Q&A for the November 23, 2010 Decentralized Wastewater Webinar

Do you really mean alternating "saturated" and unsaturated conditions for subsurface dispersal systems? Knowing what we do today about how best to achieve good soil treatment, isn't it more just alternating "wetting" and "drying cycles, to make sure that conditions remain mostly aerobic? That seems more consistent with the improved soil treatment performance we see with micro-dosing (also used for sand filters).
Yes, this is a good point. "Saturated" is not sufficiently specific (does this refer to the entire vadose zone or the soil just beneath the trench or…?). Alternating wetting and drying (or resting) is a more accurate description. Thank you for the comment.

When I dissect leach fields the gravel is covered with growth, indicating that it is treating effluent much like a single pass filter. This seems important. What is the justification for using graveless trench systems? Has the effluent quality been compared?
The justification, as I understand it, relates more to the storage capacity in the trench (a chamber has more overall storage per unit length than a typical gravel trench) and the infiltrative surface (which depends on the specific dimensions of the trench or architecture of the gravel-less system). I agree that the stone in a conventional trench will act like a trickling filter, further conditioning the effluent prior to filtration through the much finer-pored soil matrix. This issue has popped up regularly over the past 50 years, but it appears that the potential effluent quality improvement through the gravel is inconsequential to overall system performance.

I think Colorado School of Mines has done some work looking at the effect of various dispersal system architectures. You could start by exploring the following report for more information and perhaps by contacting the authors with your question:
http://www.ndwrcdp.org/research_project_DEC1R06.asp

What is a good dosing frequency?
Recirculating filters may be dosed as frequently as every hour or half-hour. When recirculating effluent, there will always be some fraction of the effluent available to dose to the filter. With a soil absorption system (or an intermittent/single-pass filter, for that matter), the effluent is dosed only once and not recirculated. Therefore, you have less flexibility with regards to dosing. Additionally, you are limited by several other requirements. For example, in a low pressure distribution system, you need to first pressurize the laterals (which requires a certain amount of effluent), then we want to make sure that the vast majority of the dose is applied under pressure (>80%). When you work through the design, you may find that you only may have enough effluent available for 4 or so doses per day. In that case, you'd be initiating a dose every six hours.

Please define waterproofing and recommend water proofing products
The most important factors are good tank design (e.g., top-seam vs. mid-seam concrete tanks or high-quality fiberglass or plastic tanks), and sound construction practices.

However, even a mid-seam concrete tank can be easily made waterproof, provided that the joints are formed properly. Seams of precast concrete tanks are sealed by placing a 1-in. diameter bead of a pliable rubber mastic sealant (specifically manufactured for this purpose) on the bottom joint, and then setting the top half of the tank on top of it. If the halves are properly aligned, the weight of the top half will squeeze out the mastic such that it fills the joint completely (often some mastic will squeeze out from the joint to the outside of the tank, indicating a tight fit). After the mastic has been applied, the seam should be plastered over either with another specially made rubber mastic "band" or a hydraulic cement. The same process can be used to seal the riser to the top of the tank.

In addition to these seams, pipe penetrations are critical for watertightness – these should be made using a resilient flexible rubber boot that meets ASTM Standard C-923.

Would a grease trap that is 2-compartment suffice for a 2-compartment septic tank if it is 1500 gal.?
It depends on the design characteristics of the grease trap in question. Grease traps usually have inlet pipes, baffle wall openings, and outlets that extend much deeper into the liquid depth than recommended for septic tanks, to allow for greater floatables storage. If this is the case for your situation, then I would not use the grease trap as a septic tank unless you can retrofit the tank as appropriate. Grease trap compartment openings and outlets usually extend at least 50% down into the liquid, while for septic tanks, these extension depths are usually closer to 25 to 40%, to allow more room for storing settled sludge.

More of a comment than question: Regarding flow modulation, my observation has been that flow out of septic tanks is really just a delayed event relative to inflow, and that actual flow equalization, or true modulation is often overstated. Realistic assessments of that are important to our assumptions relative to loading to downstream treatment units, and needs for actual equalization through timed dosed, or however that might provided.
I totally agree. We shouldn't think of the septic tank as providing flow equalization (it does not). There will be some modulation of flow, but the peaks will track the influent flow characteristics as you've observed.

Can you explain how a septic tank provides flow modulation? Of course it provides retention and settling and fermentation, but with the liquid levels as they are, I do not understand how it would provide modulation during periods of peak flow or intermittent flow. Would this function not be achieved by a balancing tank?
See the response to the above question. There will be some modulation of peaks, but not to an extent that would impact design. The comment during the presentation was meant to be more of an incidental observation than a description of a feature that would affect the design of the treatment system. Designers should be aware that tanks with larger surface areas will provide better settling efficacy while modulating flow to a greater extent than those with smaller surface areas.

What are some estimates of how long LPDS can last without cleaning out pressurized pipes, e.g. because there is no maintenance access such as the threaded plug as shown in slide 47?
It will be very dependent on the characteristics of the specific system in question, including wastewater strength, septic tank performance, and LPP design details. However, I can't remember ever flushing out LPP lines and not having significant amounts of solids come out, so they will build up quickly.

There are two issues to be concerned about – first, if the laterals are clogging then they are not performing the function they were intended to (even distribution across an area) – accordingly, this lack of performance may be causing harm to the soil absorption system; second, they can be pushed to the point that a more intensive rehabilitation or even replacement is necessary.

My strong recommendation would be to bite the bullet and dig up the ends of the lines and fit them with cleanouts.

Do you believe equal distribution is important or can step designs with planned partial failure along the distribution system be just as or more effective?
I believe that equal distribution is important and preferable to sequential failure. However, I come at things from an engineering perspective (rather than say, a soils perspective) and think of the soil absorption system as a big biological filter; accordingly, the most uniform dosing will provide the greatest contact time with the soil, and thus provide the best soil treatment. I do know that serial systems are used for large applications with good success in some states, so I will keep an open mind about it! Note also that soil absorption systems with alternating drainfields actually function as a sort of "planned partial failure" system, making use of the restorative effects of biomat drying during the 6 to 12 month "resting" cycle.

In your discussion of setbacks, you referenced what looked like a universal plumbing code requirement for a WS-1 stream. This looked like a special setback for an impaired waterway. Can you provide the reference or a description of a WS-1 stream for our use in siting systems near 303(d) listed waterbodies.
That table was actually pulled from North Carolina's state regulations for decentralized systems (http://www.deh.enr.state.nc.us/osww_new/new1//images/Rules/1900RulesAugust2007.pdf; see 15A NCAC 18A .1950). A WS-1 water body is a primary water supply water – in other words, the highest designation for a water supply source; thus, the relatively strict setback of 200 ft. These are actually very high quality, rather than impaired, waters.

I have read that compartments should not be of equal size because of oscillations back and forth. Any truth to that?
I've read the same thing. Indeed, most septic tank designs do use compartments of unequal size. The first compartment is usually larger, 66-75% of the total tank capacity. For more information on the factors that influence tank performance, you can reference:
http://www.ndwrcdp.org/research_project_04-DEC-7.asp

Drip irrigation in frozen ground? We typically have 6' frost depth in northern WI.
This has been studied in northern Wisconsin and Minnesota. It was found that 6 to 12 inches of good quality cover (eg, mulch) has generally minimized freezing problems. Of course, long periods of non-use during extremely cold weather without snow cover may still be a problem. The tubes are flexible plastic, have holes every 2 ft or so, and with a good design they should drain after each pressurized dose of (somewhat warm) effluent.

For additional information, you may want to consult with the University of Wisconsin (which has a renowned program in decentralized wastewater management), a local supplier of drip systems, or an engineer in the area. Feel free to contact me off-line for a referral.

This is a question about the webinar series. A lot of time is being spent on discussion about how septic systems work, often with a focus on an individual system. I am interested in more discussion about decentralized systems which aggregate serveral users. What are the advantages/disadvantages of these types of systems, design considerations and management considerations?
Stay tuned for the next 2-3 webinars!

Also, please refer to this excellent reference document about cluster system planning and design: http://www.ndwrcdp.org/research_project_WU-HT-01-45.asp

Another good reference about the performance of relatively large decentralized systems can be found here: http://www.ndwrcdp.org/research_project_04-DEC-9.asp

Are these systems suitable for sites with <3 ft of soil over bedrock? Are there other systems (post septic tank) that would be better fits?
Drip systems or spray systems are generally best for situations where you have shallow soil depths, because they can be easily used at-grade or at shallow burial depths. However various mounded systems and at-grade trench systems have been used effectively for shallow soils as well.

Where you have shallow bedrock, you need to also make sure that you have enough soil depth to be able to move the dispersed effluent away from the soil absorption area without surfacing or interfering with the aerobic soil treatment zone. Tune in to next week's webinar for information on how to determine the conveyance capacity of a site.

What is HRT, and how is it calculated?
HRT stands for "hydraulic retention time" and describes the amount of time water stays in a reactor (tank). The theoretical (design) HRT is a simple calculation: reactor volume / flow rate (check your units!). Actual HRT can be estimated by analyzing the results of field tracer tests. Actual HRT is always lower than the design HRT. Ensuring good flow characteristics through the tank will reduce short-circuiting, which will cause your actual HRT to approach design (this is the goal!).

How effective are low pressure systems in Northern WI? Would frost be a concern?
See the comment above regarding drip irrigation systems in northern WI. I can refer you to local contacts who may be able to provide more detailed information. Feel free to contact me off-line for a referral.

So for your LPP example problem the holes would be spaced over 20 ft apart. Do you think there may be dry areas between those holes? SSPMA suggests holes be spaced no further than 7 ft apart.
Actually, the maximum hole spacing in the design example (as shown in the table) for line 4 was 8.5 feet, not 20 feet (let me know if there is a mistake in my calculation, but I think this is right). Note also, that in this example, the effluent was being dosed to the interior of a perforated pipe, with holes spaced much closer together ($\leq$ 1 ft). Your point is well taken, though, that there is a limit to how far apart holes on an LPP lateral should be spaced, and that even 8.5 feet may exceed recommendations, like those you reference from SSPMA.

Another design guide (the one I used, which is available here: http://www.deh.enr.state.nc.us/osww_new/new1//images/Marinshaw_paper.pdf) suggests that maximum hole spacing is a function of the soil type. Coarser soils (e.g., sands) should have closer hole spacing, because the effluent is expected to quickly infiltrate into the soil matrix after application. For tighter soils (e.g., clays), a larger spacing is allowed, because the effluent, after it is applied, is likely to spread out along the trench until it can infiltrate into the soil matrix. This particular design guide suggests a maximum spacing of 5 feet for sands and 10 feet for clay soils. Good question though and thanks for asking it so that everyone can be aware of those design considerations!

What is LTAR?
LTAR stands for "long-term application rate". It is the system design flow divided by the soil absorption system area, and is usually expressed in units of gpd/sf. The soil absorption system area may be the entire "footprint" of the system, the trench bottom area, or the trench interface area (the area of the trench bottom plus the sidewalls) – this basis must be specified by the regulatory agency, soil scientist, and/or designer. The "long-term" designation is there to distinguish this number from a more instantaneous application rate (e.g., the pumping/dosing rate divided by the soil absorption system area). LTAR is one criteria that may be used to calculate the required size of a soil absorption area.

Can pressure dosed laterals have distribution holes facing up or down, is there an advantage to either way?
Most suggestions are to place the holes facing up (or offset from center) to prevent them from being blocked by the perforated pipe sleeve or orifice shield (see diagram in slide presentation). It is also usually recommended to include one or two holes facing down to ensure that the laterals drain completely between doses.