

## **Wastewater Treatment – You Ask The Question**

By Bill Fenner, Creative Environmental Systems, Inc.

### *Part Four: Readers' Questions Answered*

In the previous three articles on wastewater treatment on the Outer Banks, I have attempted to shed a light on a topic that most people would rather forget about....waste. Still, waste, and in this case wastewater and that which goes down our toilets and drains, is real and must be properly managed. So, I have discussed some of the treatment options available and hopefully have given you some ideas as to what options might work best in a given situation. However, we must also remember that each and every situation is unique and that there are no blanket solutions for any given scenario.

Well, while I don't know if I have helped answer any questions for you....I do know that I have raised some questions. Numerous questions have been received since this series started and I am pleased to be able to answer some of them here. The questions received have told us two important things: first, people do care about our environment and are willing to modify and adjust in situations that will benefit our environment. And secondly, many people realize that they do have options concerning wastewater operations and that there are excellent solutions that fall between the individual septic system and the large, municipal sewer system.

This article will attempt to answer the questions that you have concerning wastewater; how we deal with it and how we treat it. So, let's open the letter bag and begin.....

First question, and one that I get a lot...

#### ***I have a septic system in my back yard. How does my septic system work?***

A septic system is actually comprised of two systems, a treatment component and a disposal component. The treatment system starts with a septic tank. The septic tank is separated into two compartments with a series of holes in the separating wall about halfway up the wall between the compartments. The environment inside a septic tank is one without oxygen and the bacteria that grow there are the ones that do not need oxygen to survive. The wastewater enters the septic tank through your plumbing connections. In the compartment the heavy solids (anything that doesn't float!) settles to the bottom and the liquid and everything that does float stays on the surface.

A somewhat clear liquid forms in the middle of the tank. Remember, the solids went to the bottom and everything that floats went to the top. So, here in the middle, is the most treated liquid. This simple process, plus the work of the "good" bacteria that don't require oxygen, will remove about 20% of the contaminants and 90% of the solids from the liquid in this middle area. This "effluent" then leaves the septic tank to go to the drainfield where it is further treated by air breathing bacteria that live in the drainfield trenches. These are shallow trenches installed with only 6" of soil over the top of the gravel so that oxygen can reach the bacteria. Nitrogen in the wastewater is removed through plant uptake by the grass growing over the drainfield. (Now you know why the grass is always greener over the septic field!)

These bacteria get their oxygen from the atmosphere so the trenches must be shallow enough to allow for the oxygen to reach the bacteria. The trenches also act as the disposal

system where the effluent goes out to the soil and moves through the soil to the groundwater. The soil itself acts as a physical filter and removes remaining solids in the wastewater as well as most of the pathogens and viruses that constitute a public health issue.

A septic system may not provide the best treatment possible, but if properly maintained and if systems are not allowed to become too crowded, a septic system can be a workable solution for an Outer Banks residence.

### ***Why do I have to pump out my septic tank and what happens to it after it is pumped out?***

There are basically two types of threats to the environment from septic systems that concern us. A system that malfunctions can contribute significant volumes of untreated wastewater and bacteria to surface and ground waters. This type of failure can take place in either the tank or drainfield. In fact, septic systems are one of the most frequently reported source of groundwater contamination in the southeast US.

The second type is much harder to identify as it is an impact to the environment and can take place even with a properly operating system. The septic tank itself provides only minimal treatment, with the exception of separation of solids, with the majority of the treatment taking place in the drainfield trench and soils, thus making the site soils the biological, physical and chemical facility for the treatment of wastewater as well as the disposal conduit to the groundwater. As stated in the NC ON-Site Guidance Manual “Wastewater treatment in the soil can be broken down into three different types of processes: physical, chemical and biological. Physical processes include soil filtration, sedimentation in the soil profile, dispersion, and dilution. Chemical processes involve cation exchange, absorption, organic residue complex formation, and precipitation. Biological processes consist of biological oxidation, nitrification, Denitrification and plant uptake, interaction, immobilization and pediation.”

### ***What is the difference between a septic system and a sewer system?***

A septic system typically treats and disposes of wastewater on the site where it is generated. This is also known as an “On Site” system. A sewer system has pipes which transport the wastewater away to a remote treatment system where it is treated and disposed of either through a point discharge into a receiving water body or through land application.

Sewer is a system of collection pipes interconnected to homes and businesses for the transport of wastewater to a large centralized treatment plant where the wastewater is treated to a specific standard and then disposed of through either a discharge into surface waters or some type of spray system. The level of treatment required is dependent on the disposal method and impact of that disposal

The typical sewer wastewater treatment plant on the Outer Banks uses a process known as extended aeration / activated sludge and is comprised of the following components: a surge tank that manages the varying flows that a typical community system would have; an aeration process that allows for biological treatment of the waste; a clarifier to separate out solids (much the same way that the septic tank separated that which floats from that which sinks) , another filter process to further eliminate solids from the effluent (remember that word from the septic question) a disinfectant system (either through chlorination or through the use of ultra-violet lights.) While this is the filtration process of there are other parts to the plant which allow for the

periodic cleaning of the system itself. While these are very simple treatment plants to explain, they are dynamic biological systems and must be monitored daily by professionals who understand both the mechanics of the system as well as the science of the biological process.

***Does it really matter once wastewater is in the ground? How does it affect the groundwater? What is in wastewater that causes a problem?***

First, as you can tell from the first two questions, the quality of the wastewater that is put back into the ground varies. Some on-site septic systems work extremely well. Some do not. It is unfortunate that no regulatory agency requires that septic systems be monitored for effectiveness and efficiency. (But that is another issue that we can get into later!) Wastewater treatment systems on the other hand are monitored constantly. So, the wastewater that a particular system is putting back in nature or the groundwater very definitely matters. Now, let's see what is actually involved. There are four (4) components that is put back into the groundwater from wastewater, and, simply put, the less the better! Now these components are generally never completely eliminated, but the measurement of how much is there is very important.

First, there is BOD5 (5 day biological oxygen demand). This measures the bacteria in the effluent and how much oxygen these little suckers will require when introduced back in the groundwater. Ever hear about a lake or other body of water where all of the fish died from lack of oxygen in the water...the BOD of bacteria that got into that lake could well be the problem. ) TSS (total suspended solids) is a measure of the amount of solids suspended in the wastewater. Nitrogen, which can come in several forms, is the third indicator of the quality of the effluent. The final indicator is the Fecal coliform. This measures the potential for the existence of pathogens and viruses in the wastewater. The fecal coliform themselves do not constitute a hazard in and of themselves but show a probability that other harmful bacteria exist

***Why doesn't the town or county provide sewer for me? They do at my home back in Pennsylvania.***

The development of the Outer Banks historically used on-site septic systems as the most inexpensive method of development. The cost of the wastewater system was deferred from the developer back to the builder/owner who incurred the cost at the time of home construction. The early developments were primarily geared to investments in retirement or second homes so many lots were purchased with no intent of building for a long period of time. Over time this became the preferred method in an effort to indirectly control the development density. Wastewater treatment plants were viewed as a way to build very dense developments and large condominium/apartment complexes along the beach.

Disposal options for large sewer plants are difficult on the outer banks. Discharges to our sound waters are very difficult to permit and large land areas are not available for spray disposal systems.

Collection systems are expensive to operate due to the need to pump our waste. The Outer Banks lack the topography needed for large scale gravity collection systems so we would have localized gravity systems interconnected to a large scale pumping system to transport waste to the treatment facility.

The solution most favored by environmental scientists is neighborhood and community wastewater treatment systems. These systems seem to provide the best of both worlds – the advanced treatment of a plant with the localized discharge of smaller systems.

***Why do I need a maintenance contract for my septic system?***

A conventional septic system is comprised of a septic tank that discharges by gravity to a nitrification drainfield. The system has no mechanical components and although it should be inspected periodically there is not a state requirement for a certified operator. The Town of Nags Head has taken the lead on the Outer Banks by encouraging and rewarding those property owners who have their septic systems pumped and inspected regularly. (see the next question!)

***Why do I have to pump out my septic tank and what happens to it after it is pumped out?***

Your septic tank acts to settle out the solids and hold them in the tank. Anaerobic bacteria living in your septic tank use these solids as food and release hydrogen sulfides as a by product. Over time these solids build up and form a sludge layer in the bottom of your septic tank. When that layer gets to be approximately 1/3 of the tank depth it needs to be pumped out and hauled away. This sludge is generally dewatered and land applied on non-food crops such as turf grasses by a licensed company.

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