



Biological Solutions

US Municipal Portfolio

WATER TECHNOLOGIES

Biological Solutions

Advanced Nutrient Removal



Veolia offers biological solutions to help utilities comply with nitrogen and phosphorus limits. These solutions are compact, robust, resource efficient, and easy-to-operate. From basic nitrification to enhanced nutrient removal, Veolia has the most comprehensive line of innovative biological treatment solutions, including MBBR, IFAS, deammonification, activated sludge, and membrane treatment processes.

Advanced Biological Nutrient Removal

- Secondary plant retrofit for BNR
- Tertiary nitrification/denitrification addition
- Pretreatment for AWT or water reuse
- Sidestream and mainstream anammox

Anaerobic , Aerobic and Anoxic Wastewater Treatment Systems

Portfolio of Solutions



Veolia offers comprehensive biological process solutions in order to be flexible to individual needs.

MBBR/IFAS



AnoxKaldnes™ MBBR (Moving Bed Biofilm Reactor) is a biological wastewater treatment process that utilizes specialized polyethylene carriers (AnoxK™5 media) to create a large protected surface on which biofilm can attach. The media is mixed in the reactor, and the large surface area provides more treatment capacity in a smaller volume compared to activated sludge.

- 1,100+ installations with capacities of 0.01 - 137 MGD
- Excellent for ammonia and total nitrogen limits ($\text{NH}_3\text{-N} < 1 \text{ mg/L}$, $\text{NO}_3\text{-N} < 1 \text{ mg/L}$)
- Smaller footprint than activated sludge
- Increase plant capacity through tertiary nitrification/denitrification

Deammonification



The **ANITA™ Mox** process is the simplest, most stable and robust anammox process solution for high strength ammonia streams. It combines aerobic nitrification with anaerobic ammonia oxidation (anammox) in a continuous single-stage reactor.

- Biofilm based system preventing anammox washout
- Highly resistant to high TSS, polymer, DO, pH, nitrite and ammonia variations
- Tolerant of irregular dewatering schedules
- Flexibility in system expansion and construction phasing
- 30+ installations with TKN loading of 127 - 11,900 ppd



AnoxKaldnes Hybas™ (Hybrid Biofilm Activated Sludge) is an IFAS process in which moving AnoxK™ 5 media is mixed into an activated sludge environment. The result is both fixed-film and suspended growth biomass working together and lending the strengths of each to the hybrid process, excellent for retrofitting existing activated sludge plants to improve ammonia and nitrogen removal.

- Effective in cold water
- Accommodates a wide range of flow and load
- $\text{TN} < 3 \text{ mg/L}$ and $\text{TP} < 1 \text{ mg/L}$
- Flexible design for almost any tank configuration
- 80+ installations with capacities of 0.03 - 185 MGD

Lagoon Polishing



LagoonGuard™ utilizes an innovative lead-lag design to maximize biofilm growth and biomass inventory on media carriers to ensure efficient treatment performance under low temperatures with the smallest footprint and lowest capital costs.

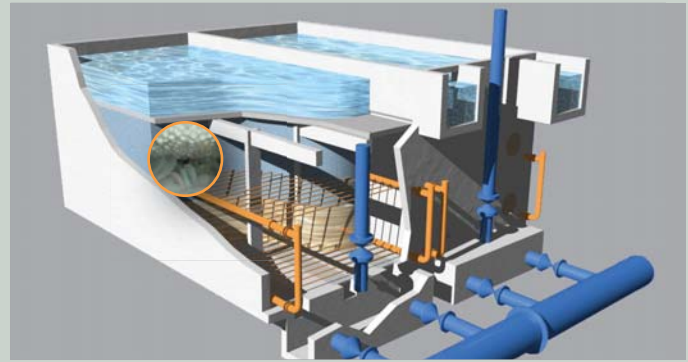
- Performance at a temperature as low as 0.5°C
- 20+ installations with capacities of 0.2 - 12 MGD
- Lower construction and capital costs
- Easy to maintain and operate
- Lower energy costs due to use of medium bubble diffusers with increased oxygen transfer efficiency

BAF



BIOSTYR™ is a biological aerated filter (BAF) that combines biological treatment and solids filtration into one compact biological filter system using **BIOSTYRENE™**, buoyant polystyrene beads, that provide surface area for biomass attachment.

- BOD removal, nitrification, denitrification and solids removal
- 20% footprint of conventional activated sludge technologies
- High quality effluent requiring no secondary clarifier
- No odor, full automation, pleasing esthetics, and site flexibility



BIOSTYR™ DUO adds a second media layer of AnoxK™ 5 media for increased carbon, solids and nitrogen loading capabilities functioning as an added MBBR.

- Up to 100% increase in BOD loading compared to traditional BAF
- Up to 40% increase in $\text{NH}_3\text{-N}$ loading compared to traditional BAF
- Negligible impact to system headloss for DUO media layer
- Smaller footprint resulting in cost savings
- 175+ installations with capacities of 0.1 - 449 MGD

MBR



NEOSEP® is a Membrane Bioreactor (MBR) system that incorporates the FibrePlate™ membrane, a hybrid of hollow fiber and flat plate technologies that retains the strengths while eliminating the weaknesses of conventional MBR membrane technologies.

- Smallest footprint and lowest energy use in today's market
- Provides BOD removal, nitrification, denitrification, and enhanced phosphorus removal
- Resists sludging, no obstructions to MLSS flow paths such as top headers with potted fiber, criss-crossing or bent fibers

Activated Sludge Technologies



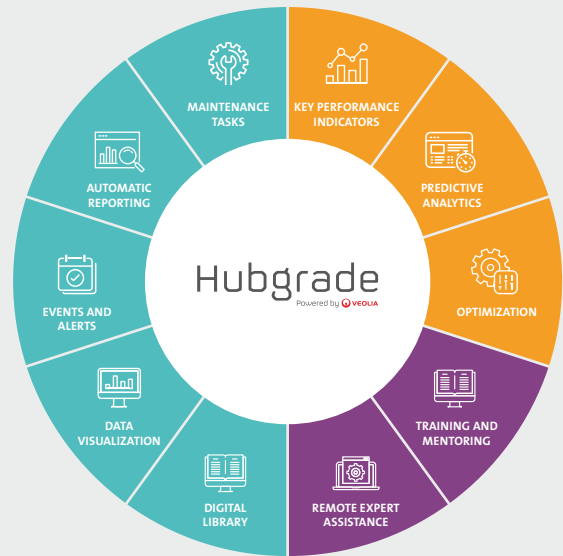
Bio-Denitro™ phased isolation technology is a continuous flow activated sludge process with one or more reactors that alternate between oxic and anoxic phases, controlled by timed sequence or online nutrient monitoring. A long history of exceptional process control can be configured into rectangular tanks with deeper side water depth.

- Simplified Concrete Construction
- 25-50% Reduced Footprint and Installed Cost
- Replaces Rotors with Diffusers and Blowers
- Eliminates Automated Effluent Weirs
- 25-50% More Energy Efficient

Digital Services

Hubgrade™ is Veolia's highly flexible suite of digital service offerings for water treatment and reclamation facilities. Hubgrade™ helps these facilities improve treatment performance and compliance, reduce operating and maintenance costs, and in many cases postpone or avoid capital expenditures.

Hubgrade™ provides several levels of service to match Veolia's expertise with the needs of the customer.



Hubgrade

ESSENTIAL



Performance Optimization Tool

- Secure cloud portal to facilitate better access and use of data
- Digital library to access all relevant documents
- Data visualization to collect and display process data
- Events and alarms to prevent shutdowns or regulatory breaches
- Automatic reporting to facilitate data analysis and reporting regularly

Hubgrade

ASSIST



Access to Veolia Experts

- Expert assistance to help facilities proactively address performance and maintenance needs
- The latest in augmented reality tools for enhanced remote support
- Increase operator skills with e-learning courses and operator refresher training programs
- Expert support is enhanced with the use of Hubgrade Essential

Hubgrade

PERFORMANCE



Online Smart Control Tool

- Key performance indicators assess the quality of the operation and guide operational decision making
- Predictive analytics predicts the evolution of strategic operation parameters or anticipates the failures, reduces downtime risks and optimizes maintenance
- Optimization features provide simulated operational scenarios and setpoints



Aftermarket Services

Customer support is a continuous process, from the design, to start-up, to operation. Our team of informed and experienced professionals are available for anything from process reoptimization, preventative maintenance or spare parts. Additionally, we offer Hydrex™ chemical cleaners to provide the most effective cleaning method available.

We also maintain an extensive parts inventory so that most items can ship the same day the order is placed. In addition to parts, we can provide a repair service that includes a trained technician to assist with the part replacement.

