The EHS SMART-Treat™ On Site

Wastewater Treatment System

<u>Site Location & Installation Manual</u>

Produced by:

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Featuring: Biofilm Carrier Elements by

BIOWATER TECHNOLOGY

SITE LOCATION COMMENTS

All system designers and/or plumbing contractors and/or system owners are fully responsible for evaluation of the site for suitability to properly locate, install, operate and maintain the SMART-Treat Onsite moving media treatment system. The statements below are, in general, appropriate to systems of this type.

Site must be clear within 1 hour of starting installation or maintenance work to avoid waiting charges.

If the municipality, town, county, state or any other agency requires the installation of silt fencing for any installation or maintenance item, this will be an additional charge.

During installation or maintenance--Repairs for errors will be billed accordingly.

Installation, Inspection Operation and Maintenance contractors take no responsibility for broken sprinkler lines, water lines, electrical lines, or damage to existing sod, driveways, or walks or existing septic system lines because of equipment used to complete installation, inspection, operation or maintenance duties.

Any inspection fee or re-inspection fee assessed by the county or by any other organizations or individuals regarding installation, inspection, evaluation, pumping, sampling, maintenance or other reasons other than specified in the owners operation and maintenance manual shall be paid by owner, and shall be separate from any maintenance contract.

INSTALLATION COMMENTS

Introduction

With the SMART-Treat™ Onsite system, the internal components of the aerobic reactor are usually assembled and installed into the tank to be used before the unit gets to the site. However, this process is so flexible that any of the components are able to be assembled onsite—depending on the specific project needs. If this is the case, specific instructions will be provided to the contractor or installer by EHS or their distributor prior to installation. For a fee, on-site installation guidance is offered by EHS. The air distribution header, carrier retention screen and carrier elements may be assembled and loaded prior to arrival at the site.

Due to the individual site characteristics of each installation site—whether new construction or add-on or retrofit of an existing onsite treatment system, it is impossible to know and take account of every detail of any one particular site. Therefore, a general discussion of the progression of installation is offered in this section. It will be up to each system designer and installation contractor to do the right thing regarding each step of their planned installation of the SMART-Treat Onsite moving media system.

General guidelines --Installation of EHS SMART-Treat™ Onsite moving media Advanced Treatment Systems:

- For high FOG wastewaters, a FOG separation process or tank is the first treatment step. FOG maximum for SMART-Treat advanced treatment systems is <100 mg/l.
- Primary solids separation (septic or trash tank or some other solids separation device) precedes the SMART-Treat aerobic treatment system. Primary Solids Separation (septic) Tank

  It is recommended that this tank have an effluent filter of at least 1/8" filter size. This will both prevent solids to enter the aerobic reactor and not allow backflow of carrier elements to go upstream in the event of system backup. If an effluent filter is not able to be installed in the primary tank, an inlet screen is recommended in the aerobic tank, placed inside of a vertically oriented 4" sanitary Tee.

Setting Aerobic Treatment Tank

- Surge flow equalization is not necessary in most moving media applications---**when the system is specifically designed for surge flow equalization to be ABSENT**. If that is the case, the system designer must take peak flows into account when designing the entire treatment system.
- Surge Flow Equalization is desirable for many situations for many reasons. If surge flow equalization is installed, the surge flow basin or tank is located between the solids separation and the advanced aerobic treatment unit—in this case, the SMART-Treat aerobic (s).

General Statement--- Specific to Moving Media treatment systems---

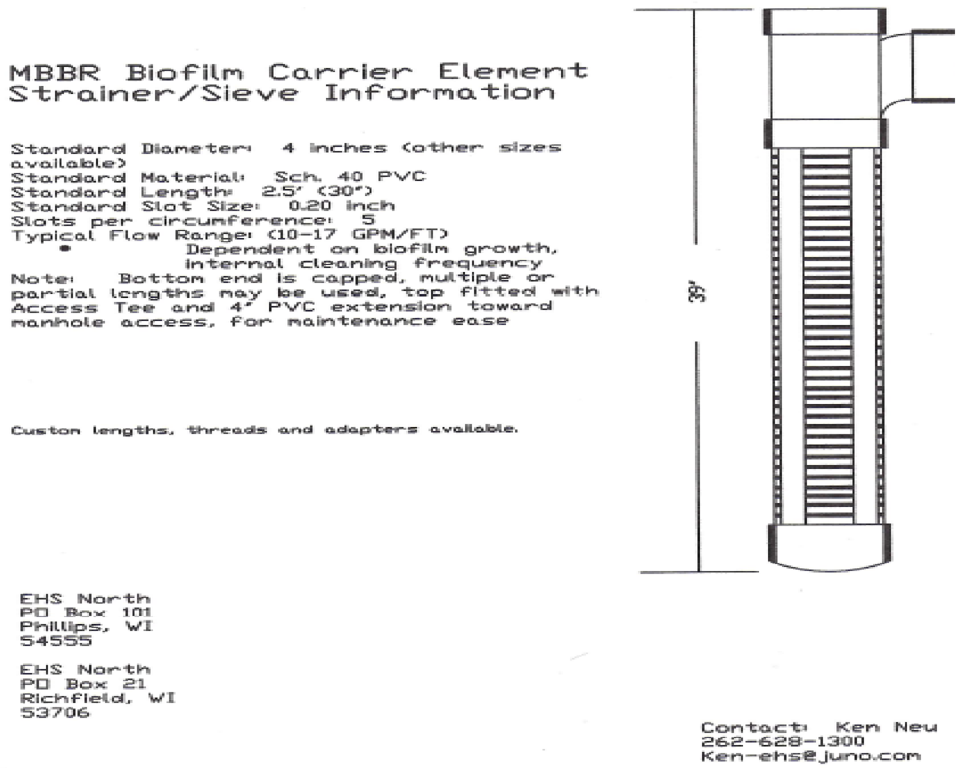
The goal of this treatment system is to provide a large biological surface area in a small space. The protected area of the moving plastic biofilm carrier elements provide a "house" for the microbes to live, grow, multiply, remove wastes from the water. It is imperative to keep the carrier elements that house the microbes in the intended aeration basin. EVERY EFFORT to make sure that there are no escape routes for the microbes attached to the plastic carrier elements---will assure proper treatment. Therefore, as installation takes place, seek every opportunity to keep the microbes in the reactor. Note: Cleaned water and waste microbes are intended to flow out the slotted screen pipe at the effluent end of the SMART-Treat reactor. Other than the intended cleaned water/waste microbe exit point--- Any space greater than ¼" is a space that the carrier elements (WITH MICROBES) can escape. Be aware of the goal of keeping the microbes in the aerobic reactor AT ALL TIMES during construction and take particular time & material to install barrier (screen, grating, etc) at ANY route larger than ¼".

- Preassembled precast concrete, fiberglass or plastic tank(s) containing SMART-Treat internal components are off-loaded from transport trucks into prepared excavations with appropriate elevation grades—in about the same manner as conventional septic tanks.
- Tanks should be set as level as possible on a gravel bed, so that the water is the same depth throughout the tank. This will allow even air distribution over the entire bottom of the tank.
- Aeration reactor inlet and outlet connections are made.
- In the case of flow equalization the timed dose pipe or hose should enter the SMART-Treat tank at least 1 foot above the normal water level. A backflow check valve should be installed on the pipe from the pump or a screen of ¼" should be installed at the discharge end of the timed dose EA tank pump pipe or hose.
- The contractor will locate the main air supply blower at a point convenient to connection of the SMART-Treat air distribution pipe (usually near a tank manhole). Recommendation is to use a section or two of riser or a series of stacked concrete blocks set atop a solid base as the starting base for blower placement. The newly set tank cover is a good place to locate the base that will support the blower. Doing so will allow tank and soil settling to NOT disturb the blower/air distribution pipe connection.
- After blower initial base is built atop tank cover, place plastic blower base on riser or block base, place blower, align with most convenient place to connect blower outlet—through riser—to air distribution header (this is totally up to plumbing contractor discretion). A "soft" or flexible connection –using a Fernco coupling or heat-resistant (radiator) hose is the last connection point from blower to air distributor pipe. Soft connection is usually near blower outlet piping.
- Due to heat generated from blower, galvanized steel pipe is used at blower outlet fittings, followed by heat-resistant soft connection to Schedule 80 PVC p plastic pipe—used from blower soft connection to close to water connection to air distribution header in SMART-Treat tank.

Smart-Treat Aeration Reactor Inlet and Outlet Screens

- The inlet screen is a course plastic mesh to be placed in the inlet Tee of the aerobic reactor. The purpose of this screen is to retain biofilm carrier elements with treatment microbes from upstream migration—in the unlikely event that circumstances are such that backward flow within the system is possible (an unlikely scenario—unless down-steam events cause flow backups. Maintenance is variable. Screen should be checked each 6 months and cleaned when necessary. Installation of an upstream septic tank effluent filter will greatly reduce solids buildup on this screen and reduce maintenance.
- The aeration reactor outlet retention screen retains carrier elements from downstream migration. There should be a 4" PVC pipe extender placed atop the screen Tee, to within 5-7" of the riser cover. A drain screen insert (with a nylon or plastic pull rope) should be inserted (not glued) into the 4" PVC pipe. The purpose of the drain screen inside of the

pipe is to completely prevent carrier elements from migration into the pipe---in the event foam lifts and carries the carrier elements up the riser to the end of this screen access pipe. Re: Outlet retention screen maintenance: A 4” circular brush with a 10’ extension wire is supplied. Annual internal screen cleaning will assure internal side of media retention screen is clear of biological buildup that may impede flow—if allowed to do so—in certain heavy biomass, high strength wastewaters. The exterior of the media retention screen is continuously cleaned by the movement of the carrier elements.


MBBR Biofilm Carrier Element
Strainer/Sieve Information

Standard Diameter: 4 inches (other sizes available)
Standard Material: Sch. 40 PVC
Standard Length: 2.5' (30")
Standard Slot Size: 0.20 inch
Slots per circumference: 5
Typical Flow Range: (10-17 GPM/FT)
- Dependent on biofilm growth, internal cleaning frequency

Note: Bottom end is capped, multiple or partial lengths may be used, top fitted with Access Tee and 4" PVC extension toward manhole access, for maintenance ease

Custon lengths, threads and adapters available.

39'

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In the event that the carrier elements are shipped to the jobsite separately, the following are shipment, storage and loading procedures associated with the biofilm carrier installation.

Biofilm Carrier Shipment and Storage

The biofilm carriers will arrive in sacks that measure approximately 4 ft by 4 ft by 7 ft tall and weigh approximately 800 pounds each. There are lifting straps on the top of the sacks from which they are removed from the truck, and loaded into the basins. A draw string is at the bottom of each sack from which the contents are emptied.

IMPORTANT: If the biofilm carriers will not be placed in the basins upon delivery, then the sacks must be covered to prevent over exposure to UV light as the sacks will become brittle and degrade, causing difficulties in loading later. Covering with tarps is adequate for storage of bags.

FIGURE 1 - EXAMPLE OF BWT-X IN SUPER SACKS

Biofilm Carrier Loading

EHS uses Biowater Technology's BWT-X biofilm carrier elements. The carriers are shipped in sacks. There are handles on the top of the sacks from which they are removed from the container and a draw string at the bottom from which the contents are emptied. The loading procedure (placement of biofilm carriers into the process basins) will require a crane (or backhoe or fork truck for shallower tanks), operator, and one (1) or two (2) laborers during the entire process. The following picture shows biofilm carriers being loaded into a concrete basin. EHS anticipates the carrier loading procedure will take 5 minutes per sack. At the option of the installer, the installing contractor may conduct an aeration grid testing procedure before actual loading of biofilm carriers into the wastewater tanks. The procedure is described under the startup procedures.

FIGURES 2 & 3 Examples of Super Sacks being Moved and Loaded to Reactor Basin

Biofilm Carrier Addition to Basins

With the SMART-Treat Onsite system, the internal components of the reactor can be assembled onsite—or before the unit gets to the site, depending on the specific project needs. The air distribution header, carrier retention screen and carrier elements may be assembled and loaded prior to arrival at the site. In that case, the comments regarding addition of carrier elements to basins do not apply. Regardless of where the carriers are loaded, due to the hydrophobic nature of extruded carriers, one can expect foam to be generated and for the carriers to tend to float. There are a few things that can be done to help speed up the wetting process for the biofilm carriers.

The first is to add screened wastewater, primary effluent, or return activated sludge. These waste streams will provide a food source for the seeding bacteria and will help in reducing the surface effects and allow the biofilm carriers to start moving. A physical knock-down of foam and carriers from above, using pumped wastewater through a hose or using anti-foam spray nozzles typically shortens the wetting process.

Anti-foam can be dosed into the reactor, which will cancel out the hydrophobic effects of the biofilm carriers. It should be noted that WATER-based antifoam must be used and SILICON-based antifoam should NOT be used due to surface characteristics of the biofilm carriers. Dosing of antifoam will vary from case to case but it seems to be required when a) the wastewater temperature is cool (<15 °C) and/or b) the influent wastewater has low suspended solids and organic concentration. Dosing of anti-foam can last for 1-2 months after start-up depending on how fast an established biomass attaches itself to the biofilm carriers. Acceptable anti-foam agents are NALCO 71-AF7 or DF-269.

Biofilm Carrier Element Fill Procedure

After the tank's aeration system has been tested, add raw wastewater or return activated sludge (if possible) to the normal water surface elevation. If the addition of activated sludge or waste aerobic sludge is not possible, primary effluent, septic tank effluent, or screened wastewater will suffice and will act as a jump starter to establish a biofilm on the carriers' surface.

For small flows systems, it is OK to add carrier elements prior to tank transport. If that is the case, it is VERY IMPORTANT to have the tank cover on, or cover the carriers to AVOID carrier escape during transit. Elements may also be added at the installation site—all at once, or as time permits. If time permits and water or wastewater is available, fill the tanks with water or wastewater, add the biofilm carrier one bag at a time until all biofilm carriers have been added to each tank—if a multi-tank system. As biofilm carriers are placed into the tank it may be necessary to add additional liquid. Once biofilm carrier placement is complete, the system can be left with the blowers in operation.

Figure 4 **SMART-Treat aerobic reactor/biosolids clarifier with vertical air distribution pipe and carrier element retention screen exposed. The 2nd compartment also shows the waste biosolids removal pump.**

Biosolids, Clarification, Waste Biosolids

In contrast to competitive processes, the aerobic treatment zone of the tank NEVER should be pumped to remove solids. The solids will pass from the aerobic reactor through the carrier element retention screen to the biosolids settler (clarifier) compartment or separate tank. The waste microbes will settle to the tank bottom, and will be removed with a pump (either airlift—air for airlift pump piped via a small diameter flexible braided hose from main blower to inlet to airlift pump, air flow regulated by valve at blower piping----- or removed by conventional submersible pump on timer, 2-4 minutes, 2 times per day.

Figure 4 shows a two compartment reactor tank, with new clean white carrier elements covering the air distribution header in the aerobic reactor zone. The second compartment is the biosolids clarification zone. Note the waste biosolids removal airlift pump. The airlift pump raises water and waste biosolids for disposal and return to the septic tank. It consists of a ½" OD air feed line that is connected to the main air blower. It also has a 1" vertical effluent pipe that is to be connected to a 2" gravity feed line. The water + biosolids is lifted HIGH vertically into the manhole—almost to the riser cover. A 2" pipe should be connected to the 1" pump pipe and installed from the biosolids clarifier manhole—on an angle—to the septic tank inlet. The purpose is to allow waste biosolids to flow by gravity FROM the airlift pump TO the inlet of the septic tank. The waste biosolids flow can be directed to a 2" x 4" Tee at the septic tank inlet pipe OR through the ST inlet riser, and directed to drain or empty into the INLET side of the INLET baffle of the septic tank.

The return flow would operate 24/7 –receiving air from the aeration blower. The airlift pump would not operate during the time that the blower was not operating—if the blower is connected to an ON-OFF sequence timer. If a flow equalization tank was located between the ST and SMART-Treat aerobic reactor, and there was no flow through the system for an extended period of time, the airlift pump would pump down about ½ of the depth of the clarifier and stop pumping as a self-regulating control. The air would continue to flow but pumping action would stop due to the lack of head pressure to lift the water--- at a point where the water level would dictate that it could not continue to be lifted to the intended outlet point height.

In cases where airlift pumping and gravity flow-back to ST inlet is not practical, a standard submersible solids handling electro-mechanical pump can be used to remove waste biosolids from the clarifier and deliver to the septic tank. The electric pump would require another electrical circuit in the supplied electrical panel and would require timer, set on a timed dose of 2-4 minutes each 12 hours—as an example. Highly pretreated, low solids cleaned water will flow out of the biosolids clarifier to downstream surface or subsurface dispersal.

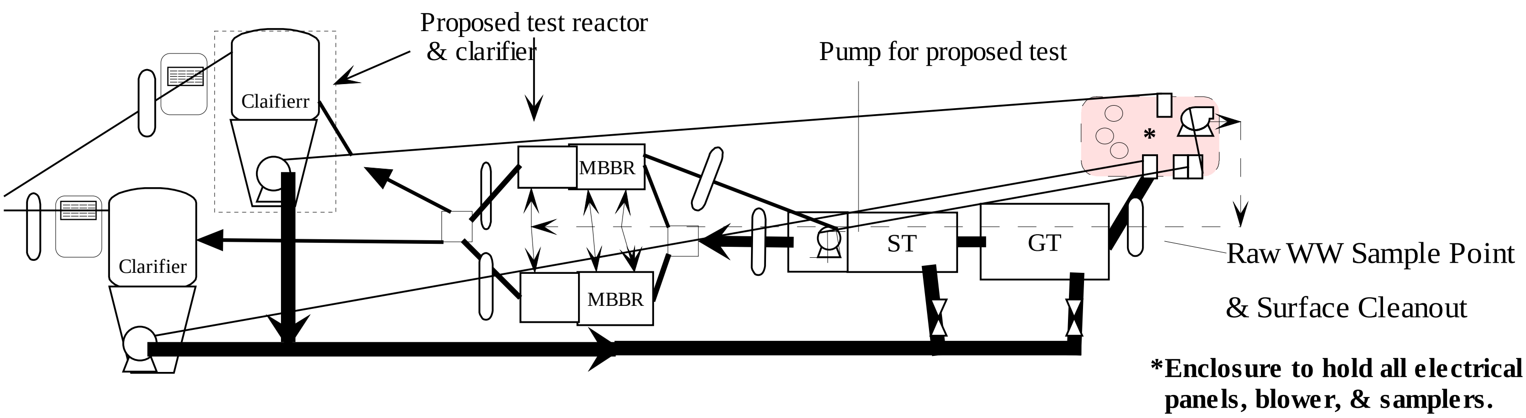
Biosolids Return Line

At the bottom of the clarifier, whether airlift or conventional pump, whether new or existing installation, the contractor must install a 2" pitched gravity line from the biosolids clarifier to the inlet pipe or inlet riser of the primary solids separation tank (septic tank), with pitch from clarifier to primary solids separation tank. This line is how waste biosolids are transferred to storage for ultimate disposal.

The air for airlift pump comes from main blower with a 1/2" OD flexible hose. The 1" pump line allows water to be LIFTED 24/7 to an elevation sufficient to flow by gravity to the inlet pipe of the tank preceding the aerobic reactor. The easiest way to do get biosolids from clarifier to septic tank is to provide a 2" PVC pipe at the 1" pipe discharge of the airlift pump **(2" x 1" Bushing is NEEDED),** run the pipe so water flows BY GRAVITY to 4" inlet of ST upstream of aerobic tank. A simple 4" x 2" tee joint at the point in the 4" line upstream of the septic tank inlet point is sufficient.

As NOTED PRIOR: If gravity flow back from biosolids clarifier is not possible, an electric submersible pressure pump will be the alternative. The electromechanical pump and added timer control circuit to the electrical control panel will increase overall system cost approximately $ 1000 for a typical onsite treatment system of 10,000 gpd or less design flow.

Figure 5　　SMART-Treat™ system installed at a full-service restaurant in 2001



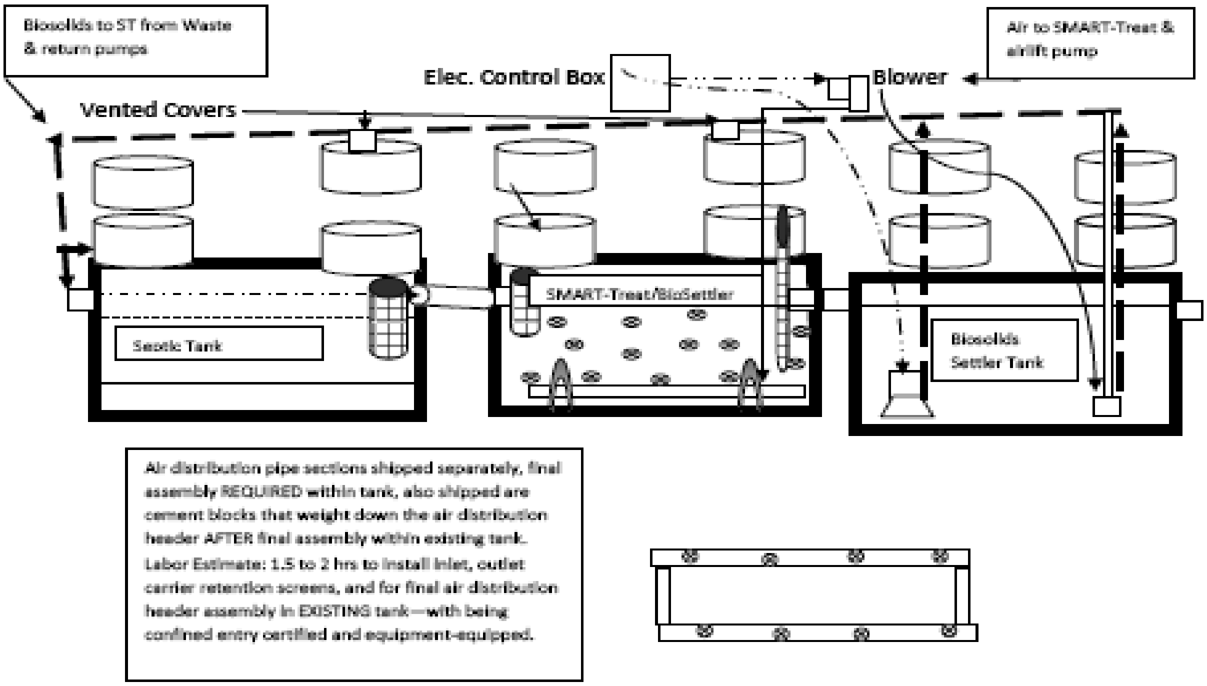
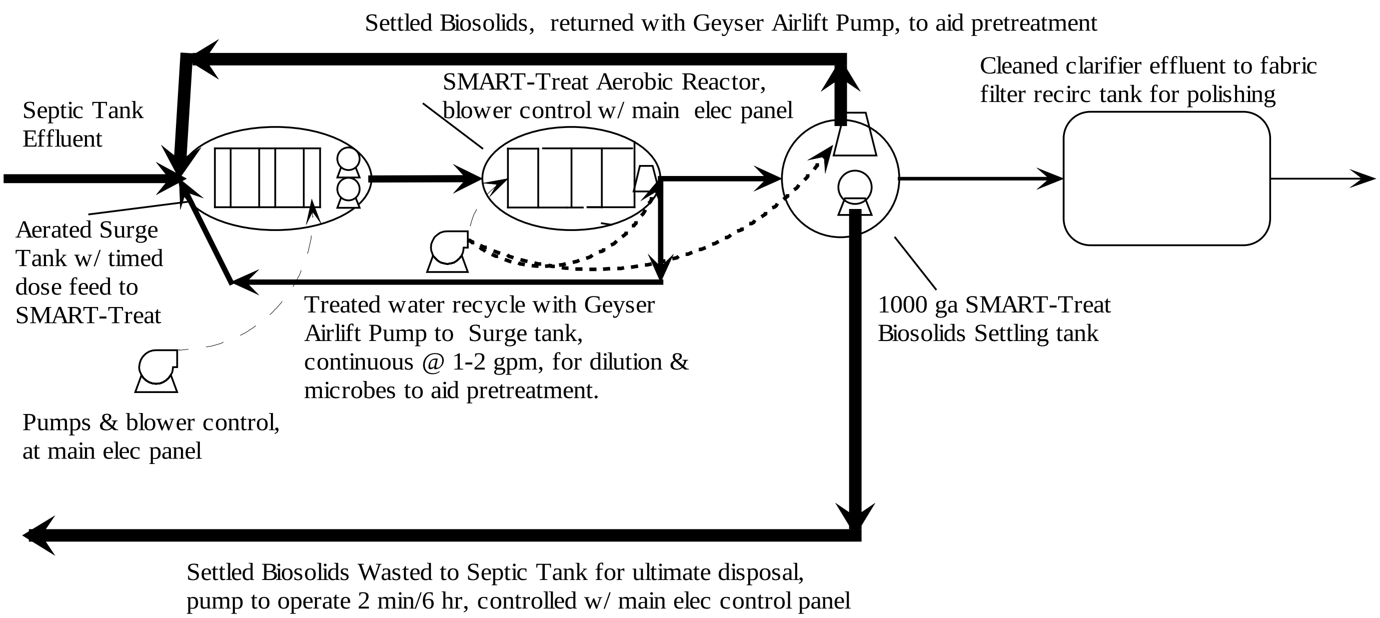


Figure 6-above- SMART-Treat™ system w/o flow EQ. Note1: Example of two types of biosolids pumps

Note 2: Narrative in comment box pertains only if SMART-Treat™ internal components are for retrofitting or upgrading an existing septic or other treatment tank. Most often, with new SMART-Treat systems, aerobic reactor is fitted with SMART-Treat internal components prior to tank delivery.

Figure 7-below-SMART-Treat™ is "SUPER-CHARGED" with features unique to EHS On-Site systems



Proposed Restaurant WW Treatment Flow Diagram

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