



DE NORA TETRA® DeepBed™ Denite® Filtration System

Nitrogen and phosphorous pollution due to population growth and other factors has caused a serious ecological challenge to lakes, rivers, and estuaries around the world. Global regulations are trending toward stricter standards to control harmful algae blooms and other nitrification effects. These changing regulations are impacting wastewater treatment effluent discharge requirements.

For decades, the proven technology and expertise of DE NORA TETRA DeepBed Denite Filters have been a step ahead of regulations, offering advanced wastewater treatment solutions for denitrification, phosphorous, and solids removal.

Reduces nitrogen, phosphorous and suspended solids in a single step.

Designed for long life and reduced operating expense.

Ideal for tight space restrictions and retrofits.

Technology designed to reduce OPEX with decades of process knowledge prevent water quality issues and plant downtime.

Wastewater treatment facilities face both increasing regulations and tightening operating budgets. With the DE NORA TETRA® Denite® biological denitrification system, nitrogen, phosphorous, and suspended solids are removed in a single process solution. Ideal for space restrictions, the fixed-film process requires only one-tenth of the space needed for suspended growth systems, making it easy to expand or retrofit existing tertiary filtration systems.

Why De Nora?



**EXPERTISE AND PROCESS
KNOWLEDGE**



**LONG-LIFE,
TROUBLE-FREE
OPERATION**



**100S OF INSTALLATIONS
OPERATING WITH MINIMAL
INTERVENTION**



**DESIGNED TO
REDUCE OPEX**



**GUARANTEED
PERFORMANCE**



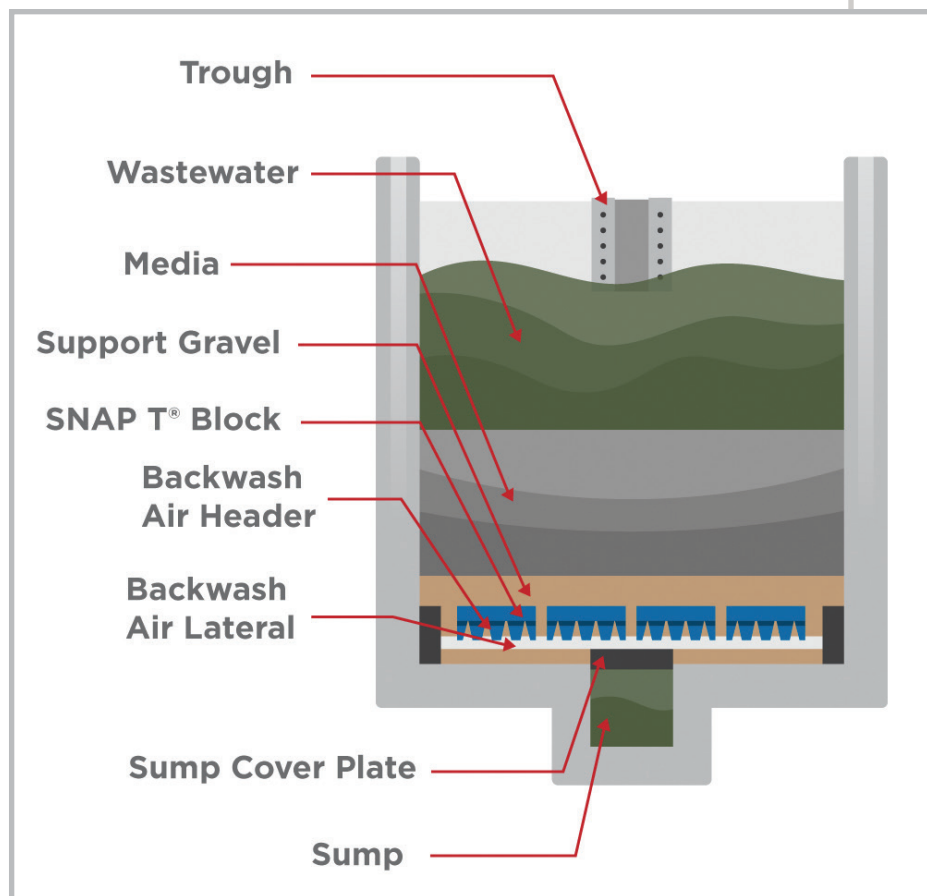
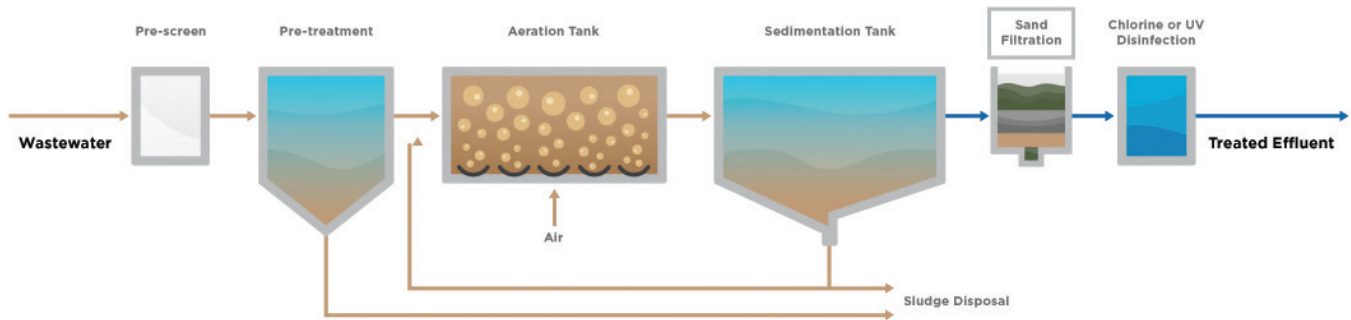
**PROVEN TO MEET AND
EXCEED REGULATIONS**

SNAP-T® Underdrain blocks reduce plant operating expense.

- Excellent backwash air/water distribution improves bed cleaning efficiency
- Interlocking grid resists uplift, even from a water hammer event
- Installation is simple and fast
- No moving or wearing parts that require maintenance
- Block weight prevents lifting without grout or anchoring
- Expected life of 50 years +



THE PROCESS





1. $\text{NO}_3\text{-N}$ is converted to nitrogen gas and captured in the media bed, along with suspended solids and biomass formed during the denitrification reaction. Media design allows for heavy capture of solids between backwash cycles, maximizing operation time even during plant upsets and peak flow.

2. The gravity filter system operates in a downflow mode to maintain suspended solids removal to a level of 2-3 mg/L, avoiding the need for clarifiers or additional effluent polishing filters.

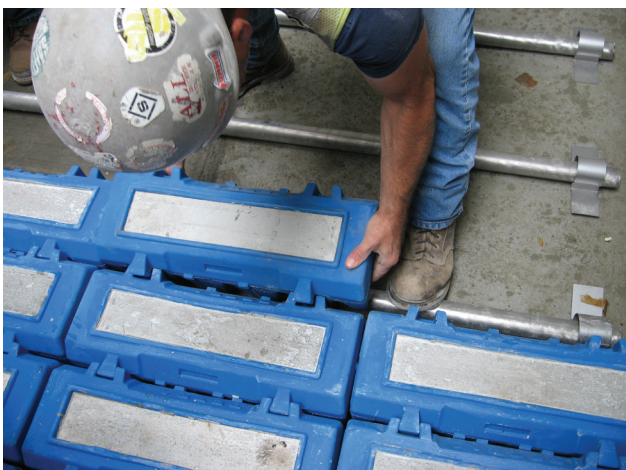
3. As nitrogen gas accumulates in the media bed, wastewater flows around the gas bubbles in the media voids, reducing media void size and improving biomass contact and filtration efficiency.





4. As solids are captured in the filter media, increased head loss triggers a backwash cycle to remove the solids. Despite heavy loading capacity, concurrent air/water backwash is highly efficient, using less than 4% of the plant's forward flow.

5. Over time, gas bubbles increase head loss and require periodic removal of nitrogen gas between backwashes. This nitrogen release cycle, or "bump", releases the entrapped nitrogen gas into the atmosphere, reducing the head loss.



Filter underdrains

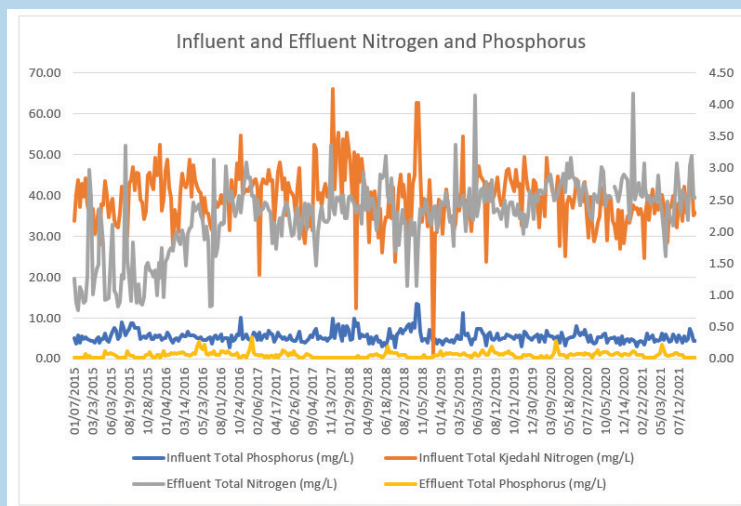


Filter construction/structure



CASE STUDY: WATER POLLUTION CONTROL BOARD Arlington, Virginia

Using a highly effective filtration system that stays clean in large part through automated backwash processes, innovations such as using site-captured methanol to reduce effluent nitrogen and system design that includes the flexibility and scalability to handle regular heavy wet weather events as effectively as normal flow, the Arlington County WPCP reports nitrogen effluent to below 2.0 mg/L, down from a 1985 level of 19.5 mg/L; and phosphorous levels below 0.1 mg/L.



NITROGEN REMOVAL

Reaction is time-dependent, varying according to the temperature of the wastewater. Filtration rates of 1-3 gpm/ft² (2-7 m/h) are designed to achieve complete denitrification. Peak hydraulic rates up to 6 gpm/ft² (12 m/h) are designed during wet weather events.



SUSPENDED SOLIDS REMOVAL

TSS removal from wastewater effluent also lowers BOD by 1 mg/L or more while at the same time reducing nitrogen, phosphorous and heavy metals which are also contained within the effluent solids. With proper chemical treatment, effluent total phosphorous concentrations <0.2 mg/L are consistently achieved. De Nora filters easily meet <2 NTU or < 5 mg/L TSS with typical results of <2 mg/L TSS.

Specifications

Denite System Components and Specifications

Filter Vessel: Concrete or steel, round or rectangular, usually 18-20 feet (5-6 m) deep with free board.

Filter Bottom: Nozzleless design; stainless steel air headers and pipe laterals; plastic jacketed 5000 psi (350 kg/cm²) concrete SNAP T Block underdrains.

Filter Media: Monomedia granular sand with 2-3 mm effective size at depths of 4-8 feet (1-2.5 m).

Support Layers: Gravel in five layers totaling 18 inches (46 cm) deep in a reverse graded fashion.

Filter Controls: Either filtration with constant head using modulated effluent valves controlled by level element, or filtration with variable head using open/close effluent valves.

Backwash Air: Distributed across the entire area of the filter bottom, supplied by a positive displacement blower at a rate of 3-5 icfm/ft (55-110 m/h).

Backwash Water: Supplied at a rate of 5-6 gpm/ft (12-15 m/h) with a low head centrifugal pump. The head loss across the filter bottom is 4 in (100 mm) water column.

Filter Valves: Pneumatic or electric control valves with double acting cylinders. Isolation valves can be included.

Chemical Feed Systems: Supplemental carbon storage and feed system with TetraPace™ automatic dosing control. Can also be used for other chemical feeds.

Instrumentation: PLC with human machine interface; multiple screens; outputs for a centralized computer control and/or SCADA system; flowmeters, analyzers, level switches, local panels and system alarms.

Filter Operation: Automatic with manual overrides. Backwashing and bumping are time based.

Head Requirement: Typically 6-8 feet (2-3 meters) of water but vary by application.

System Integration: Works well with other treatment plant processes such as overall nitrogen removal, phosphorous removal, and virus removal.



About De Nora

Backed by 100 years of experience, you can be confident in the reliability and safety of DE NORA TETRA® DeepBed™ Denite® Systems. De Nora is the partner of choice for communities and companies around the globe. In fact, more than 500 million people around the world use water treated by De Nora products every single day.

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