

AMPHIDROME[®]

ADVANCED TREATMENT SOLUTIONS



Submerged Attached-Growth Bioreactors

Economical Treatment Solution

Advanced Nutrient Removal

Low Visual Site Impact



Innovative Wastewater Treatment Solution

System process technology for advanced nutrient and solids removal

The Amphidrome® system is an economically and energy efficient decentralized wastewater treatment solution designed to suit site constraints and regulatory requirements.

As a Biologically Active Filter (BAF) treatment system, FRMA's technology utilizes both filtration to remove suspended solids and a high biomass concentration within attached-growth biofilms to treat BOD, ammonia, and nitrates in effluents from a wide variety of applications.

The system is highly customizable, with each design and process control tailored to meet the most stringent of effluent limits year-round or for seasonal locations.

Typical applications include condominiums, cluster system developments, healthcare facilities, resorts, campgrounds, shopping malls, schools, office parks, and single family homes.

A collection of advanced treatment solutions

Treatment add-ons for highly stringent regulatory requirements

The Amphidrome Plus™ denitrification reactor is an addition for systems requiring nitrate/nitrite as Total Nitrogen (TN) reduction to the lowest level biologically attainable.

Coagulant addition combined with the Amphidrome® media filtration allows for an enhanced level of phosphorus reduction.

Additional adders such as UV disinfection and the Amphidrome EnBAC™ reactor can treat fecal coliform and total organic carbon (TOC), respectively, making our system viable for producing water reuse quality effluent

Treatment Systems Can Designed to Meet the Most Stringent Limits

- BOD < 5 mg/L
- TSS < 5 mg/L
- Ammonia < 1 mg/L
- TN < 3 mg/L
- Total Phosphorus < 0.15 mg/L
- Coliform < 200 colonies/100 mL
- TOC < 3 mg/L

System Benefits

- Low Visual Site Impact
 - System Below Grade
- Low Audible Site Impact
 - Sound-Enclosed Blowers
- Simple to Operate
 - Automated Process Controls and User-friendly Touchscreen
- Energy Efficient
 - Intermittent Aeration and Pumping Leads to Low Annual Operational Costs
- Consistent Treatment
 - Submerged Attached-Growth Bioreactor With High Biomass
- Filtered Effluent
 - Deep Media Bed Filter Removes Suspended Solids
- Easily Upgradable
 - Future Nitrogen or Phosphorus Limits
- Filter Longevity
 - Sand media does not require replacement

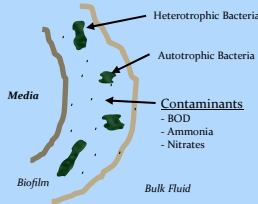
Highest Level of Wastewater Treatment, Lowest Site Impact

High-grade monomedia silica sand



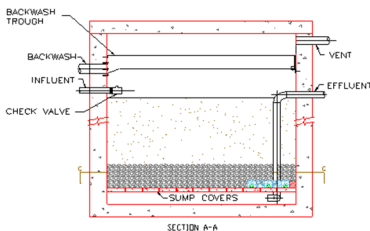
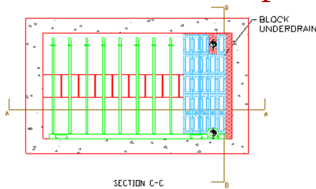
- Utilized for solids filtration and biofilm substrate
- Effective size: 2.0—3.0 mm
- Uniformity coefficient: Max of 1.4
- Sphericity: Min of 0.8
- Specific surface area: 250 ft²/ft³

Attached-growth biofilm

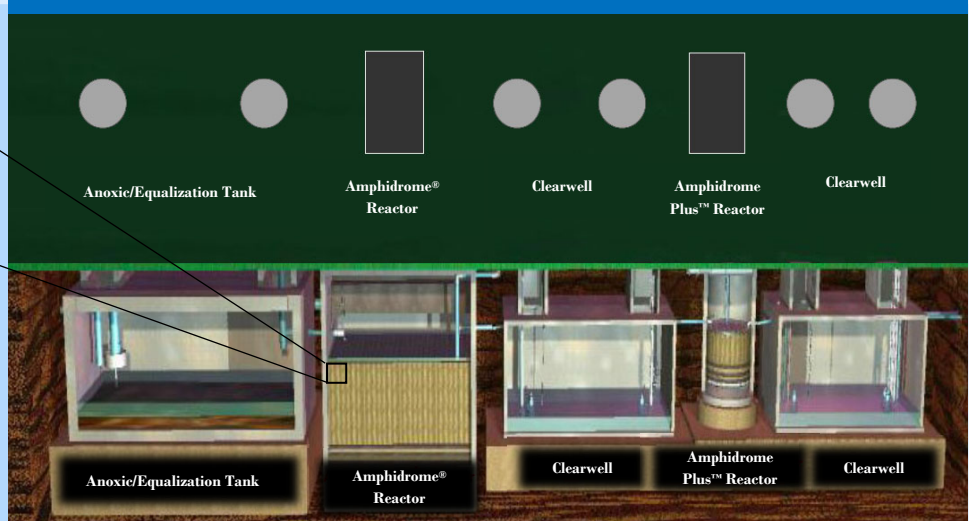


- Organic polymer gel attached at solid-liquid interface
- Colonies of microorganisms
- Extra-cellular polymeric substances
- Inorganic particles
- Dissolved compounds
- **Biomass concentration equivalent to 8,000 - 15,000 mg-VS/L**

Amphidrome® Reactor Specifications

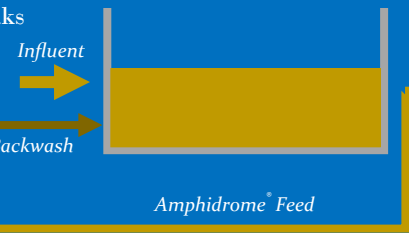


- Design loading @ 20°C
 - 40 lbs. NH₃-N / 1000 ft³ media
 - 150 lbs. BOD₅ / 1000 ft³ media
- Reactor underdrain provides intermittent aeration
 - Optimal O₂ reqs lead to non-continuous blower operation
- Systems designed individually based on loading
- Rectangular or circular reactors
- Influent can be hydraulically fed or pumped
- Tailored for specific site and application constraints



Anoxic/Equalization Tank

- Flow equalization
 - Handles large flow variability, peaks
- Solids settling
 - Includes sludge storage volume
- Recycled flow:
 - Anoxic denitrification
 - Alkalinity recovery

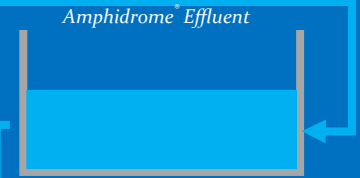


Amphidrome® Reactor

- Solids Filtration
 - Eliminates need for downstream clarification
- Biofilm growth
 - Microbiological degradation *via* oxidation
- Underdrain provides optimal intermittent air
 - Aerobic conditions for heterotrophs (BOD) and obligate chemolithoautotrophs (NH₃)

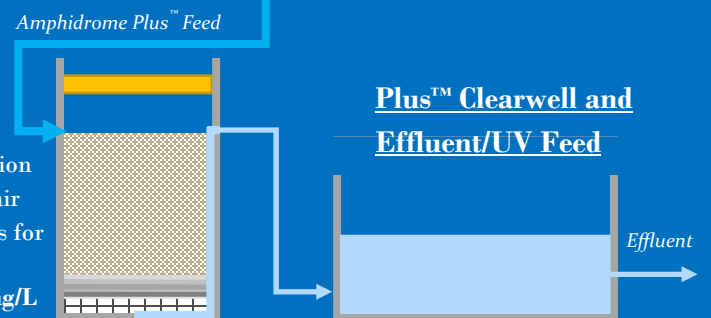
Clearwell Tank

- Stores return and backwash volume
- Can act as either:
 - Effluent dosing
 - Amphidrome Plus™ feed tank



Amphidrome Plus™ Reactor

- Flocculant filtration
- No intermittent air
- Anoxic conditions for NO₃ reduction
- Achieves TN < 3 mg/L



Economical Treatment Solution, Long-Term Effectiveness

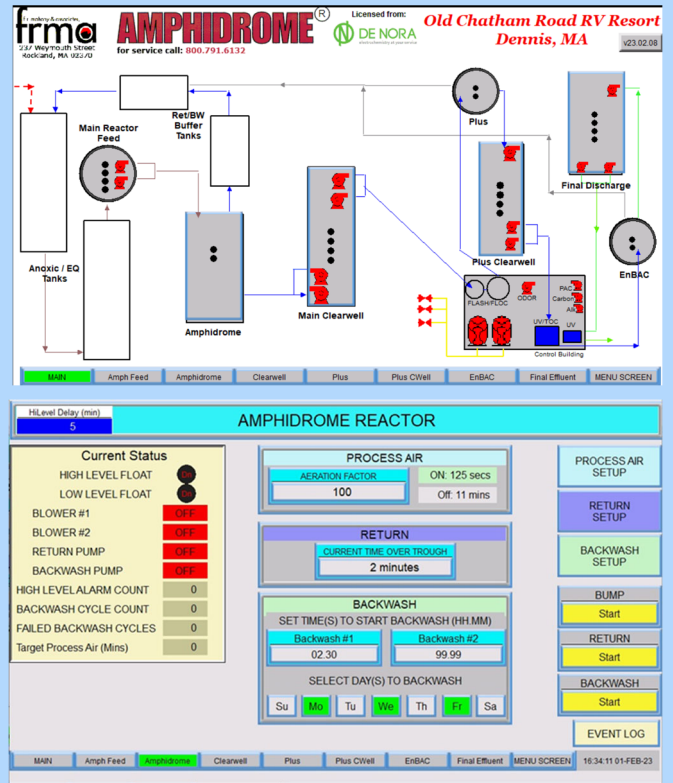
Control Building



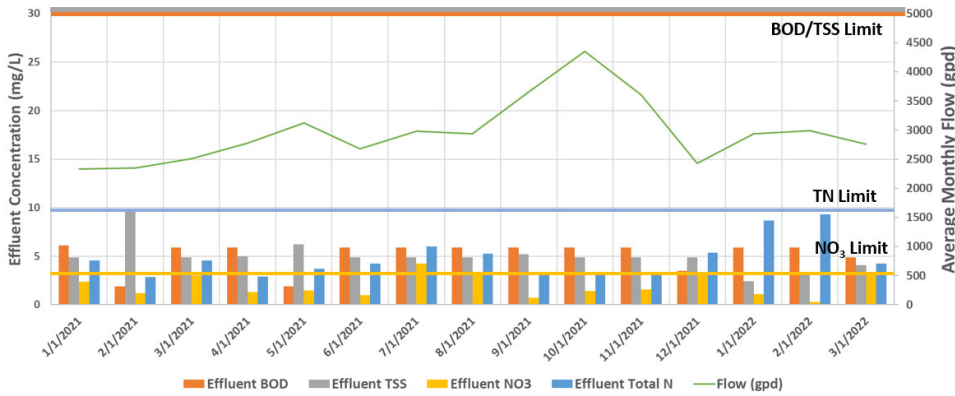
- Contains most equipment to support the Amphidrome® system
 - Blowers
 - Control Panel
 - Chemical Feed Pumps
 - Odor Control Unit (optional)
 - UV Disinfection (optional)
 - Flash/Floc Tanks (optional)
- Building can be designed to fit the landscape and surrounding building styles

Control Panel Touchscreen

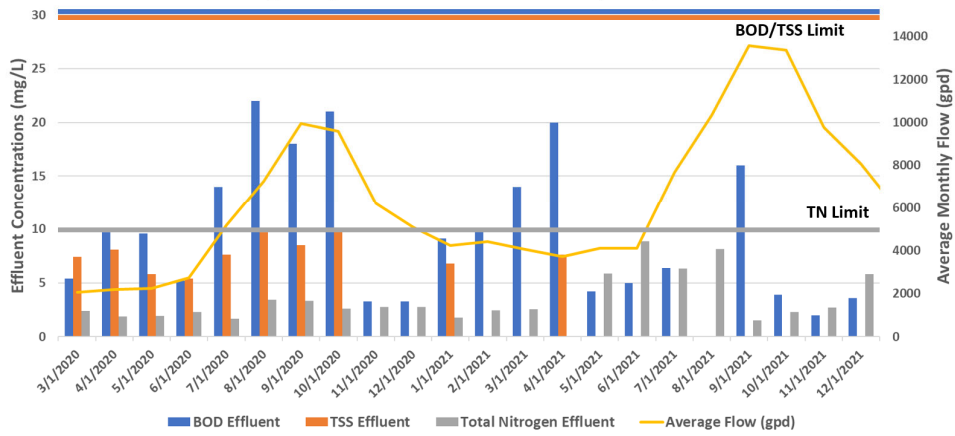
- Operator-friendly color touchscreen interface
- Main screen indicates current operational status of various equipment
- Access to individual component screens containing process controls
- Remote monitoring capabilities



Hamilton-Wenham Regional School Amphidrome Plus™ in Hamilton, MA (School)



Harborside Village Amphidrome Plus™ in Wellfleet, MA (Mobile Home Park)



Performance

- Amphidrome® Reactor
 - <5 mg/L BOD₅
 - <5 mg/L TSS
 - <1 mg/L NH₃
 - <19 mg/L TN
- Amphidrome Plus™ Reactor
 - <3 mg/L TN
 - <0.15 mg/L TP
- Amphidrome EnBAC™ Reactor
 - <3 mg/L TOC
- Effective nitrification and

F.R. MAHONY & ASSOC.
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 A Division Of
CUMMINS-WAGNER
 100% Employee Owned

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