cap through the implementation of a stormwater phosphorus reduction program. For every kilogram of TP above the WRC annual cap, 3 kilograms of TP will be removed from area stormwater. The new facility includes preliminary and chemically enhanced primary treatment, 4-stage Bardenpho bioreactors, secondary clarifiers, cloth disk filtration, microfiltration, reverse osmosis, UV disinfection, and effluent post-conditioning. Design of the $600 Million project is complete.
**Owen Sound WWTP, Ontario, Canada**
GHD led planning and design for the upgrade of the 24 MLD (6.4 mgd) Owen Sound WWTP to implement effluent quality improvements for discharge into the Georgian Bay. The team also completed a detailed assimilative capacity study to identify treatment effluent limits for the plant upgrade and new outfall diffuser with respect to eutrophication impacts associated with total phosphorus and toxicity of ammonia-nitrogen discharges. The project included upgrades to preliminary and primary treatment, new phosphorus removal facilities, a new six-cell biological aerated filter (BAF), new UV disinfection, new temperature phase anaerobic digestion, and a new outfall diffuser. Construction of the $45 Million project was completed in Fall 2017.

**Cleveland Bay Wastewater Treatment Facility, Queensland, Australia**
GHD was responsible for the design for the upgrade and expansion of the 29 ML/d (7.7 mgd) Cleveland Bay WWTP to achieve biological nutrient removal. To achieve a very high effluent quality, state-of-the-art biological processes were utilized by combining an oxidation ditch (to achieve a high level of nutrient removal) with membrane solids separation. This retains the simplicity and flexibility of the oxidation ditch while adding the exceptional solids separation capability of the membranes. The MBR process uses hollow fiber membranes manufactured by GE Zenon. The facility serves an estimated population of 126,000 and has been on-line since 2008.

**Binghamton-Johnson City WPCP, New York, USA**
After a major flooding event caused significant damage to the existing treatment facilities, including the Biological Aerated Filter (BAF) facilities, GHD was retained to design a Major Restoration and Rehabilitation of the existing 227 MLD (60 mgd) wastewater treatment facility. GHD’s fast-track design approach to restoring treatment operations at the plant involved converting the existing BAF system to a dual-media BIOSTYR BAF system that supports bacterial growth for carbon removal and nitrification in the first stage followed by denitrification in the second stage. In addition to the redesigning the BAF system, the project involved adding and enhancing solids removal processes to minimize the concentrations of solids reaching the BAF. The $285 Million project is under construction and scheduled for completion in 2019.

**Wiikenberg Ranch WRF, Arizona, USA**
GHD provided planning, design, construction administration and contract operations for the Wiikenberg Ranch WRF. The treatment facility includes fine screening, flat sheet membrane bioreactors (MBRs), and UV disinfection. Phase 1 has an average day capacity of 100,000 gpd and is being expanded in Phase 2 to 365,000 gpd. The facility provides Class A+ reclaimed water which will reduce the demand on the aquifer by up to 29 million gallons annually during Phase 1 operations and by 106 million gallons annually during the future Phase 2 expansion. This project was awarded the Arizona Water Association’s 2018 Wastewater Treatment Plant of the Year.

**Westport WWTP, Connecticut, USA**
The Town of Westport retained GHD for facilities planning and design of a project to double the capacity of their existing wastewater treatment plant to 12.9 ML/d (3.4 mgd) and implement low level nitrogen removal. GHD designed the new facility using the Carousel Bardenpho oxidation ditch process followed by secondary clarifiers. Sequencing was complicated by a constrained site and the need to keep the existing facility on-line during construction. The new process went on-line in 2007 and has consistently averaged less than 3.0 mg/L effluent TN despite operating with winter wastewater temperatures as low as 7 degrees Celsius.

**Front Royal WWTP, Virginia, USA**
GHD was responsible for facilities planning and design for the upgrade and expansion of the Front Royal WWTP to 20 MLD (5.3 mgd). The project included new preliminary and primary treatment facilities, a BioMag magnetically ballasted activated sludge process, and UV disinfection as well as new autothermal aerobic digesters (ATAD). Energy efficient mixing and aeration in the biological process is achieved through jet aeration controlled by a combination of DO and ORP probes. Enhanced nutrient removal to 4 mg/L TN and 0.3 mg/L TP is achieved. The $45 Million project was completed in 2018.

**To talk advanced wastewater treatment, contact:**

**Thor Young**
T +1 240 206 6810
E thor.young@ghd.com
(last updated July 2018)