Separation Necessary to Protect Groundwater Quality;
Greywater vs. Septic Tank Effluent

Art Ludwig, Greywater Researcher and Educator

Jan 11th, 2010

Experience with groundwater contamination from septics does not translate to greywater.

In over 20 years of working in the greywater field, I have never heard of groundwater contamination from any of the 8 million greywater systems in the US.

It is not likely that this has ever, or will ever occur. Because, multiplied together, these factors make a greywater system several orders of magnitude groundwater-safer than a septic:

1) **greywater has on the order of 1/1000th as many pathogens as combined sewage, and a fraction of the nutrients.**

1) **Unlike a simple mechanical filter, the treatment capacity per inch of soil increases logarithmically with proximity to the surface.** The first foot of soil, has on the order of 100 times more treatment capacity than the fourth foot of soil. The first inch has thousands to hundreds of thousands of times more capacity than the 37th inch. (See reverse and below).

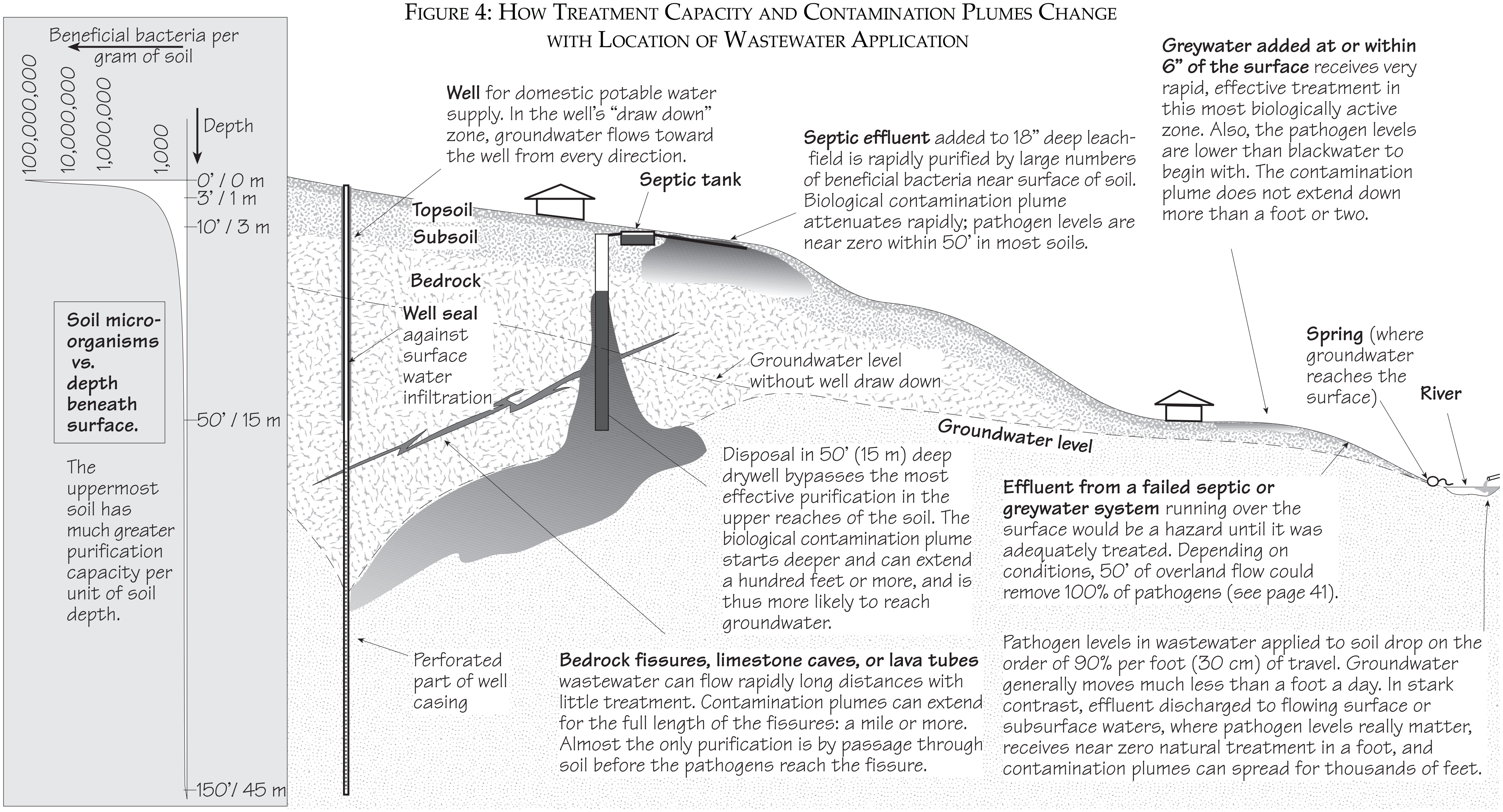
3) **greywater application is typically diffuse as compared to septic application.** Instead of all the septic effluent being added at one point in the leachfield, greywater systems typically have 4 to 30 or more outlets, and thus much less intense point loading.

1000 x 100 x 4 = approximately 400,000 times less bacteria reaching groundwater from a greywater system than a septic at the same average loading rate and separation.

This is a very rough calculation, however there is plenty of extra margin here to defend the decision to allow greywater to be applied with 3/5th or 60% of the separation.

In areas with high groundwater, the option for local jurisdictions to allow diversion of greywater to treatment higher in the soil profile is an important tool to safeguard groundwater quality.

Figure 4: How Treatment Capacity and Contamination Plumes Change with Location of Wastewater Application



Plume extents do not equal recommended separation distances. If a septic leachfield plume generally extends 50′, the separation distance should be a multiple of that to allow a safety factor. The UPC requires 100′ of separation from a well to a leachfield, for example—a 2x safety factor.

The Code is not especially rational. It only requires 150′ for a drywell, which provides little or no safety factor. The code separation from a greywater outlet to a well is 100′, about a 10x safety factor, but only 50′ from natural surface waters, about a 3x safety factor (pathogens can travel farther over the surface than through the soil).

The optimum application point is a balance between various considerations. You want to apply wastewater high to get the best treatment, safeguard groundwater, and improve reuse, but not so high that it daylights. Though excellent treatment can be attained on the surface (see Overland Flow. p. 43), wastewater may be contacted by children or animals, or run off into surface water before it is treated.

In bulk flowing water, there is almost no natural treatment other than dilution, the treatment modality considered least desirable by the World Health Organization. Contamination can spread for miles downstream. This is a major weakness of current wastewater treatment thinking in the US, which favors a pipe dumping artificially treated effluent directly into natural waters. If there is any problem — the plant runs out of chlorine, the power goes off—or for that matter, even if there is not, the waste is injected into the worst place for it in the entire water cycle. Bulk water flows have thousands of times less purification capacity than water in soil, *and* they are the point in the water cycle where it is most critical that the water be pure.

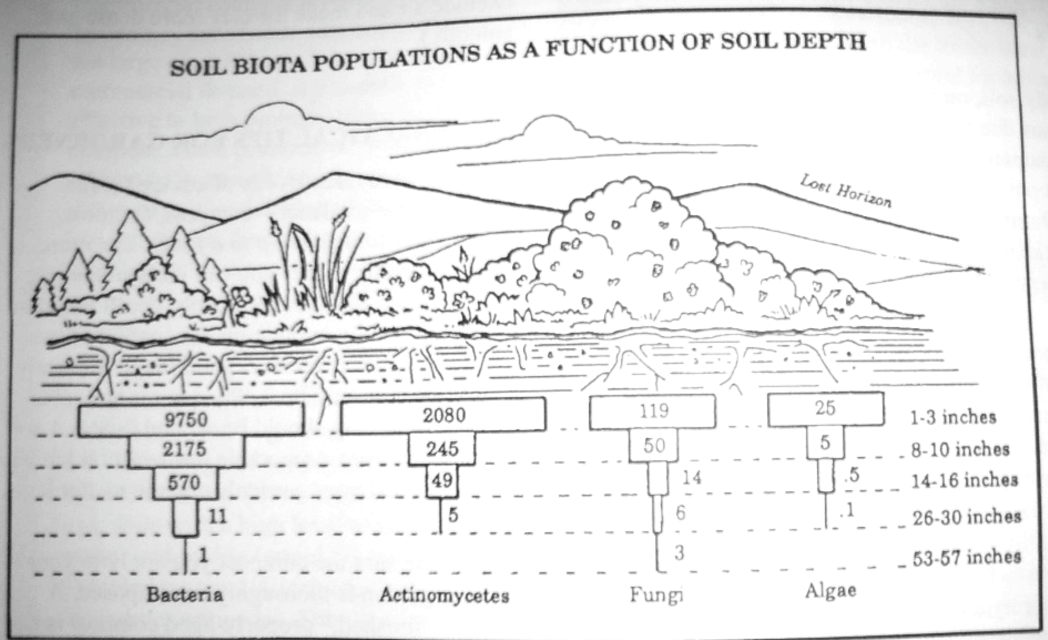


Figure #3: This illustration shows how dramatic the difference is between the surface-loving soil life and soil life just a bit deeper. Tillage disrupts this natural layering until the various "crittters" have a chance to repopulate the level of soil they prefer the most.

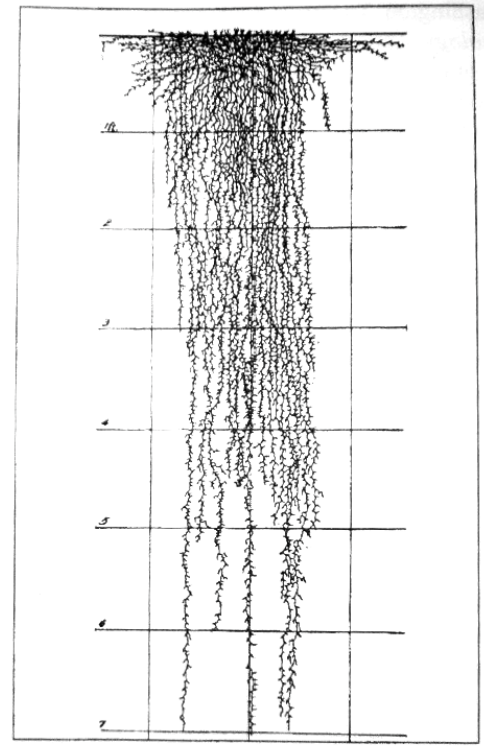


Figure #10: Buffalo grass can grow roots as deep as seven feet to utilize deep moisture. However, the most moisture and nutrients, if available, will be absorbed in the top 12 to 18 inches.

From: Relation of Hardpan to Root Penetration in the Great Plains, J. E. Weaver & John W. Crist. Ecology (July 1922) Vol. 3, No3. Page 241. Grid equals one-square foot.