| By Dennis F. Hallahan, P.E.

Meeting Environmental and Financial Concerns

Onsite sewage collection, treatment, and management offer developers and design professionals with wastewater options.

The increasing popularity nationwide of cluster or community onsite septic systems is good news for sustainable development. It presents opportunities to provide better environmentally sound solutions for wastewater.

Generally, these community septic systems serve multiple residential dwellings or commercial establishments and often use technologically advanced collection and treatment systems, monitoring capability, and engineered infiltration chambers to provide a higher level of treatment. By definition and goal, these systems treat wastewater and return it to the ground in close proximity to where the wastewater was generated as opposed to transporting it long distances to a centralized sewer facility.

This national trend is a result of the high cost of centralized sewers and lack of availability of quality land. Therefore, it is forcing developers and builders to consider developing sites that may have previously been deemed unusable. These sites, often featuring difficult soils and tough terrain, requiring new onsite wastewater strategies and alternative methods of treatment, are often the only way to make these sites work and to get them approved.

In addition to these challenges, the need to satisfy ever-stricter environmental regulations is a major factor in their popularity with local health officials. The same scenario also applies to large recreational and commercial developments in environmentally sensitive areas where a combination of technologies must also be considered.

The Typical System

Community/cluster system designs are anything but typical due to differing regulations and site constraints. But a typical cluster system may feature a septic tank at each dwelling or shared by several homes or facilities. Here the wastewater exiting the building is collected and treatment begins. Effluent is then either collected or transported to a treatment system within the development for further treatment if required. The collection is usually accomplished via a small diameter sewer or a septic tank effluent pump (STEP) system to a central chamber drainfield. Here, further treatment occurs from the soil.

Cluster systems may reduce each lot's required footprint area as compared to individual septic tanks and leachfields. This allows builders and developers to cluster the homes together and minimize infrastructure costs from road and utilities. It also allows the developer to plan for a phased-in construction of the wastewater management system. While collection lines must be installed upfront, the onsite components are fixtures that are only necessary when each home is constructed. Additions to the cluster treatment system can be phased in as homes and/or units are sold.

In many communities, where centralized wastewater treatment facilities are overburdened and the addition of new sewer lines is prohibited, or where individual septic systems are frowned upon, cluster systems are being recommended to developers by local health departments and planning agencies. These officials recognize the need to advocate advanced wastewater treatment systems of a scale that will support and require professional management. Professional management provides more control on the quality of the waste treatment process. If competent management is available, some utilities are even favoring this approach as the most cost effective long-term solution.

Crew members work to excavate the trenches and install the leaching chambers in one of the discharge facility's many zones.


CATERPILLAR

A pressurized Infiltrator leaching chamber disposal field is constructed in a raised bed of sandy fill for the Brudenell Chalets. Each dispersal field zone has four lines that are 150 feet long.

The Solution for Environmental Challenges

Environmental issues are often the catalyst for consideration of a community system. This was the case recently when the rapidly growing Four Corners community near Bozeman (MT) needed a new discharge facility to expand sewage treatment capacity. The community, which is very close to the Gallatin River, is extremely environmentally conscious.

When the original parties involved with the Water Sewer District faltered, Utility Solutions LLC was created to take over the project and development. Many of the current homeowners were deeply concerned about sewage contamination within their existing wells and the health of the nearby river. They were convinced that the Sewage Treatment Plant would discharge sewage and contaminate their drinking water and other areas.

With that controversial climate in place, the reality was that development in this area would go beyond the existing infrastructure very quickly and something needed to be done. To accommodate existing and future planned development, Utility Solutions – Four Corners Water and Sewer District designed a small-scale sewage treatment facility to serve the Four Corners community.

Approved by the State of Montana Department of Environmental Quality under their subdivision approval process, the discharge facility utilizes 2700 Quick 4 High Capacity chambers from Infiltrator Systems Inc and will ultimately include 31 zones. At this time only 12 zones are completed.

Originally, gravel was considered for the discharge area, but due to cost and storage volume, Infiltrator chambers were ultimately chosen. Currently equipped for up to 250,000 gpd, when the project is complete (by 2010) it will be equipped to serve 2000 homes and handle flows of 1.5 million gpd.

Remote and Recreational Settings

Integrating a cluster system into a recreational setting is an ongoing challenge for designers of resorts, camps, and outdoor facilities in environmentally sensitive areas, where system management concerns can also be an issue.

One example is the Brudenell Fairway Chalets, a fully winterized, four-star, cottage rental development located in Roseneath, Prince Edward Island (Canada) comprised of 14 country-style chalets situated on a six-acre property across from two world-class golf courses. The resort development needed a sewage system design that could be installed with minimum site disruption and respond effectively to the higher flows produced by the increasing levels of tourist traffic in the summer months. Low maintenance was one major criterion, since the owners, Marwood Properties, did not want to risk disturbing vacationing guests for maintenance and repairs.

Another key consideration was to find a system design that would be cost efficient to install in a phased plan allowing for future expansion. In this scenario, it was desirable to defer capital costs by phasing sewage treatment and effluent dispersal system capacity until it was actually needed. With a pool, playground, and other recreational amenities planned for the open land on the site, the size of the overall system became another factor in the design and the selection of the component technologies.

The Fairway Chalets wastewater collection and treatment system was designed so that at full build-out, septic tank effluent from 22 chalets and a laundry/office facility could discharge to a four-inch (100 mm) effluent sewer located along the front of the buildings. Because of the system components selected, the horizontal alignment of the effluent sewer main did not need to be straight. This allowed changes in direction and routing around the natural contours, trees, and environmental features that were important to the overall beauty of the site. Other advantages of this system included ease of installation, reduced excavation costs, shallow burial depth, reduced overall gradient, and reduced infiltration and inflow (I & I) when compared to conventional gravity sewers.

Monitoring and Management

Cluster systems can provide the advantage of home construction in an area that may not be able to support lot-by-lot soil absorption systems, but these systems do require a much higher level of management. At this time, many local governments are not equipped to manage these systems and are looking for management companies that can insure that the proper ongoing maintenance practices are followed.

If a cluster system is installed, it may be managed by the homeowners association, school board if installed at a school site, or, where available, by a local septic management company. An effective form of management is a contract with an independent wastewater professional.

In the future, many communities will require this level of management offering tremendous opportunities for growth to those septic industry professionals willing to expand their knowledge and their business. Contracted management is good news for the homeowner, the environment, and the industry.

This issue of proper management of onsite wastewater systems was the greatest need identified in the Environmental Protection Agency's (EPA) Report to Congress. EPA's recent guidance is to develop management support through local government.

At The Fairway Chalets, the system was designed with several features to facilitate monitoring and maintenance. The pump control panel tracks pump run time and starts. It can detect high and low effluent

levels and pump failure. A valve monitor also confirms correct sequencing and can provide early warning of unequal distribution among disposal field zones.

The leaching chamber trenches have been fitted with maintenance ports for periodic flushing of the pressure distribution laterals and to check the residual pressure at the end of the laterals. If the residual pressure is observed to increase significantly it is an indication that the laterals need to be flushed or cleaned. The Chalet's maintenance foreman or the installing contractor can easily carry out most routine maintenance. The owner reports that the system has been reliable and economical to operate and maintain.

(Above) Elk Grove subdivision is part of the rapidly growing Four Corners community in Bozeman, MT.

(Below) A typical discharge field at the Four Corners community.

Reducing Development Costs in Remote Areas

In remote areas that may also have poor soils, cluster systems are being installed in conjunction with advanced treatment systems. These systems extend the ability of the soil to absorb effluent, ensuring the safe return of the effluent into the soil environment. Because of their level of performance and their reduced impact on the soil, chambers are often the technology of choice in cluster system pretreatment and leachfield designs.

The economies of scale of today's cluster systems combined with the low cost of small diameter sewers brings the cost per unit of the more advanced cluster systems below that of regionalized sewer and very close to that of a common septic system in many cases. This is especially true with the new breed of installation and engineering (design-build) companies arriving on the scene that can "package systems." By standardizing components they can offer a turnkey solution to provide the best possible treatment for that given site.

Conclusion

Cluster systems offer many benefits to the builder, homeowner, regulatory agency and most importantly the environment and are therefore here to stay. When given a true review at the project feasibility stage they can result as the most cost effective option for wastewater service. Due to the simplicity and robust treatment offered by a septic tank, they will continue to be a core unit in these systems. Cluster systems enjoy the economies of scale, and therefore reap the cost benefits. This cluster-system trend will also be a catalyst for the wastewater industry to develop quality low-cost collection systems and other technologies that can be applied in these community systems. **LDT**

About the author: *Dennis F. Hallahan has over 16 years of experience with on-site wastewater treatment systems design and construction. He has authored several articles for industry magazines and has given numerous presentations nationally on the science and fundamentals of on-site wastewater treatment systems.*

Dennis is currently Technical Director at Infiltrator Systems, where is responsible for government relations and technology transfer between Infiltrator Systems and the regulatory and design communities. Dennis also oversees a staff that is responsible for product research and testing for both universities and private consultants.

He received his master of science degree in civil engineering from the University of Connecticut and his bachelor of science degree in civil engineering from the University of Vermont. Dennis is a registered professional engineer in Colorado and Connecticut and also holds patents for on-site wastewater products.

Dennis can be reached at 800-221-4436 or dhallahan@infiltratorsystems.net