General

Product

Information

AquaO$_2$ Wastewater Treatment Systems, Inc.
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$AquaO_2$ Wastewater Treatment Systems, Inc.

GENERAL INFORMATION

The $AquaO_2$ advanced aerobic wastewater treatment systems and disposal methods are suitable for a variety of applications where a regular septic system is not an option. The Mini-Plant series treats small flows for single-family home sizes. The $AquaO_2$ systems are sold as a package with tank, or as a kit for concrete mounting, and a factory built control panel. The Maxi-Plant series is capable of servicing a residential community or commercial establishment. Over thirty years of study, and experience proves $AquaO_2$ systems to be the most reliable and one of the most innovative solutions to water conservation and quality.

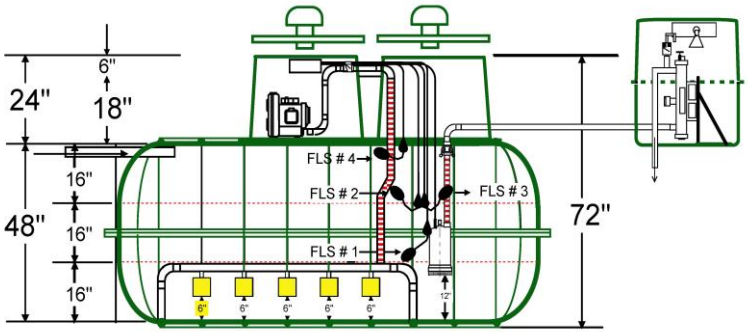
The $AquaO_2$ fiberglass tanks are manufactured of the finest materials and are extremely durable. Tanks have undergone stress-loading tests and consistently perform better than most plastic tanks. Mini-Plant units are sold completely factory assembled in fiberglass tanks and ready to install, or as a kit allowing the system to be installed onto constructed concrete tanks. Advanced, tertiary treatment is achieved by the $AquaO_2$ add-on components. Denitrification Chamber, Recirculating chamber, and Ultraviolet lights are optional add-ons available to produce better test results of less than 5 BOD/SS (<5 mg/L BOD/SS).

AQUAROBIC MINI-PLANT

The Mini-Plant treats wastewater flows from 360 to 5,000 gallons per day. Outstanding test results were observed after a comprehensive six-month testing program by National Sanitation Foundation (NSF) certified inspectors. Aquarobic Mini-Plant test results exceeded all requirements, and are certified NSF Standard 40 Residential Wastewater Treatment plants. The Mini-Plant tank is designed to hold a total capacity of three times the daily flow in case of a power outage. This gives the service technician up to three days to fix the problem. Average power consumption for a 600 GPD Mini-Plant is 8.5 kilowatts per day.

Mini-Plant Applications:

- Single Family Residences
- Parks, Country clubs
- Small Commercial facilities
- Repair failing systems



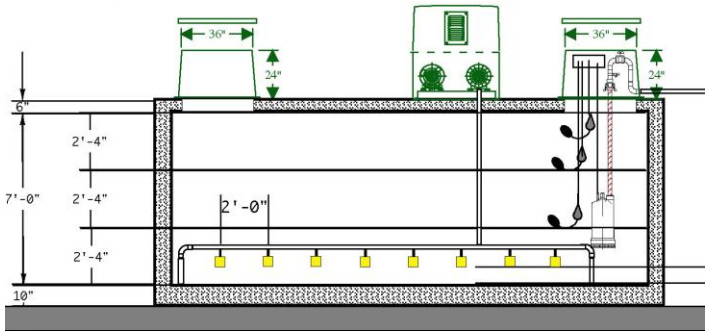
SECTION VIEW

PROCESS DESCRIPTION

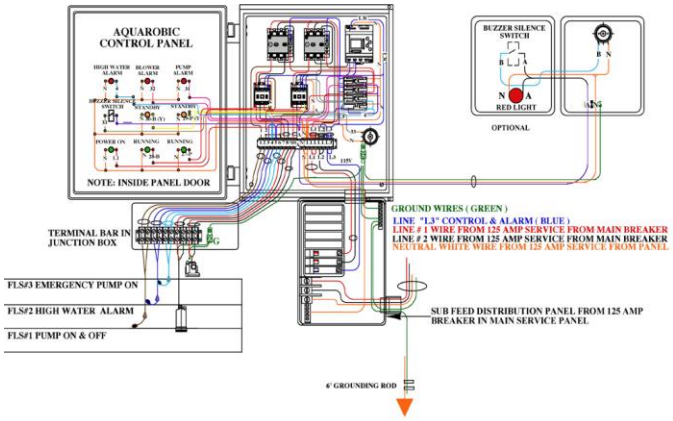
The Mini-Plant is a Sequential Batch Reactor (SBR) system, controlled by a factory set program that times aeration and settling functions. A batch of treated effluent is pumped out to the disposal area once a day. The program is set to aerate for 20 hours, 6:00 am until 2:00 am, when compressor pumps air through a series of diffuser manifolds that supply the wastewater with fine diffused air. Air diffusers create thousands of fine air bubbles supplying the oxygen for the aerobic digestion process. From 2:00 am until 5:00 am the program turns the compressor off for a 3-hour settling period. After the 3-hour settling period, the supernatant is discharged (5:00 am to 6:00 am) to the disposal area.

COMPONENTS

The Aquarobic fiberglass manways and housings are manufactured from heavy fiberglass reinforced polyester. They protect and provide access to the air compressors, electrical junction boxes, and the mechanical connections. Inside the manway, energy efficient ring type air compressors are mounted. The level sensors and submersible pump are also wired to the junction box.



The Aquarobic Control Center is built with audio-visual alarms and is both UL listed and CSA approved Type-3 enclosure suitable for Indoor/Outdoor mounting. The program timer, control alarm buzzer, and off-switch are located in the Control Center. A separate circuit breaker load center panel is mounted onto the bottom of the Control Center. A control panel drawing is provided to guide the qualified serviceman or electrician to troubleshoot any part of the system. Visual, audible, and remote alarms are provided to monitor and ensure continuous operation.



ADD-ONS

Recirculating Filter:

The filter is installed in a separate fiberglass tank or in a “kit" form to install onto a locally built concrete tank. The effluent from the Mini-Plant is pumped into a 4" distribution manifold at the top of the filter material (1/4" to 1/2" stone or pea gravel). The effluent sinks slowly through the filter media where it is collected by another 4" perforated pipe manifold at the bottom of the filter material and flows to the center of the 16" PVC recirculating filter pump well. A predetermined volume allowance in the center well activates the recirculating pump switch, which pumps the liquid around and back into the top 4" perforated manifold for continuous filtering. The filter tank is designed to hold the daily wastewater flow from the Mini-Plant, in the empty space above the filter, and in the filter media.

Ultraviolet Lights:

UV lights are always “on” intensifying the bacterial kill. Treatment time can be extended to further polish the effluent. The recirculating pump line has a restricting valve that can be adjusted to allow some of the recirculating liquid out to the UV disinfection system. The restriction valve determines the amount of liquid circulating in the disinfection area. Depending on the size of the unit, an adjusent to affect the flow of less than one gallon per minute can increase the treatment time and efficiency of the UV.

MODEL	GALLONS PER MINUTE	GALLONS PER HOUR	① INLET AND OUTLET	REPLACEMENT LAMPS	② POWER CONSUMPTION	UNIT DIMENSIONS (Inches) Length	Width	Height	SHIPPING DATA (lbs.) Gross Wt.	Net Wt.
S14A	2	120	1/2" NPT	05-1400	14 Watts	16 1/8	4 3/4	8 1/4	11	7
S17A	3	180	3/4" NPT	05-1098	18 Watts	19 1/8	4 3/4	8 1/4	11	8
S23A	6	360	3/4" NPT	05-1097	24 Watts	25 1/8	4 3/4	8 1/4	14	14
S37C	12	720	1" NPT	05-1343	44 Watts	39 1/8	5 11/14	9 1/2	30	30
S50C	20	1,200	1 1/2" NPT	05-1334	54 Watts	52 1/8	5 11/14	9 1/2	36	36
S2400C	40	2,400	2" NPT	05-1311	140 Watts	52 1/8	6 3/8	11 1/8	49	36

① All inlets and outlets are male pipe threads.
② Total power consumption including ballast loss (approximate).

- Maximum recommended operating pressure for all purifiers is 100 PSI
- Pressure drop at maximum recommended flow rate is less than 5 PSI
- Flow rates are based on Maximum Concentration Levels.
- 120 Volt 60 Hz and 220 Volt 50 Hz units are standard.
- 12 and 24 Volt DC units also available.
- SANITRON™ is available for operation on public power supplied through out the world.
- Consult factory with specific power requirements.

Spin Filter:

- Plastic Spin Clean® - Available in 3/4", 1", 1 1/2", and 2" sizes with unique self-cleaning spinning action max psi 150
- Steel Spin Clean® - 2" through 12" epoxy-coated carbon steel, with stainless steel spin filter cleaning action 100 to 2800 gpm
- T Filter - Low profile design with black or clear debris basin, 3/4" MPT drain with cap

Advantages of the Aquarobic Recirculating Filter:

- Tertiary treatment producing high quality effluent of less than 5 BOD_5 and 5 SS
- The entire operation is programmed and automated

DISCHARGE METHODS

In most cases the Mini-Plant units can be permitted for surface discharge. The treated effluent can be pumped to a drip field (subsurface discharge), a community disposal area such as a lagoon, a holding tank, a greenhouse, or used on the property for irrigation. There have been studies conducted on Dr. Bernhart's evapotranspiration (ET) theory, by Aquarobic's founder Dan Pavon on the filter bed and constructed wetland. Most importantly, do not worry if there is no perk on the land, you always have an option with Aquarobic.

DRIP-IRRIGATION (DRIP FIELDS)

The Mini-Plant timer regulates aeration, settling, and pump functions. The pump discharges each batch through a spin filter. The spin filter further reduces the suspended solids to less than 10 mg/L. The effluent is discharged 8 minutes "on" and 2 minutes "off" 5 a.m. to 6 a.m. to the spin filter, further polishing prior to passing through to the K valve and into one of the drip irrigation zones. During the 2 minute "off" period, the K valve switches to the next zone. Each zone has a 15-pound spring-loaded check valve at the return manifold; as the zone becomes pressurized, the check valve opens allowing a continuous forward flushing of the zone back to the front of the Mini-Plant tank, for the remaining 8-minute "on" cycle. The process repeats until the low water float switch turns the effluent pump "off" or the one-hour period expires, whichever comes first.

RAISED FILTER BED (MOUND SYSTEM)

Aquarobic filter bed is implemented when little to no perk is present on the land. The application rate to the top of the filter bed:

- Flows up to 1500 gpd = 4 gal./Sq.Ft./day
- Flows greater than 1500 gpd (Domestic, Commercial, Municipal) =2.5 gal./ Sq. ft./day
- The maximum size of any filter bed top is 900 sq. ft. Larger areas require multiple beds separated by a minimum distance of 15' using a common contact and mantle area.
- The elevated portion of the filter bed is a minimum of 30" inch depth. Whenever possible the contact area is to be cut into the ground (level + or -6"), and back-filled with a minimum of 12" of sand, 0.5 to 1.5 mm clean fine sand.
- On sloping land a 12" separation distance is required to the limiting zone, no cutting will be allowed; imported leveling material is used for the mantle area. This material is to be from soil type II or III and backfilled with 12" of mason sand with an average size of 1 to 2mm.
- The distribution grid (4" perforated pipe) is to be placed level, on 15" centers in 12" of washed 3/4" inch stone.

- If the high ground water table is only 12" from the ground surface, heavy clay material must be used around the perimeter of the filter bed's sand mantle area to prevent breakout.

The mound area is calculated by the following formula:

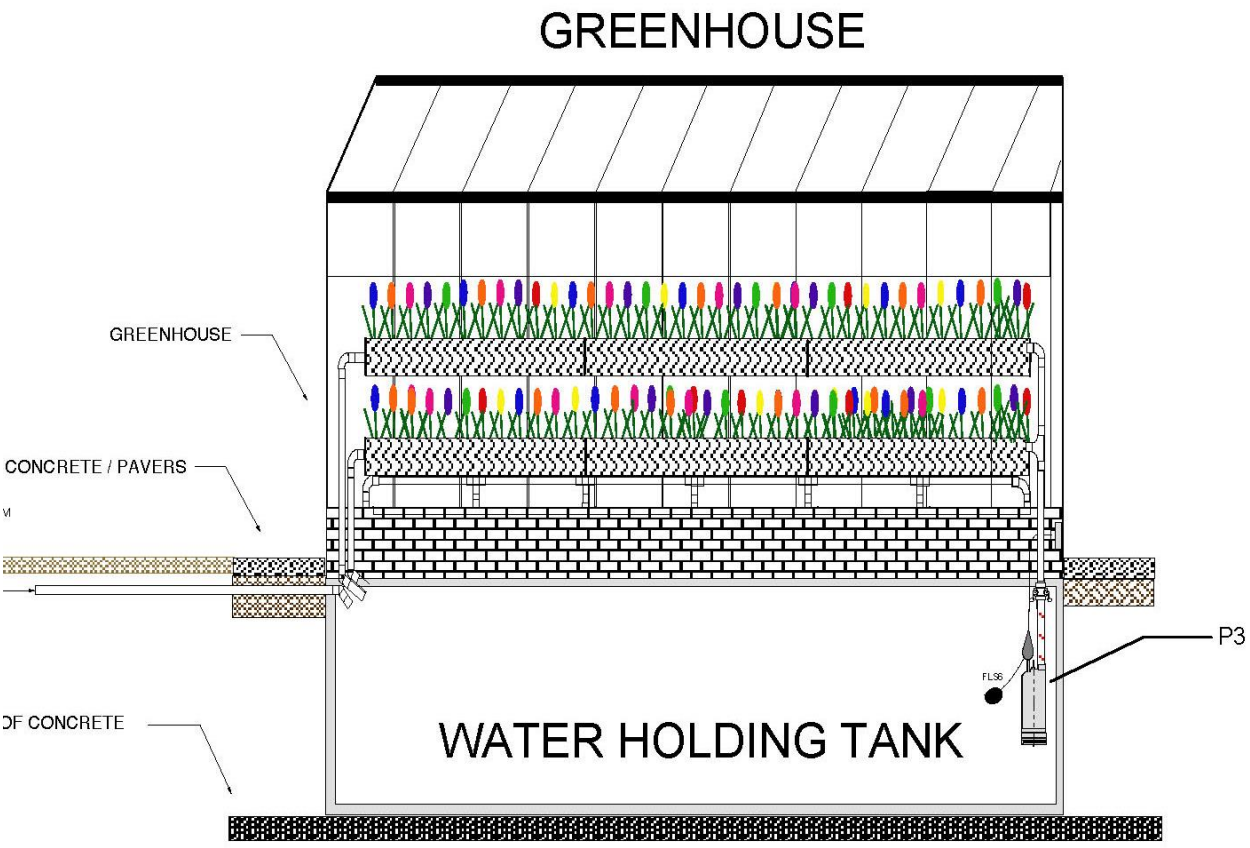
A = QT/25

A = contact and mantle area
Q = quantity of wastewater per day
T = the percolation time of the original soil in minutes/inch

For percolation rates above 120 min/in, the mantle area is to be sized at an application rate of no more than 0.20 gallons per square foot per day. At a minimum, the mantle shall be at least as wide as to equal the footprint of the filter bed material and extending to a minimum of 50 feet from the outer distribution pipes in the direction of flow. Other separation distances (Ex. well, property line, buildings, etc.) shall be measured from the foot of the filter bed.

ZERO-DISCHARGE (GREENHOUSE)

In the situation that there is no percolation land available, and the criteria for surface discharge or to the waters is strict, a greenhouse may be your only option. Aquarobic designs a complete water reuse greenhouse, where plants in the greenhouse are watered by a system of trays connected to a pump in a holding tank. The tank is sealed so that no water may exit any way other than through the pump into the planters, this is also called the Zero-Discharge System.



LAGOON

A lagoon, or aerated pond, is usually installed for holding the effluent in commercial situations. This process is rarely used anymore due to stringent laws and regulations, but is still available through Aquarobic.

ABOVE GROUND DISPERSEMENT

In certain situations this is a very simple way to disperse the effluent, but is not available in all areas. Depending on perk, county, and topography this may be a solution for you.

NON-POTABLE USES

Water may be recycled into the properties sprinkler systems, and the heating and cooling units for the building. This idea is still not accepted in the US, however many places in the Caribbean have been doing this for decades because of droughts and limited rainfall certain times of the year.

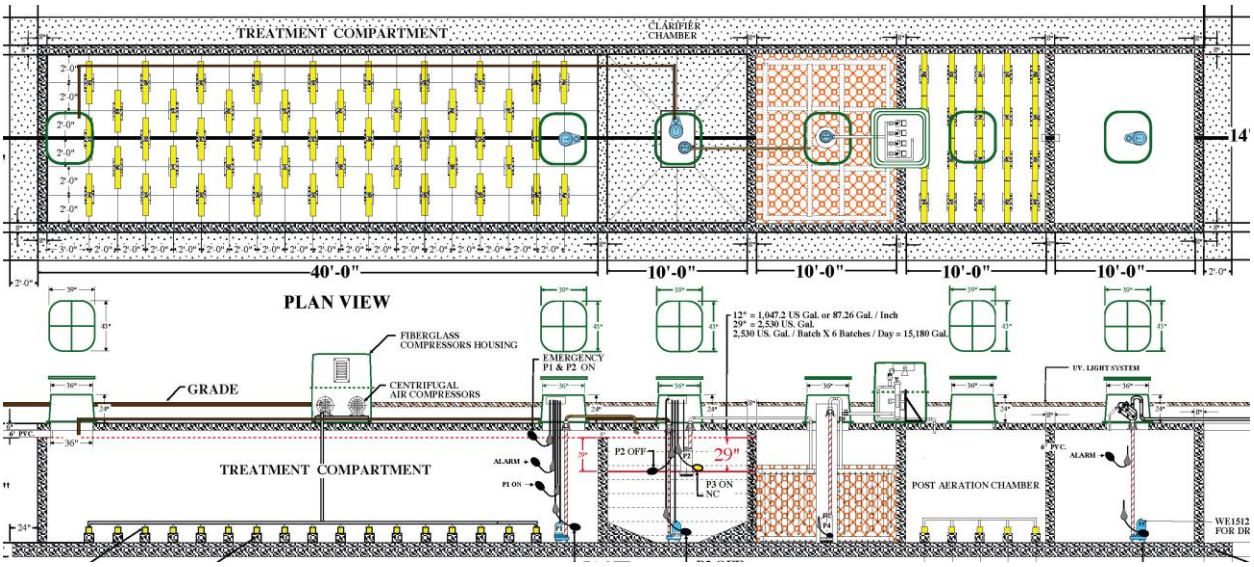
AQUAO_2 MAXI-PLANT

The AquaO_2 Maxi-Plant SBR wastewater treatment plant is capable of treating wastewater flows from 5,000 to 500,000 gallons per day. Advanced tertiary treatment is achieved by AquaO_2 add-on components. The recirculating filters, UV disinfection, and denitrification filters have produced overall results of less than 7 mg/L BOD & 11 mg/L SS.

Maxi-Plant systems are sold completely factory assembled in fiberglass tanks ready to install, or as a kit allowing the system to be mounted on concrete tanks.

Maxi-Plant Applications:

- Residential Communities
- Parks, Camps, Golf courses
- Restaurants, Marinas
- Resorts, Condominiums
- Schools, Churches
- Stadiums, Theaters



PROCESS DESCRIPTION

The $AquaO_2$ SBR system works on a periodic fill and draw principle in order to achieve optimum quality of the treated effluent. The aeration chamber is sized to hold the daily wastewater flow, plus a minimum 50% safety margin. The system processes one batch every four hours, or 1/6 of the daily wastewater flow. This gives the system the ability to handle the occasional surge without any detrimental effect on the effluent quality.

Every 4 hours the transfer pump (P1) pumps for 30 minutes from the aeration chamber to the clarifier chamber. Then a 3-hour settling period follows. After the 3-hour settling period, the effluent pump (P2) which is suspended about halfway up in the clarifier chamber, starts and transfers the clear supernatant to the recirculating or denitrification chamber, leaving 1/2 of the volume in the bottom for the sludge return pump (P3). When the liquid reaches a predetermined level, a float switch stops the effluent pump (P2) and starts the sludge return pump (P3) transferring any remaining sludge to the aeration chamber to undergo the process again. Immediately, another 4-hour cycle is initiated for a total of six cycles per day.

It is important to note, that there is no need to worry about high flows or surge, the process of this system is not affected by flow variations. The influent is retained in the large aeration surge chamber and only a predetermined volume is transferred to the clarifier chamber every 4 hours.

During periods of low flow, a low level float switch prevents transfer pump (P1) from starting, allowing the system to skip one or several cycles, saving energy. In addition, the air compressors can be programmed to operate at intermittent time cycles, also saving energy during low flow periods.

COMPONENTS

$AquaO_2$ Fiberglass Tanks

Manufactured of the finest materials and are extremely durable. Tanks have undergone stress-loading tests and consistently perform better than most plastic tanks. Manufactured from heavy fiberglass reinforced polyester, manways protect and provide access to the air compressors, electrical junction boxes, and other mechanical connections. Inside the manway, energy efficient ring type air compressors are mounted. The level sensors and submersible pump are also wired to the junction box.

The $AquaO_2$ Control Center

Type-3 enclosure suitable for Indoor/Outdoor mounting is built with audio-visual alarms and is UL listed and CSA approved. The program timer, control alarm buzzer, and off-switch are located in the Control Center. A separate circuit breaker load center panel is mounted onto the bottom of the Control Center. A control panel drawing is provided to guide the qualified serviceman or electrician to troubleshoot any part of the system. Visual, audible, and remote alarms are provided to monitor and ensure continuous operation.

Aeration Chamber (Treatment Comparent)

This comparent has a capacity of 100% of the calculated daily flow, plus a minimum 50% safety margin. The influent is continuously exposed to the finely diffused air bubbles. Each regenerative compressor provides a minimum of 2100 cubic feet of air per pound of BOD_5, at the maximum water depth possible. The air blowers are highly efficient with a low sound level and low power consumption. All piping and porous air diffusers are fabricated from non-corrosive materials.

Clarifier Chamber

The capacity of the clarifier chamber must equal 3 times the designed batch size or 1/3 the daily calculated flow rate. This chamber is programmed to separate the solids from the supernatant and uses time and careful positioning of float switches to accomplish the separation.

Denitrification Chamber

The rate of denitrification is minimized in the presence of free oxygen. Denitrification can occur at minimal rates if anoxic conditions have previously existed during which enzyme synthesis may occur. It is, however, generally agreed upon that the level of dissolved oxygen should approach zero in order to achieve consistently good performance. The process for removal of nitrogenous compounds in wastewater is easiest described as two separate biological reactions although they are frequently interrelated.

The first step is to convert ammonia nitrogen and organic nitrogen into nitrate. This process (nitrification) is a result of certain bacteria being able to oxidize ammonia to nitrate nitrogen. These bacteria (nitrosomonas and nitrobacter) require aerobic conditions in order to procreate. The $AquaO_2$ Advanced wastewater treatment plants have been found highly effective in supporting biological nitrification.

In the second step, denitrification is accomplished with the use of another group of bacteria (psuedomonas, micrococcus, archromabacter, and bacillus). These bacteria require anoxic conditions (no oxygen) in which they use the nitrate as an oxygen source, thus reverting the nitrate to nitrogen gas, which then escapes into the atmosphere.

Recirculating Chamber

The filtration media is installed in a fiberglass tank as addition to the Maxi-Plant or as a kit to install on a locally built concrete tank. The effluent from the Maxi-Plant is pumped into a 4" distribution manifold at the top of the filter material (1/4" to 1/2" stone or pea gravel). The effluent sinks slowly through the filter media where it is collected by another 4" perforated pipe manifold at the bottom of the filter material and flows to the center of the 16" PVC recirculating filter pump well. A predetermined volume allowance in the center well activates the recirculating pump switch, which pumps the liquid around and back into the top 4" perforated manifold for continuous filtering. The filter tank is designed to hold the daily wastewater flow from the Maxi-Plant, in the empty space above the filter, and in the filter media.

Post-Aeration Chamber

This chamber is to introduce oxygen back into the process after denitrification is complete.

Ultraviolet Lights

UV lights are always "on" intensifying the bacterial kill. Treatment time can be extended to increase disinfection rate. The recirculating pump line has a restricting valve that can be adjusted to allow some of the recirculating liquid out to the UV disinfection system. The restriction valve determines the amount of liquid circulating in the disinfection area. Depending on the size of the unit, an adjustment to affect the flow of less than one gallon per minute can increase the treatment time and efficiency of the UV.

TESTING:

NSF completed testing the Aquarobic system capabilities. The results are published in NSF's June 1994 report entitled Research Study, Aquarobic Aerobic Sewage Treatment System with Denitrification. The executive summary of this report states:

"...The unit was able to achieve significant denitrification resulting in effluent nitrate levels consistently less than 4 mg/l (overall mean 4.5 mg/l), while generally maintaining CBOD, levels below 30 mg/l. Influent tkn levels averaged approximately 40 mg/l, while effluent tkn plus nitrate-nitrogen concentrations averaged below 3 mg/l. In limited sampling, effluent nitrite levels were generally non-detectable and some removal of dissolved phosphate species was observed through the overall unit."

MAINTENANCE:

- Trained WWTP Operators
- Weekly Inspections
- Operation & Maintenance Manual
- Removal by a septic tank hauler may be required

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