



# Pumping to Septic Tanks

*Contributed by Michael Kelley, P.E.*

**O**nsite Sewage Systems (OSS), though seemingly simple in design, are an intricate, balanced treatment system. A traditional OSS has three parts: the waste source, typically a home or building not on municipal sewer, the septic tank, and the dispersal. Due to site limitations, we sometimes use wastewater pumps which can impact the balance of the OSS. Pumping to septic tanks is never ideal but keeping a few things in mind will help mitigate issues arising later.

The workhorse of an OSS is the septic tank. This buried storage tank receives raw waste from the waste source. Bacteria naturally present in the human body go to work in the septic tank to breakdown and consume biodegradable solids. This process is slow but thorough.

Nonbiodegradable solids, as well as treatment byproducts, slowly accumulate on the bottom of the tank. Fats, oils, and greases float to the surface. This material is known respectively as sludge and scum and will remain until physically removed. What leaves the tank is a relatively clear liquid known as effluent.

Equally important in the treatment process is the dispersal method, typically the effluent is disposed into the soil; leach lines, mound systems, or drip irrigation are typical methods used for dispersal. The soil is responsible for polishing the water and cleaning it to a point that it does not harm any receiving body of water such as water tables, aquifers, wells, lakes, rivers, etc. The soil accomplishes this by physical filtration via the pores of the soil and biologically by building up microorganisms

that feed on the harmful organics within the effluent. The type of dispersal and size of the drainage field are typically driven by local codes and regulations, but in most all cases are linked to soil classification, waste strengths, and the anticipated daily flow.

Though waste strength can be quantified in many ways, the two most common measurements are 5-day biochemical oxygen demand (BOD5) and total suspended solids (TSS). BOD5 is the oxygen demand to break down the organic waste over a 5-day period measured in mg/l (parts per million) and quantifies the organic load of the waste. TSS is a measurement of inorganic solids suspended in the waste also measured in mg/l. These are measured by labs as they are too fine to be measured in the field. If the BOD5 levels become too high, the drainfield may be inadequate to treat the effluent before it enters the surrounding environment. Additionally, the microorganisms present in the soil can proliferate and cause a biomat to form. Excessive buildup of a biomat can lead to a failed field caused by plugged soils and effluent ponding on the surface. Similarly high concentrations of TSS can lead to the same failure with plugged soils and effluent

ponding. These waste strengths are directly tied to the sizing and balance of an OSS.

Due to elevation or difficult site conditions, wastewater pumps are commonly used in OSSs. However, if proper precaution is not taken, they can throw off the balance of the overall treatment process. Pumping to a septic tank is never ideal. The energy from pumped water can disturb the settlement process within the septic tank and potentially result in higher waste strengths.

Grinder pumps can be particularly troublesome as they grind all solids into a fine slurry. This slurry can create a suspension within the septic tank hindering the critical separation process of solids, fats, oils, and greases from the effluent leading to higher concentrations of BOD5 and TSS.

To further emphasize how fine the debris can be, a typical centrifugal grinder rotates at 3450 RPM with a running clearance between the cutter and plate as low as four thousandths of an inch (0.004"). This means a two-blade grinder would have over 100 cuts against the cutter plate per second. The slurry produced by a grinder can hinder the separation process and reduces solids to sizes smaller than what most effluent filters can catch. This could lead to higher strength wastes and a failed field over time.

How bad could a grinder be? There has been little research done on grinders and their effect on OSSs so it is hard to quantify. Most regulating authorities and design manuals have not taken a hard stance against grinders, some still openly allow them. However, there has been extensive studies on garbage disposals. While grinder pumps are not the

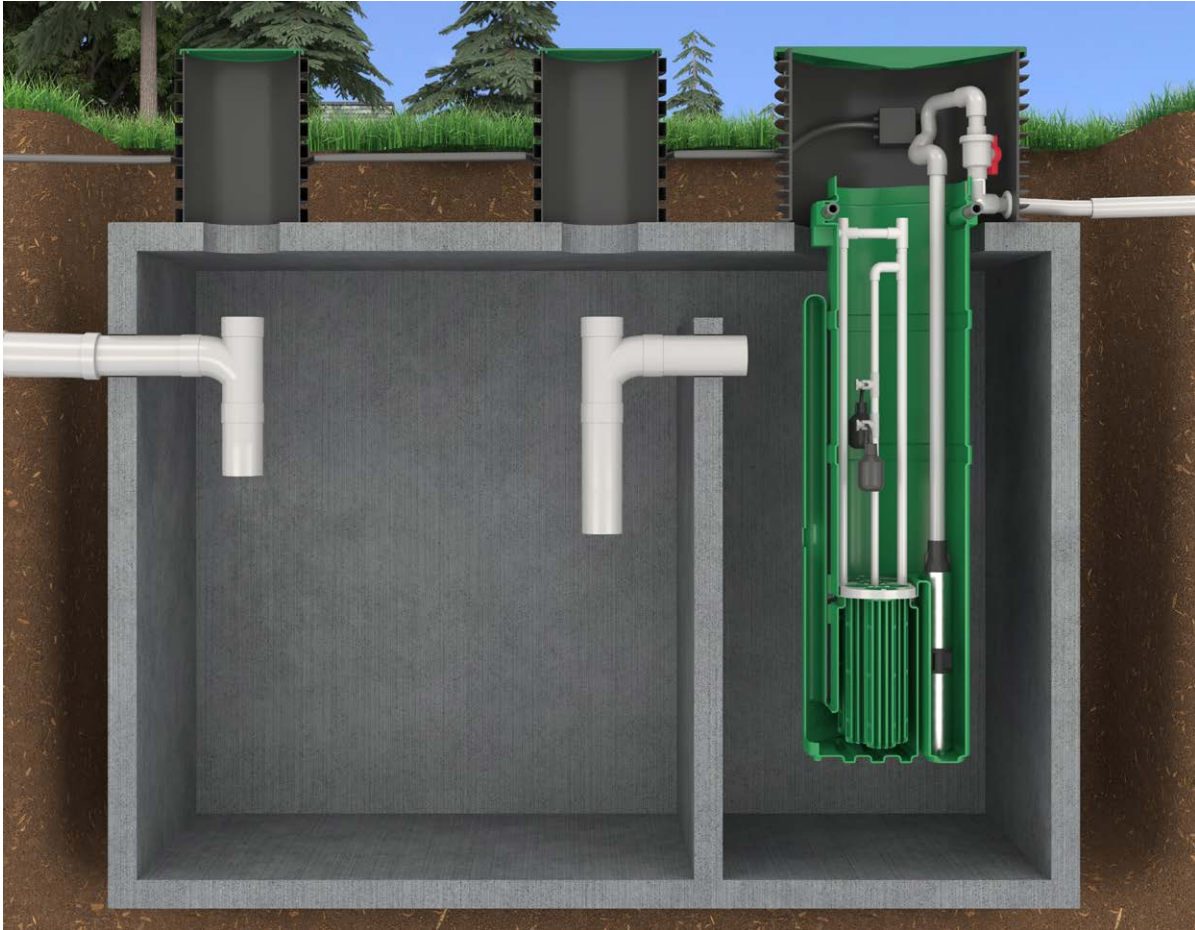
## WASTEWATER MEASUREMENTS

### » BOD5

The oxygen demand to break down the organic waste over a 5-day period measured in mg/l (parts per million) and quantifies the organic load of the waste.

### » TSS

A measurement of inorganic solids suspended in the waste also measured in mg/l.



STEP (Septic Tank Effluent Pump) vaults are a common installation method for turbine pumps, featuring a built-in filter that's easily removed for cleaning.

same as garbage disposals, they both reduce waste into fine particles. The US EPA Onsite Wastewater Treatment Systems Manual states that homes with garbage disposals can see a 20-65 percent increase in BOD, 40- 90 percent increase in TSS, and 70-150 percent increase in fats, oils, and grease. This increase in waste strength leads to additional accumulation and subsequent pump outs and increased chance of plugged soils. Since several studies have been done on garbage disposals, many

states have written additional requirements into their regulations to combat high waste strengths and the hinderance in the separation process. For homes that choose to use garbage disposals, regulations typically require larger or additional tanks, larger drain fields, or alternative designs.

So, what can you do for applications where a pump is needed? The preferred option is to move the septic tank so that it can be gravity

fed from the waste source and pump the effluent to the drainfield rather than pump the raw sewage to the septic tank. This option may require preplanning by the plumbing contractor so that the primary discharge from the building is suitable for gravity flow to a septic tank and/or require the septic tank be placed closer to the building.

For commercial systems with multiple buildings or sewage outlets, multiple smaller tanks can be used in place of one large septic tank, often referred to as a cluster system. Effluent from cluster systems can be collected via pressure sewer with septic tank effluent pump (STEP) systems and small diameter pipe. Gravity fed septic tanks eliminate the negative effects of pumping to a septic tank and there are less limitations when pumping effluent. Effluent pumps are typically less expensive, more efficient, and the removal of solids, fats, oils, and greases prior to pumping leads to more reliable operation reducing overall life cycle costs.

In some cases, gravity flow to the septic tank is not feasible. In the instance where a pump is needed to pump waste to the septic tank, the first recommended option is a solids handling pump. Solids handling pumps are designed to pass solids through the pump. Passing solids whole and intact will aid in the separation process within the tank. However, solids handling pumps can be limited in their head capacities, therefore, in some cases a grinder pump may be the more feasible option. Regardless of the pump used, the energy at which the water comes into the tank is still a design concern. To help reduce the agitation within the septic tank, it is recommended to pump up to grade ahead of the septic tank and

transition to a larger diameter gravity line that then feeds into the septic tank. Transitioning to a larger diameter gravity line will reduce the velocity of the water entering the tank mitigating the disturbance within the septic tank. Additionally, it may be wise to consider increasing the capacity of the septic tank, using baffle walls, multi-compartments, and/or using a filter with a fine filter sock. All of which will help increase the settling and reduce solids escaping the septic tank.

What about the effluent side? Some owners may have experienced a clogged effluent pump and considered replacing it with a grinder pump, but this is not recommended. The downstream, effluent side of a septic tank should not have any sizeable solids in the water. If solids are present, it is an issue with the upstream process, not the pump selection. This effluent is discharged directly to the soil, if solids are present, they will plug the soils over time. It is best to address why the solids are passing through the septic tank rather than mask the problem with a grinder pump. Common fixes would be pumping out the tank, adding or cleaning filters, increased capacity/retention, owner education, and/or baffles.

In conclusion, which pump(s) you use in your OSS can vary based on the requirements of the site. Zoeller offers best in class STEP Vaults, effluent, sewage, and grinder pumps. We have great sizing tools and resources available online to help you size your own pump. You can also reach out to one of our environmental product experts to help you understand the nuances of utilizing pumps in your design for collection, treatment, and dispersal and what considerations need to be taken. 