Effective Land Use Planning
How to Avoid the "Zoned by Septic" Trap

Anish Jantrania & Craig Goodwin

Growth management and land use planning policy at the local level are today heavily driven by the decision whether or not to extend public water and sewer service. Schools, transportation and other community services are certainly critical ingredients to zoning policy, but water and sewer infrastructure often serves as the blunt instrument of policy implementation. If you are in an area served by public water and sewer, the path is reasonably clear – growth will occur largely in designated areas as the market dictates, though not always as our policy makers would like.. If you are in an area not served by public water and/or sewer, what the future holds is far less clear. You are now in the hands of both the market and the local Health Department.

For example, current zoning ordinances in most counties provide for a "rural" or "rural preservation" designation in areas not to be served by public water and/or sewer infrastructure. In most cases these rural designations do allow for some residential development typically in the 1 home to 1 acre or 1 home to 2 acre plus density range. Development in these areas is now driven not just by the market but also by whether or not you can get a permit through the Health Department. The result is that unwittingly, our Health Departments have now become the enforcers of zoning policy by default and the result is often random patterns of development and sprawl due to large lot sizes and "perc" regulations.

Those opposing growth hide behind these "perc" regulations and hope that development in these areas can be denied because Health Department regulations will not allow it. This can be a "Taking" of land without having to pay for someone's property. There are plenty of tools available for preserving land in the public interest such as Transfer Development Rights and Conservation Easements without hidden Takings. If there were a scientific or sound technical reason for this result, one might have more empathy for having to live with the "luck of the draw". But the reality is rather different. Health Department regulations are a vestige of a time long past – it's septic after all and designed to be temporary and to fail.

Wastewater treatment and dispersal technology have advanced considerably from the cesspools of the past. And while we agree that applying advanced treatment and dispersal technology to individual home onsite systems is <u>not</u> currently a long term sustainable solution, Clustered decentralized water and sewer infrastructure have become both affordable and very sustainable.

To see how anachronistic current Health Department regulations are in today's environment for clustered community sewer systems, let's evaluate current Health Department Conventional Wisdom ("CW").

1. ***CW***: Two to five feet of separation from the seasonal high water table in drainfields is required for the soil to protect us from groundwater contamination and from health risks caused by pathogens, fecal Coliform, E-Coli, etc.
   Reality**:** Direct groundwater discharge is both feasible and in many cases preferable. Wastewater can be reliably treated to meet advanced Wastewater Reclamation and Reuse standards suitable for human contact (though not potable). So these historical "septic" regulations truly do not apply to wastewater treatment and dispersal systems appropriately designed and professionally managed. Membrane BioReactor treatment technology is now both proven and sustainable for decentralized Clustered community sewer systems.

2. ***CW*****:** Discharge into unsaturated soil is a must.
   Reality: This is clearly not necessary if we remove the Coliform and sufficient other biological constituents prior to discharge to the soil. Saturated soil actually has a significantly higher hydrogeologic conductivity than does unsaturated soil. So if we want to maximize site hydrogeologic capacity, we should discharge into saturated soils.

3. ***CW*****:** Always discharge to the shallowest elevation possible to maximize oxygen transfer capability and soil treatment capacity.
   Reality**:** Deeper discharge of highly treated aerobic effluent is often preferable and offers better protection from the possibility of surfacing.

4. ***CW:*** Clay and other "tight" soils are bad and unsuitable for discharge.
   Reality: Soil physics actually demonstrate that even shrink swell saturated clay soils have a reasonable capacity to move water given sufficient gradient. These values can be calculated and dispersal fields designed and installed to function in these soils[1].

Virtually all land that is not solid rock, therefore, has an inherent hydraulic capacity to accept treated wastewater. Rather than rely on perc tests and our Health Departments to be the instruments of zoning enforcement, it is both feasible and advisable to assign predetermined wastewater dispersal capacities directly to the LAND. Zoning and land use decisions can then be much more deliberative with conscious decisions made by our elected representatives, avoiding the backdoor "Zoned by Septic" trap.

The purpose of this paper is to outline a planning tool that counties can use for effective land use planning and also for comprehensive water and sewer capacity planning.

[1] A demonstration project in Westmorland County Virginia designed by Anish Jantrania, formerly with the Virginia Department of Health, is currently operating in shrink swell clay soils at an application rate exceeding 0.3 gpd/sf of total drainfield area.

To illustrate, let's focus on current planning requirements in Maryland[2]. Periodically, typically every two to three years, each county in the state must update and submit for approval by the Maryland Department of the Environment (MDE) a comprehensive Water and Sewer Capacity Plan. In this plan, areas to be served by municipal sewer and/or water are identified, with those areas not to be served in the near future or distant future are also identified. Any specific development or facilities to be served by a sewer system exceeding 5,000 gallons per day must also be specifically listed in the plan, whether classified as a "multi-use" or "shared" facility.

Within this capacity planning framework and specified zoning density limits, what then happens is truly a random event. In those areas not served by municipal sewer, whatever development may occur is left totally to the whim of the state and/or local regulations for septic system designs. Typically, these regulations outline soil and site constrains for locating and sizing a drain field necessary for dispersing partially treated wastewater (also known as 'effluent') from an onsite wastewater treatment system such as a septic tank or an aerobic treatment unit. The horizontal set backs necessary from the edges of the drain field to various topographical features such as wells, surface water bodies, property lines, etc., along with the size of the drain field and the size of structure served by the drain field would determine the total lot size necessary for the project. Thus, for the lots with an approved site for a drain field, the size of drain field and horizontal set back basically determine the "sewer capacity" expressed as gallons per day flow allocated to the lot for wastewater system. The lots without an approved site for a drain field obviously are assigned sewer capacity of ZERO and are thus declared as not suitable for development or typically called no-perk lots.

The current regulatory model for sewer capacity allocation can be called DFD (Drain Field Design) concept. Since the soil and site characteristics are the primary basis for capacity allocation by DFD concept, these areas are truly "zoned by septic" and the resulting development patterns may not at all be what the county truly wants. It also leaves major uncertainty as to the level of other county services that will be required, including schools and other county infrastructure, and questions the sustainability of the wastewater infrastructure, typically unmanaged individual home onsite systems.

Ironically, zoned by septic development patterns also can perversely contribute to segregation of the haves and have-nots. Under served and poorer communities are more often than not located in areas with poorer soils that don't meet the required perc rates or separation to seasonal water tables or other soil/site requirements – thus limiting development potential on large tracks land that may have access to water and have location adequate for growth. Though the area from a land use planning standpoint is one that the county would like to encourage some additional residential and commercial development to better serve basic community needs, extending central sewer is not economically feasible and thus we are left being "zoned by septic." The Nanjamoy area in southern Charles County, MD serves as a good example of this phenomenon.

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[2] Although the specifics of Maryland county land use planning and sewer capacity planning processes vary from those of other states, there appear to be enough similarities to those processes in other states to illustrate what might be learned from a new capacity planning tool.

As an alternative to this conundrum, we offer the FAI (Flow Area Index) sewer capacity allocation model as an alternative planning tool for the counties. The FAI concept is developed based on the following assumptions:

- Access to land is far easier than access to surface water for effluent discharge;
- Land offers a great alternative to surface water for assimilating wastewater;
- Every track of land has capacity to assimilate waste load, both hydraulic load and pollutant load, when effluent is discharged on top of or under the ground surface;
- The larger the track of land of land, the greater the capacity for assimilating waste load, and visa-versa;
- It is possible and essential to establish land assimilative capacity by rule based on three parameters – land area, effluent quality, and management program.

The FAI sewer capacity allocation model assigns capacity to all land area within a political jurisdiction based on the following three concepts:

- Commonsense rule – lesser the treatment of wastewater before discharge and weaker the management level means lesser the capacity allocated to the land, and visa-versa;
- Environmental issue – mass load and concentration of all regulated parameters must be within the established limits at the compliance boundary established in the permits;
- Economical issue – permanent management of sewer infrastructure must be affordable based on the densities allowed by allocated capacities and required technologies.

The main differences between the two regulatory models (DFD and FAI) for sewer capacity allocation are as following:

- DFD model uses soil and site characteristics for estimating a site's capacity, while FAI model uses land area for estimating a site's capacity;
- DFD model does not allow land owners or land developers to quickly and cheaply determine what sewer capacity will the rules allow for the site considered for development, while the FAI model does;
- DFD model does not allow counties/localities to quickly and cheaply determine the total sewer capacity within their jurisdiction, while the FAI model allows the counties to do so, thus allowing for better overall planning of all other infrastructures such as roads, school, and emergency services for area where growth is desired;
- DFD model does not allow the designers to prepare optimum design for decentralized wastewater treatment and effluent dispersal system while taking full advantages of the benefits that the site offers and accounting for all the challenges/limitations the site has, the FAI model allows the designers to do so, thus offering the land owners/developers most cost-effective design of sewer systems for the development planned on their land;

- DFD model is perceived by citizens as inefficient (taking more time for getting a permit), ineffective (costing lot of money on paper work design and review) and inequitable (how come my neighbor got a permit for a four bedroom home on his/her acre property when I did not); FAI model once implemented properly will be perceived by the citizens as efficient, effective, and equitable.
- DFD model does not allow Responsible Management Entities to offer affordable and competitive sewer rates for their customer, while the FAI model allows Responsible Management Entities to do so, thus making decentralized solutions viable on a permanent basis in areas where centralized solutions are not desired and/or are not affordable.
- DFD model focuses more on loading rates for sizing individual drain fields than on cumulative impact on environment from operation of multiple drain fields, while FAI model focuses more on loading rates for determining project area and on cumulative impact on environment from operation of multiple drain fields than on drain field sizing rate for individual project area.
- DFD model does not allow system designers to take full advantage of the total land area available for wastewater management, thus does not allow for "optimum" system design, while FAI gives freedom to the designers for preparing optimum design to meet the wastewater management need as it arises. Good example would be the case where land developer wants to develop a large track of land (say 100 acres), but does not need the full scale wastewater system from the day one. A management entity, like NCS, once get the sewer capacity allocation for the project area, can develop optimum sewer solutions for the developer to meet the need for wastewater management as it occurs.
- DFD model has served its purpose in the 20th century for permitting use of land based effluent dispersal systems, the FAI model is needed for permitting those systems in the 21st century to serve justice to our knowledge and understanding of using land effectively for waste assimilation with the available technologies and permanent management infrastructure.

Sewer capacity for a tract of land can be expressed in terms of amount of sewer (units of flow GPD or MGD) that can be disposed off (or recycled, reused, reclaimed) within the project area during specified time period. Typically, the loading rates for drain field design are reported as gallons per day per square foot. We propose that the FAI be reported as inches per year (inches/year) and once the amount of project area, i.e., the tract size is known, the sewer capacity for the tract of land can be determined using the following formula:

$$\text{GPD} = (\text{inches/year}) * \text{Acres} \div 0.01344$$

(Round up the result to the nearest 5 GPD value)

We propose the following matrix approach for sewer capacity allocation (inches/year) using FAI model:

	Management Model Proposed		
Treatmetn Levels	A	B	C
TS1 (Septic Tank)	**1.0**	**2.0**	**2.5**
TS2 (Secondary)	**2.0**	**4.0**	**5.0**
TS3 (Secondary + Disinfection)	**2.5**	**5.0**	**6.0**
TS4 (TS3 + Nutrient Reduction)	**3.0**	**6.0**	**>6.0**

Where: Management Model A = systems managed by the system owner like homeowner;
Management Model B = systems managed by non-government utility like NCS;
Management Model C = systems managed by government utility.

So, what does this means? When the state and local regulatory agencies adopt the FAI model for capacity allocation and have a matrix with the capacity numbers (inches/year) similar to what we are proposing (or something less or more than what we are proposing), the land owners or the land developers could easily and quickly determine what type of treatment and management they will need to meet the demand for sewer they will have from the development they are planning for! For example, a landowner with 100 acre tract could have an assigned capacity of as little as 14,885 GPD for septic tank effluent to as high as 44,645 GPD for the highest level of treatment before discharge.

With these types of capacity allocation given to management companies, they can then prepare detail designs for wastewater treatment and effluent dispersal systems for the land developers. If the demand for sewer is greater than the maximum allocated for the non-government utility then the land developer can either consider acquiring more land, or consider reusing treated effluent for toilet flushing, or involve the local government utility. In any case, the FAI model offers a great tool for landowners to evaluate options for development without having to worry about sewer capacity issues. The FAI model also offers a great tool for planning and zoning staff to determine sewer capacity available within their jurisdiction for each parcel of land, thus allowing for better planning with the sewer issues factored in from the beginning rather than having to speculate on the sewer capacity values.

What do you think of this approach? We at NCS are quite confident about our abilities for designing, building, and managing sewer systems on a permanent basis within the capacity we are proposing in the FAI matrix. Do you think the capacity numbers are appropriate? If not, what would you propose? More importantly, do you think it is unreal for us in the wastewater industry to assume that we are not ready for the FAI capacity allocation approach because someone among us will abuse this approach and will make all of us look unprofessional? We hope that is not the case! It is time for all of us to rethink the conventional DFD model for capacity allocation and replace it with something more efficient, effective, and equitable model like FAI so that our customers (land owners) can confidently rely on our abilities to meet their demand for sewers. Feel free to offer your suggestions/comments on this concept and as always contact us anytime you have a need for water and sewer infrastructure for existing communities or new development. We can bring to you sustainable water and infrastructure that meets your demand at an affordable long-term cost.

Anish Jantrania, PhD., P.E., is a Senior Project Manager and Technical Director, NCS Wastewater Solutions, Richmond Virginia. For more information on Decentralized Sewer Systems, contact Anish at:
anish@nwcascade.com
www.ncswastewater.com

Craig Goodwin is General Manager, NCS Wastewater Solutions, Puyallup, Washington.
Contact Craig at:

craig@nwcascade.com
www.ncswastewater.com