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## **Decentralized Wastewater Management Options for Community Involvement**

By

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Onsite and decentralized wastewater management systems are a permanent element of the Nations wastewater infrastructure – they have been in use successfully for over 100 years. During the last 25 to 30 years the options and alternatives available to manage domestic, commercial or institutional, and industrial wastewater, at or near the source through either an onsite alternative or a small community collection and treatment system have increased dramatically. Collectively, these managed onsite and community collection and treatment options are called decentralized systems. These decentralized options are receiving increased interest. In January, 2005 Ben Grumbles, Assistant Administrator of Water Programs for the USEPA indicated that Agency strategy included an aggressive effort to assure the long term management of all wastewater systems and to assure that onsite and decentralized wastewater treatment systems remain a permanent and essential element of infrastructure (USEPA, 2005).

Reasons for this increased interest in the decentralized option include:

1. Greater attention devoted to sustainable management for all centralized and decentralized systems now strongly encouraged,
2. Increasing levels of treatment and reliability possible, and
3. Increased attention to cumulative watershed wide impacts associated with development.
4. Increased local concerns for protecting homeowner investment, community values, and expanding local tax base

This presentation is intended to illustrate examples of communities that have implemented permanent and sustainable management programs to facilitate the long term use of onsite and decentralized wastewater systems. These communities continue to address the issues that must be addressed if comprehensive management programs are to continue. This continual assessment is consistent with the environmental management guidelines promulgated by the Agency.

Issues that must be addressed continually include:

1. Improved methods for characterization of receiver environments and determination of assimilative capacity
2. Improved efforts to characterize wastewater characteristics from each of the sources
  - a. Flow
  - b. Characteristics
    - i. Organic strength (BOD, COD, TOC) and concentration for specific compounds (endocrine disruptors, etc)
    - ii. Salt levels
    - iii. Nutrients
    - iv. Organism levels
3. Improved methods for site and soil assessment and assimilative capability of receiver environments
4. Improved mechanisms to assess options and alternatives in regulatory agencies
5. recognition of management as a permanent element of infrastructure
  - a. Technology
  - b. Personnel
  - c. Organization
  - d. Attention to management activities
    - i. Planning
    - ii. Organizing
    - iii. Financing and sustaining
    - iv. Enabling

Efforts to better characterize assimilative capacity of receiver environments are necessary to assure that no pollutant input into a receiver environment exceeds the capacity of that environment to adequately assimilate the pollutants of concern.

Wastewater flow and characterization information is essential to assure that treatment and dispersal systems can be designed to handle the flow and characteristics of a specific wastestream.

Site and soil assessment data is critical to assure that adequate site and soil properties are present to assure assimilation and treatment on a receiver site before pollutants exit a site and enter the immediate receiver environment. Physical properties such as slope and landscape position, lot size to assure adequate travel time to receiver environment, soil depth, color patterns, texture and structure are present on a site must be assessed to assure protection of health and environmental concerns.

Options assessment procedures will assist local decision makers specify technology required in an area and more critically the management needs associated with technological solutions. Management requirements intensify as environmental sensitivity and treatment technology become more risky.

Management is required to assure onsite and decentralized systems are viewed as the permanent element of infrastructure that they have been for over 100 years. Remember, the EPA Guidelines are voluntary, but when a community makes a commitment to utilize onsite and decentralized wastewater systems as the wastewater management system of choice, management becomes essential to assure sustainability.

A management program must ultimately address the elements of listed in the EPA Voluntary Guidelines for Onsite and Decentralized Wastewater System Management. These elements must be addressed and if a community can justify that an element need not be adopted, then the vitality of the management effort is not diminished. Sustainable management efforts may require funding for these decentralized facilities. Sources of funding utilized to support ongoing decentralized programs include SRF (PennVest, Minnesota Agriculture Department, and Massachusetts Development Bank), USDA Rural Utility Service (RUS), and local funding alternatives such as the Clean Water Management Trust Fund in North Carolina. The elements of a management program contained in the EPA Voluntary Guidelines are presented in figure 1.

Figure 1, Program Elements and Activities

Element	Essential Activity
Public Education	Educate owners regarding proper system care
Planning	Coordinate with local planning agencies
Performance	Establish appropriate performance criteria and indicators of success/failure
Training/certification	Develop and administer programs as required
Site Assessment	Establish appropriate site requirements
Design	Establish appropriate design requirements
Construction	Oversee construction/installation
Operation/maintenance	Establish operation and maintenance requirements
Residuals management	Administer system for residuals management
Compliance monitoring	Establish program for compliance monitoring
Corrective action	Establish program for corrective action
Record keeping/reporting	Administer record keeping/reporting program
Financial assistance	Consider program of financial support to users to assure sustainability of local efforts

Programs that address each of the elements lead to the development of a sustainable wastewater management solution. Remember, adoption of an element may not be required, but the community must address the element and justify reasons for rejection

of the specific element. Sustaining workable wastewater management programs is the goal of this EPA effort, not simply a checklist of elements. These elements are contained in each of the Program Models proposed by the USEPA and presented in the Guidelines.

The USEPA *Guidelines for Onsite and Decentralized Wastewater System Management* (USEPA, 2003) provide detailed information concerning implementation of a comprehensive approach to water management. These guidelines are part of the agency's effort to tailor water management programs to local needs and mandates. The State of North Carolina has been a national leader in developing onsite and decentralized water and wastewater management systems. The North Carolina efforts have been largely through local health agencies and regional authorities. Other ongoing efforts involve City or County Governments, rural water authorities, sanitary districts, and private entities. Recent recognition of the value of perpetual management for onsite and decentralized water and wastewater systems as a part of a larger infrastructure has increased interest in these distributed systems in the context of a larger utility system.

Management of the onsite and decentralized systems in urban fringe sub-urban, and rural areas will allow expansion of service areas without extending hard infrastructure. Management of onsite and decentralized systems in a defined service area will allow protection of homeowner investment and tax base. Finally, management of onsite and decentralized systems in a defined service area affords improvements in ability to protect health and environment. Similarly, management of the decentralized or distributed stormwater systems is essential to assure the sustainability of these systems as an element of environmental protection.

The various models proposed by the USEPA for management of distributed infrastructure are described and working models where this decentralized approach has been applied in a community context are available throughout the nation. Both public and private management structures have been utilized effectively.

The matrix below presented in Figure 1, Management Models displays the management models proposed by the USEPA. This matrix serves as the foundation for the management models contained in the USEPA Guidelines for Onsite and decentralized wastewater management. These models can be used as a foundation for a comprehensive management program addressing all elements of the water environment: water supply, stormwater, and wastewater.

**Figure 1, Management Models Developed by USEPA**

Model Program	Application	Potential cost
Inventory/awareness	Simple technology, little risk	Low user cost, amplification of ongoing operation
Contract	Mechanical technology, little risk	Moderate user cost,
Performance base, operating permits	Mechanical technology, moderate risk	Moderate costs, permits require renewal and performance review
Management entity operation	Mechanical technology, significant risk	Moderate costs, permits require renewal and performance review
Management entity ownership	Mechanical technology, serious potential risk	Potentially high user costs, permits require renewal and performance review

*Source: Guidelines for Management of Onsite and Decentralized Wastewater Systems (USEPA/OWM, 2003)*

Information on the EPA onsite and decentralized effort is available on-line at [www.epa.gov/owm/septic](http://www.epa.gov/owm/septic). The USEPA has populated this web site with a significant volume of valuable information dealing with onsite and decentralized systems including funding opportunities, technology options, and links to state and regional governments.

As watershed managers examine the entire watershed management efforts more comprehensively issues in addition to onsite and decentralized wastewater systems will emerge as critical in the protection efforts. Many of the systems specified in these comprehensive efforts will include distributed systems for wastewater management; storm-water management, solid waste management systems, and systems to assure animal wastes are managed properly.

## **OPERATIONAL MANAGEMENT MODELS**

Model 1 – Albemarle Regional Health District (ARHD): This district was formed by special legislation enacted through the North Carolina General Assembly in 1991. The district initially received funding through the assembly to manage onsite wastewater systems in a four (4) county region in the sensitive Coastal region of Northeastern North Carolina. Prior to establishment of the District, failure rates for the onsite options utilized in then region ranged between 20 and 40%. Subsequent to establishing the district, the malfunction rates have fallen to between 5 and 10%. In 2002, the District received Congressional funding through SRF to establish a stormwater management effort in conjunction with the wastewater management program.

Model 2 – Charlotte County, Florida: Growth in the Charlotte County area is concentrated along sensitive coastal waters and excavated canals. The Charlotte County Health Department requires advanced treatment systems on all lots with less than 10,000 square feet of area or with wastewater management systems located within 100 feet of marine waters. These advanced treatment devices must be those approved by NSF, International and one element of the NSF approval process is a mandatory, manufacturer based management program. This mandatory management effort meets the requirements of a Model 2, Management by Contract program established in the EPA Guidelines. Costs for the Charlotte County program are borne by local tax-payers and by fees paid to the management or contact entity.

Model 3 – Sea Ranch, California: This community is located on the North Coast in California and the receiver environment is sensitive to pollutant loadings. The Sea Ranch development opted to manage the onsite wastewater systems serving both individual homes and the cluster system serving almost 900 residents of a condominium community. The management entity issues renewable/revocable operating permits to system owners in the community. The maximum time allowed for a permit is three (3) years. Upon review of the operational status of a system, a permit may be renewed for an additional three (3) years. If there are any operational difficulties noted during a system review, the system owner is given a specified time frame to affect required repairs and a permit is reissued for one (1) year. If at the end of that year the system is operating properly, a new permit is issued for three (3) years. This flexibility assures successful operation of the onsite and decentralized wastewater systems in this sensitivity coastal community in Northern California.

Model 4 – Charles City County, Virginia: Shallow watertable and slowly permeable soils limit the potential to develop onsite wastewater systems in this Coastal County and productive shellfish waters surrounding the county limit options to develop NPDES systems. Growth and development in this area was limited by the inability to manage wastewater. The county received approval from the Commonwealth of Virginia to establish a wastewater management program involving comprehensive management of all systems approved in the jurisdiction. Under this permit issued jointly by Environmental Health and Water Quality, the county is authorized to utilize best professional judgment to correct existing wastewater system malfunctions. Once permitted, the operations permit is issued to the County Public Service Division to assure proper operation. This structure transfers the operation from the owner to the local utility.

Two distinct Model 5 Programs should be recognized and these involve both public and private models.–

Private Utility – Pickney Brothers, Tennessee Onsite Utilities: Established as a licensed public utility by the Tennessee Regulatory Authority, Tennessee Onsite provides wastewater management services to communities throughout Tennessee. The utility operates a variety of options and the operations are regulated as a utility. Funding for the system is through development fees and operating expenses are borne by rate-payers in each of the service areas. The sewer fee charged to users is approximately \$35.00/month.

Public Utility – Shannon City, Iowa: The residents of Shannon City, Iowa recognized that few of the wastewater treatment systems utilized in the community met required standards. A preliminary engineering assessment indicated that the cost to develop a wastewater collection and treatment system could reach over \$3,000,000.00. The development and use of managed, technologically advanced onsite solutions was recommended as an option. Assessment of these costs indicated that the total cost to upgrade the onsite systems using advanced onsite technology would range up to \$20,000.00 for some of the homes, but would be generally less for most. The onsite solution was funded by Rural Utility Service and the systems are managed through a cooperative agreement between the Southern Iowa Rural Water Authority and the City. Since Shannon City, three additional Iowa communities have utilized a combination of RUS and SRF funds to create management programs for a variety of onsite and decentralized wastewater systems. The water and sewer fee in each of these communities is approximately \$40.00/month

## **COMPREHENSIVE APPROACH TO WATER MANAGEMENT**

The USEPA *Guidelines for Onsite and Decentralized Wastewater System Management* (USEPA, 2003) provide detailed information concerning implementation of a comprehensive approach to water management. These guidelines are part of the agency's effort to tailor water management programs to local needs and mandates. The State of Florida has been a national leader in developing onsite wastewater management systems. The effort has been largely through local health agencies. Recent recognition of the value of perpetual management for onsite and decentralized wastewater systems as a part of a larger infrastructure has increased interest in these distributed systems in the context of a larger utility system.

Management of the onsite and decentralized systems in urban fringe areas will allow expansion of service areas without extending hard infrastructure. Management of onsite and decentralized systems in a defined service area will allow protection of homeowner investment and tax base. Finally, management of onsite and decentralized systems in a defined service area affords improvements in ability to protect health and environment.

A comprehensive and sustainable management program must ultimately address all the elements of listed in the EPA Voluntary Guidelines. These elements must be addressed and, if a community can justify that an element need not be adopted, then the vitality of the management effort is not diminished. The essential elements of the various management models presented in the 2003 USEPA Voluntary Guidelines were presented previously.

Programs that address each of the elements lead to the development of a sustainable wastewater management solution. Remember, adoption of an element may not be required, but the community must address the element and justify reasons for rejection of the specific element. Sustaining workable wastewater management programs is the goal of this USEPA effort, not simply a checklist of elements.

The USEPA Guidelines and the recent Handbook (USEPA, 2005) provide detailed information concerning implementation of a comprehensive approach to water management. These guidelines are part of the agency's effort to tailor water management programs to local needs and mandates. Virginia, North Carolina, Texas, Rhode Island, Minnesota, Iowa, Massachusetts, Wisconsin, Pennsylvania and Florida have been national leaders in developing onsite wastewater management systems. Their efforts have been largely through local health agencies. Recent recognition of the value of perpetual management for onsite and decentralized wastewater systems as a part of a larger infrastructure has increased interest in these distributed systems in the context of a larger utility system.

Management of the onsite and decentralized systems in urban fringe areas will allow expansion of service areas without extending hard infrastructure. Management of onsite and decentralized systems in a defined service area will allow protection of homeowner investment and tax base. Finally, management of onsite and decentralized systems in a defined service area affords improvements in ability to protect health and environment.

Described above are the various models proposed by the USEPA for management of distributed infrastructure. Working models where this decentralized approach has been applied in a community context are common throughout the country and several noteworthy examples were addressed previously. Additional information on management programs is available from the National Environmental Training Center for Small Communities and from the USEPA. Both public and private management structures have been developed to meet the challenges associated with system management and sustainability of a distributed infrastructure.

As watershed managers examine the entire watershed management efforts more comprehensively, issues in addition to onsite and decentralized wastewater systems will emerge as critical in the protection efforts. Many of the approaches specified in these comprehensive efforts will include distributed systems for entities that appropriately

manage wastewater, stormwater and animal wastes. Training efforts are underway at the Land Based Waste Center to address these training needs.

North Carolina State University and other colleges and universities around North America and Australia developed the land-based wastewater training centers in the 1990s to provide operational and design information on land based wastewater management systems. The center in North Carolina has provided training to more than 5,000 system designers and operators since inception. North Carolina is one of a very few states that require certified operators for land based and onsite wastewater treatment systems, including the subsurface system, biosolids and residuals land application systems, animal waste systems, slow rate spray irrigation systems, wastewater reuse systems, and stormwater treatment systems.

The training center offers an opportunity to view a variety of systems in a setting conducive to education and training. Systems represented include:

1. Septic tanks and appurtenances
2. Pretreatment systems or home aeration systems utilizing fixed media and suspended media treatment processes
3. Gravity and pressure distribution systems
4. Electrical controls and pumps
5. Plant and soil systems and nutrient management
6. Irrigation systems
7. Equipment operation and safety
8. Stormwater basin management

Through efforts to train and certify system operators, the sustainability of these systems can be better assured. Without training, the advanced and conventional technology may fail to function as designed. North Carolina rule categorizes systems based on complexity, and the complexity is dictated by site and soil conditions (15 A NCAC 18A .1961, and 15 A NCAC 2H 0.0200). These onsite rules represent an application of a risk-based methodology for system development. Systems are designed to address specific site limitations. All systems developed as a type 3 or higher require some degree of operational control and mandated system review. The North Carolina Onsite Training Center as well as the Onsite Wastewater Center operated in Florida by Florida Onsite Wastewater Management Association (FOWA) provides that required training for operators of decentralized wastewater systems certified in these states.

## **CONCLUSIONS**

Onsite and decentralized wastewater systems are an integral element in the provision of distributed utility service and must be viewed as an element of infrastructure. This concept of an onsite and distributed or decentralize Infrastructure is emerging as a

critical component of the planning and development process. Environmental and economic costs associated with continued centralization may be driving systems to a more integrated, inclusive distributed utility framework. Regardless of the options selected for management of water, wastewater stormwater, solid waste, and other essential utility service requirements, the system must be managed. The USEPA recognizes the value of this decentralized, distributed approach and is encouraging communities to evaluate these options as a part of a comprehensive planning process.

Through this comprehensive process, all options available in a community are assessed and the ability of the systems to protect community values, environmental quality and public health is assessed. The process involves assessment of the environmental and health risk, the risks associated with the management framework, and the risks associated with failure of the management system to adequately sustain the infrastructure. The application of this risk base to the continued development of onsite and decentralized systems will help assure sustainable development. Through this process, systems will develop that are sustainable elements of infrastructure: that are managed to assure the technical merits of the technology, the soundness of the management system, and the sustainability of the financial structures.

The voluntary management models proposed by the USEPA and supported by Agency partners is a major step in development of a comprehensive decentralized water infrastructure. A decentralized infrastructure that is sustainable, that is protective of community values, homeowner investment and local tax base and that assures public health and environmental quality are protected and improved in perpetuity.

#### References:

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