Onsite options

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Water conservation and wastewater treatment technologies are keys to sustainable development.

In the United States, buildings use one-third of our total energy, two-thirds of our electricity, and one-eighth of our water. Given the impact buildings and development have on the environment and the growing demand from consumers, sustainable practices including green infrastructure are needed to ensure that builders and developers have the tools they need to create environmentally sound and economically viable projects.

Extensive research into the building industry shows that ecologically based building practices and green development can lead to a number of benefits, including preservation of natural habitats, fostering of stronger communities through cluster development, less dependence on the automobile, and lower infrastructure costs for roads, water, and wastewater. As the green movement continues to gain momentum in commercial and residential projects, going green is not simply getting more respect; it is rapidly becoming a business necessity. Home builders and developers are finding that customers are demanding the benefits provided by green development.

According to industry studies, it costs only fractionally more for new buildings and homes to be engineered, designed, and constructed using green techniques than using standard, non-green building practices. This initial investment in green features can reap significant long-term benefits and life-cycle costs savings in energy and water. To reap the full benefits of a sustainable building, all development decisions from the start of a project must be guided by a green mindset.

To this point, misusing and overusing our water supplies is a sustainability issue that can no longer be ignored. An understanding of the options available to move us toward a sustainable water infrastructure can help engineers, developers, and builders implement increased water efficiency, effective reuse, and recycling strategies into their developments. A big part of this sustainable water infrastructure is the development and application of innovative wastewater treatment technologies.

Replenishing the aquifer

Drought is spreading fast across the United States with 43 percent of the country now under drought conditions. The National Climate Data Center reported in mid-October 2007 that the drought parching the South and West has now spread to the Mid-Atlantic states. With these conditions expected to continue and some areas already in a water-supply crisis, strategies for long-term measures to protect and remediate our water supplies are critical. Sustainable development through sustainable designs for water and wastewater infrastructure is one means of accomplishing balance.

Infiltrated precipitation takes hundreds of thousands of years to impact most deep aquifers. Therefore, mining groundwater for a one-time use—never to be returned to the groundwater system from where it came—is not a sustainable practice. The traditional, centralized approach to water use and wastewater treatment involves extracting (and sometimes treating) water for use, sending it to a central system for treatment, and then discharging the treated water into a river where it is carried downstream. This adds more pollutants to our already impaired surface waters and does not return water to underground aquifers. With a centralized approach, each home in a development that goes on a sewer line exhausts more of our water resources.

A sustainable option becoming more common in the United States is to treat wastewater close to its point of origin and return treated water to the groundwater system through soil infiltration. Another step in this evolution of wastewater treatment involves reuse. This concept involves reusing treated wastewater for toilet flushing and other non-potable uses and allowing water to be cycled many times before being sent to the sewer system for final treatment and disposal. Treated-water reuse for golf course, crop, and landscape irrigation returns this water to the hydrologic cycle, allowing some of it to return to groundwater aquifers.

Sewered versus unsewered
The high cost of centralized, "big pipe" wastewater systems contributes to land in sewered areas selling for more than land in unsewered areas. When a developer buys high-cost land with access to sewer lines, preserving woods, prairies, and open space and building parks and trails are development costs that are difficult to absorb while staying competitive in the housing market place. Decentralized systems—or onsite wastewater solutions, including individual or cluster-types (which are available on a small community scale)—make land development that includes the open-space amenities people are seeking more affordable.

Engineered wetlands, under construction here, use vegetation as part of the treatment process and require minimal energy input. Forced Bed Aeration, a patented approach created by Jacques Whitford NAWE, Inc., introduces process control to the operation of the wetland.

Onsite, cluster wastewater systems are one design example that enable planners to look at residential development in a whole new way. The benefit for the builder/developer is that when land becomes available for development, they do not have to wait for a sewer extension or connection to move ahead. For the community, a decentralized approach to wastewater enables smart growth approaches to development and sensible land use decisions. Communities can adopt this model of development by reviewing and revising their wastewater codes to accept these alternative treatment options.

Not only is wastewater management an issue in rapidly growing areas, but also is the need for developers to be able to stay competitive and the desirability for communities to have interactive areas and open space. Rural sprawl caused by large lot zoning is a serious problem. There is no sense of community when homes are a quarter mile apart. Children must be driven to their neighbors' homes to play, and adult residents in rural sprawl developments drive everywhere. School busses stop at every driveway instead of at the end of the block. Road maintenance for a small number of homes is a community burden. This situation is not environmentally or "user" friendly.

Decentralized wastewater treatment technologies that use natural approaches are less land intensive and provide suitable long-term treatment and are leading to better development practices. Because of performance data now available that makes these systems increasingly popular with local health officials, the new onsite wastewater strategies and alternative methods of treatment are often the only solution for engineers and developers to obtain a code-compliant system. This is particularly true on sites with difficult soils and tough terrain. The same scenario also applies to large recreational and commercial developments in environmentally sensitive areas, where a combination of technologies must also be considered.

With decentralized wastewater treatment, it is possible to provide a sustainable water-use model where groundwater is extracted, consumed, treated, and returned close to its point of origin to recharge the aquifer. Further, it also enables water reuse possibilities such as irrigation, thus creating a sustainable system.

Online resources

The Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems is one of many useful resources available from the U.S. Environmental Protection Agency (EPA) about decentralized wastewater treatment. This "how-to guide" for implementing the EPA's Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems describes a step-by-step approach for development of a community management program for decentralized wastewater systems. Published in 2005, the EPA is working on an expanded online version of the handbook that will include links to topics of interest and a series of case studies to provide examples of successful management programs.

Check here for the latest guides, manuals, policies, tools, resources, technical information, and more about decentralized wastewater treatment systems.

Decentralized approaches and technologies evolve

In the evaluation of a wastewater system, both treatment and disposal technologies become interlinked. Typically standards for disposal in the soil and the characteristics of the soil are investigated first. Treatment methods are then evaluated. In both cases, new technologies are taking a more important role in the decentralized approach.

Plastic chambers provide a sustainable option to treat wastewater close to its point of origin and return treated water to the groundwater system through infiltration.

Introduction of chamber technology more than 30 years ago was a revolutionary step in increasing the effectiveness and acceptance of standard and advanced onsite systems. Since the first concrete "gallery" chamber systems or "ameration chambers" were recognized for onsite septic leachfield applications as more efficient than previous traditional stone and pipe systems, chambers have evolved dramatically in design. Several years of research and design culminated with the introduction of Infiltrator plastic chambers to the marketplace in 1987, and plastic chambers are now commonly used for onsite treatment in basic and advanced applications. Because chambers are highly adaptable and effective for specialized system designs and treatment needs, they are now a key element in septic system leaching trenches and beds, sand filters, mound systems, evapotranspiration beds, community (cluster) systems, constructed wetlands, large-scale wastewater treatment plants, pretreatment devices, and toxic waste remediation.

Suitable soil infiltration sites have soil structure with sufficient hydraulic conductivity to allow water to flow away without surfacing. In these sites, chambers provide the opportunity for large scale disposal of treated wastewater. In cases where soils are compacted or natural infiltration rates are so slow as not to be practical and cost effective, the only remaining onsite disposal method is reuse of treated wastewater by irrigation, toilet flushing, or other industrial reuse options. In some climates, evaporation ponds are feasible for disposal. However, there are sites where reuse and surface water discharge options are not available and onsite disposal is not recommended. These difficult sites usually have other construction obstacles that make them undesirable building sites.

Engineered wetlands are a natural wastewater treatment option that is gaining popularity as an effective approach for communities. What makes engineered wetlands different from other treatment processes is that they use vegetation as part of the treatment process and require minimal energy input. The application of engineered wetlands can result in substantial operations and maintenance cost savings, especially for systems that have to operate over long periods of time.

The engineered aspect of this technology is the application of enhancements that introduce process control to the operation of the wetland, such as Forced Bed Aeration, a patented approach created by Jacques Whitford NAWE, Inc. Wetland treatment systems use natural biological processes to break down the organics in human waste through bacterial action. The process is enhanced when sufficient air (oxygen) is provided to the bacteria. Enhanced bacterial action provides a more robust treatment system for domestic wastewater and the more recalcitrant, difficult-to-degrade synthetic compounds.

Engineered wetlands take up less land than their predecessor, constructed wetlands. Most sites can accommodate the engineered wetland treatment option. Sites with little or no open space component may not be suitable for engineered wetlands and onsite disposal.

Open-space approach
Even in rural areas, creating communities that have a nucleus of space and life in close proximity to clustered commercial services is a cost effective, psychologically appealing, and eco-friendly approach. Decentralized wastewater treatment can be a viable option that allows for this type of development.

Cedar Bluff Homestead, in the predominantly rural community of Afton, Minn., is a cluster-housing development of smaller lots that preserves forested areas, restores more than 60 acres of pasture into native prairie, and incorporates hiking trails and other amenities into the design. The developer's plans include using a decentralized approach to treating wastewater by using engineered wetlands.

Pratt Homes, a developer and custom home builder based in Vadnais Heights, Minn., is creating a conservation development called Cedar Bluff Homestead in the predominantly rural community of Afton, Minn., on the eastern edge of the Twin Cities metro area. In contrast to large-lot development in the area, which is rapidly consuming land for high-density suburban subdivisions, Pratt set out to create a cluster-housing development of smaller lots that preserves open space and maintains the rural character of the Afton community. Pratt Homes' dedication to creating a distinctive community can be seen in the plans to preserve forested areas, restore more than 60 acres of pasture into native prairie, and incorporate hiking trails and other amenities into the design.

The developer's plans include using a decentralized approach to treating wastewater by using engineered wetlands, which will fit into the natural open space and allow a treatment process that is friendly to the environment. In the open space, a chambered drainfield provides for recycling treated wastewater back into the environment, enabling the groundwater to be recharged. This advanced treatment system met the aggressive goals of the city of Afton to be sustainable and to treat wastewater better than conventional onsite septic methods.

Another project that will use engineered wetlands is Dorsey Creek Ranch in Wyoming. This development will take groundwater from the regional aquifer through a series of wells. Wastewater from the 138-home development will be treated by engineered wetlands and recycled back into the soil through the use of drip irrigation, enabling the aquifer to be recharged. The 750-acre property is situated along the banks of the Greybull River, 6 miles west of Basin on a mostly flat expanse of windswept valley in the shadow of Northwest Wyoming's picturesque Bighorn Mountains. Drip irrigation technology, which is common to ranchers in the West, provides treated wastewater to grow crops on an organic farm located adjacent to the development. When water is in short supply, the benefits of treatment and reuse magnify the sustainability opportunities.

Conclusion
The way communities look at their options for sensible land use management and the alternatives that are available to them for wastewater treatment and water conservation are two important pieces to the sustainability puzzle. Meeting the environmental needs of communities, reducing the burden on already overloaded surface water receiving environments, and recycling treated wastewater for beneficial purposes are all part of the long-term solution. Environmental officials can play a major role as they consider and revise zoning codes to allow the use of the new, green technology to solve their communities' desire for innovative, eco-friendly, and creative ways to develop. Whether it is preserving natural open space, fostering community cohesion by reducing dependence on the automobile, or improving energy efficiency and resource use, green development takes advantage of green infrastructure to enable an integrated approach to development that better serves the customer, the developer, society at large, and the environment.

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