



State of Delaware
Department of Natural Resources & Environmental Control
Division of Water Resources
Ground Water Discharges Section

Innovative and Alternative System Approval

ISSUED TO: F. R. Mahony & Associates
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FOR: Amphidrome ® Wastewater Treatment System

APPROVAL DATE: 4/13/12

In accordance with the Regulations Governing the Design, Installation, and Operation of On-Site Wastewater Treatment and Disposal Systems (Regulations), an application dated October 25, 2011, has been submitted by F. R. Mahony & Associates for approval of the Amphidrome ® Wastewater Treatment System as an Innovative & Alternative On-Site Wastewater Treatment Unit.

Based on the review of the application, the Department hereby grants approval of the use of the Amphidrome ® Wastewater Treatment System as an Innovative & Alternative On-Site Wastewater Treatment Unit subject to the conditions, limitations, and requirements set forth herein:

1. Product Description

The Amphidrome® System consists of a submerged attached growth sequencing batch reactor used in conjunction with an anoxic/equalization tank, and a clearwell tank for wastewater treatment. The anoxic tank provides solid-liquid separation, and anoxic conditions for denitrification. The bioreactor consists of a deep bed sand filter,

which alternates between aerobic and anoxic treatment. The reactor is a biologically active filter, (BAF) operating in both aerobic to anoxic conditions by intermittently aerating the filter. Air, supplied by a blower, is introduced at the bottom of the filter by a distribution system that produces fine bubbles to enhance oxygen transfer. This unique system design allows soluble organic removal, nitrification, and denitrification to occur in one reactor.

The cyclical action of the system is created by allowing a batch of wastewater to pass by gravity flow from the anoxic/equalization tank through the submerged sand filter (down flow mode) and into the clearwell. The flow is then reversed using a pump to move water from the clear well up through the filter and into a return pipe, which carries the wastewater back to the anoxic tank. These cycles are repeated multiple times during a 24-hour period. The conditions in the filter change from aerobic to anoxic based on the timing of the aeration cycles. The filter is backwashed using a combination of aeration and pumped water from the clear well. Treated wastewater is discharged once per day from the clear well by pumping to the receiving location. The Amphidrome® System is supplied with a programmable logic controller (PLC), which controls the frequency and duration of pump operation, aeration cycles, backwash, and discharge, as well as all alarm functions and data collection. The aeration system provides enough air to recirculate the water continuously through the reactor where it is further treated.

2. Claim

Approval is based on third party testing data submitted by the Manufacturer indicating the specified model will routinely provide effluent quality not exceeding 30 mg/l of BOD, 30 mg/l of TSS, and 20 mg/l of Total Nitrogen (TN) assuming influent loading does not exceed the treatment capabilities of the units.

3. Standard Amphidrome Reactors

Reactor Size	Design Flow (gpd)	Anoxic Tank (gal)	Clearwell Size (gal)
2' diameter	<500-1,000	2,000	1,000
2.5' diameter	750-1,650	2,000	1,200
3.0' diameter	1,000-2,200	2,000-2,5000	1,500

*** All tanks must be DNREC approved. If concrete tanks are to be utilized they must be top seam.**

4. Use and Design Criteria

- a. The Amphidrome® System may be installed for new and replacement systems with conventional and innovative and alternative disposal systems.
- b. The Amphidrome® System anoxic and clear well tanks may only be installed in DNREC approved septic tanks.

- c. An on-site wastewater treatment and disposal system permit application incorporating an Amphidrome® System shall be designed in accordance with the Regulations, and manufacturer's specifications. The design shall be completed by a DNREC Class C Design Engineer unless otherwise approved by the Department. The permit application shall include proper unit specifications.
- d. The designer must assure that the equalization tank, bioreactor (tank) and clearwell (tank) have above grade access. The design also must ensure that the control panel and blower are accessible.
- e. The Amphidrome® System shall not be installed within areas subject to traffic loads unless specially designed on a case by case basis in accordance with the Regulations.
- f. The manufacturer is responsible for providing the Department a list of all local distributors and their associated contact information. This list must be kept current and shall be submitted to the Department on a yearly basis.

3. Installation Procedures

- a. The Amphidrome® System shall be installed by a DNREC Class E System Contractor under the supervision of a manufacturer's representative, or by a DNREC Class E System Contractor who has been certified for unit installation. Proof of certification shall be provided in writing to the Department.
- b. The blower must be mounted on a base plate. Each blower shall have an inlet filter, pressure relief valve, wafer body split disc check valve, and discharge pressure gauge. The blower must be placed inside a weather tight enclosure.
- c. Start up of the system and initial operational checks shall be conducted by the Class E System Contractor (trained by the manufacturer), Design Engineer, and a Ground Water Discharges Section (Large System Branch) representative. If the Class E System Contractor is not certified, a manufacturer's representative shall perform the operational checks of the system at start up. If the manufacturer's representative can not be on site at the time of start up, they must provide final start up approval to the Department in writing.

5. Operation and Maintenance

- a. The Amphidrome® System shall be operated and maintained in accordance with the manufacturer's specifications.
- b. The manufacturer or manufacturer's representative shall comply with all Department mandated requirements as specified in permit conditions. This shall include operation and maintenance requirements.

6. Sampling and Approval

The Department reserves the right to sample any unit at any time.

7. General Conditions

- a. Use of the system for wastes other than residential shall be on a case by case.
- b. In the event that the product fails to perform as claimed by the applicant, and it is found that the system is installed and working as designed, and there is not toxicity in the waste; the use of the units for new installations shall cease. Use of the units shall not resume until such time the applicant and the Department have reached an acceptable agreement for resolving the situations.
- c. Any changes that deviate from the specifications as submitted with this approval shall be approved by the Department prior to use.