



# Soil Facts

## *Management of Single Family and Small Community Wastewater Treatment and Disposal Systems*

### *The Need for More Sophisticated Wastewater Management*

*To accommodate future growth in rural and suburban areas of our state, we will depend more on alternative septic-tank-soil-treatment systems (septic systems). However, as we use more complex and sophisticated types of septic systems, we must also use more sophisticated programs for maintaining these systems through their entire life cycle.*

*The legal means for establishing sophisticated wastewater management programs have existed for some time in North Carolina; however, few communities or counties have used these programs to manage septic systems. Recent changes in state septic system rules will provide an incentive for communities to become involved in this process. This publication explains why these management programs are necessary and briefly introduces 12 options for implementing them.*

Large regional sewage treatment plants are not economical for many rural areas. Also, some mechanical treatment plants may not meet increasingly stringent water quality limits for wastewater discharge into streams, rivers, lakes, and sounds. Therefore, rural development in North Carolina depends upon the proper use of septic systems. Forty to sixty thousand of these systems are installed or repaired each year in our state.

There are several different kinds of septic systems. Conventional septic systems are the simplest and are described in Agricultural Extension Service publication AG-439-13, *Septic Systems and Their Maintenance*. Some modified conventional systems (such as artificial drainage systems) and alternative systems (such as low-pressure pipe systems) are more complex and require more maintenance. Agricultural Extension Service publications in the AG-439 series, *Septic System Options for Difficult Sites* and *Low-Pressure Pipe Alternative Septic Systems* describe these systems more completely.

The suitability of a building site for on-site sewage treatment and disposal depends upon soil and site conditions. Many sites that are suit-

able for conventional systems have already been developed, leaving less suitable sites for future use. Consequently, modified conventional and alternative septic systems may become more important for future land development.

These systems can function satisfactorily if they are used and maintained properly. However, a recent study in North Carolina found that many alternative septic systems (such as low-pressure pipe systems and sand mound systems) were not being adequately maintained. Without maintenance, alternative systems failed twice as often as conventional systems. The lack of a maintenance program was a major cause of poor system performance for about 40 percent of the alternative systems studied.

Therefore, to protect the environment and public health, alternative systems such as low-pressure pipe (LPP) systems need more intensive maintenance than is currently required for conventional systems. Even a number of modified conventional systems require more maintenance than usually given to conventional systems. For instance, sediment that has accumulated in open drainage ditches must be removed periodically if artificial drainage

systems are to perform as designed. Other more sophisticated on-site wastewater treatment and disposal options require even more maintenance. Sand filters, chlorinators, ultraviolet light and ozone disinfection units, home aerobic package treatment plants, and constructed wetlands could possibly be used on

a regular basis in the future if adequate maintenance could be ensured. Likewise, large septic systems that serve condominiums, subdivisions, and small communities require greater oversight and maintenance than is normally given to the conventional septic system.

## Wastewater Management Options

State rules concerning septic systems have changed recently (North Carolina Administrative Code, Title 10, Subchapter 10A Section .1900 Sewage Collection, Treatment, and Disposal Systems, effective June 30, 1990). These rules require that certain types of septic systems must be maintained in the future by a "management entity" (formal organization that performs the maintenance tasks), with oversight by the local health department. Owners of these septic systems will be required to establish a contract with specific management groups. These may be public agencies (such as city or county governments) or privately owned entities (such as public utilities or certified wastewater system operators). The state rules classify sewage treatment and disposal systems into six different categories (Type 1 through Type 6), depending on system complexity and size and on their long-term maintenance needs.

Type 1 through Type 3 systems include the conventional system, privy, and other similar systems. Type 4 through Type 6 systems are more complex. They include the low-pressure pipe system, sand filter pretreatment unit, home aerobic treatment plant, open ditch drainage used for more than one home, pumped drainage system, large multifamily or commercial septic system, and others.

Inspections and routine maintenance by a management entity will

be required for newly installed or repaired Type 4, 5, and 6 systems after January 1, 1992. The frequency of these inspections ranges from twice a year to five times a week, depending upon system size and complexity. The type of management entity, the system inspection and monitoring frequency, and the requirements for a certified operator are specified in the rules for each type of system. Improvement permits cannot be issued for Type 4, 5, and 6 systems after July 1, 1991 unless an appropriate management entity is authorized, funded, and considered operational. Also, all currently existing Type 5 and Type 6 systems must be inspected and maintained by a management entity after January 1, 1992.

Because some of these requirements could change you may want to contact your local health department. They can provide up-to-date information about specific requirements of the laws and rules and about their implementation dates.

Management of a network of on-site and small community systems presents different challenges from management concerns typical of large regional sewage treatment plants. Once a septic system has been designed, installed properly, and approved by the local health department, the management entity must ensure that all system components function properly. Responsibilities include monitoring and inspecting the septic system to ensure

**Table 1. Institutional Options for Wastewater Management in North Carolina**

### Direct Management

City  
County  
Intergovernmental contract  
Joint management agency  
County service district  
County water and sewer district

### Specially Created Governmental Units

Sanitary district  
Water and sewer authority  
Metropolitan water district  
Metropolitan sewer district

### Private Parties

For profit  
Nonprofit

that routine operation, maintenance, and repair procedures are followed. These activities might also include assisting in rehabilitating systems that are not performing properly, as well as pumping, treating, and disposing of septage (solids accumulated in the septic tank). In some cases management entities might also monitor the performance of innovative septic systems and educate the public.

Selecting a management system is just as important as choosing appropriate technologies for addressing the community's wastewater disposal needs. The reliability of the management entity may ultimately determine the range of wastewater treatment and disposal options that can be used effectively in a community.

There are at least 12 possible institutional options for wastewater management in North Carolina (Table 1). Each option has its own organizational structure and powers of operation. Some options are more appropriate than others for management of individual on-site systems. These 12 alternatives may be di-

# Management of Single Family and Small Community Wastewater Treatment and Disposal Systems

---

vided into three basic categories: direct management by a public agency; management by a special governmental unit; and management by a private party. Each of these solutions has advantages and disadvantages.

## **Direct Management**

The direct management category includes six different possibilities. Some of the features of each management group for family and small community wastewater systems are briefly outlined here.

### **City or County**

Both of these governmental units have very broad powers as a possible management entity. They may levy property taxes; impose special assessments; issue general obligation and revenue bonds; set fees, rates, charges, and penalties; condemn land; and establish rules and regulations. Both may serve outside their boundaries. Both have elected governing bodies and, with respect to any given area, would have as strong a financial base as any other alternative.

Much of the need for management is likely to be for wastewater systems outside the city. Moreover, many cities are small in both area and population and may have limited financial and management resources.

County governments, on the other hand, have jurisdiction over a much larger area and in most cases have superior financial resources. They are already organized; thus, relatively little money or time need be expended to establish the organization for the management arrangements.

Furthermore, many cities and counties already have in place a management organization that is providing some wastewater management services. Simply enlarging these to assume increased responsibilities should usually be fairly easy to accomplish.

### **Intergovernmental Contract**

In North Carolina, any two units of government may contract to accomplish jointly what each is authorized to do separately. This flexibility makes it possible for two or more units to share financing and policy making while preserving the advantages of a single management entity. For example, if the small wastewater systems to be managed are principally in the unincorporated area of a county, the county government might take the lead in establishing rules, regulations, and financing. It might then contract with a city within the county to take on the responsibility for management of the small systems in the rural area of the county.

### **Joint Management Agency**

The joint management agency is a special form of intergovernmental agreement or contract. In the typical intergovernmental contract, the management staff is employed by one or more of the participating units. In the pure joint management agency; all employees are attached to the agency, which is separate from any of the participating units. The main advantage of the joint management agency is that it may make joint action possible. Each of the participating units is sometimes unwilling for the staff to report to another unit but is willing to cooperate if the staff is independent. The direct financial resources of the joint management agency are limited to fees and charges. A joint agency does not have taxing power and may not own real estate. By the same token, it may not issue general obligation bonds.

### **County Service District**

A county service district is simply an area of a county (defined by the county commissioners) that needs some authorized service that the commissioners want to finance with a special property tax. This service is one not needed elsewhere in the county or one needed at a higher

level in the designated district than elsewhere in the county. The county service district is not a separate unit of government; it has no governing body. The services in the district are under the control and direction of the county commissioners. The management team that provides the services is made up of county employees.

### **County Water and Sewer District**

This is a separate unit of government governed by the board of county commissioners. The sole reason for creating such a unit is to establish a means of issuing general obligation bonds with the vote on bond issuance confined to the district (in contrast to bonds for a county service district, which must be approved by voters in the entire county). Because county commissioners act as the governing body of the district, a county water and sewer district has almost as much flexibility in providing wastewater services as does a county government. However, the county's authority to require connections does not extend to a system operated in a district.

A major advantage of using a city or county government as the management entity is that these units have authority over both the management of wastewater systems and the regulation of land use. Of all the management entities discussed here, only city and county governments have general police powers and express authority to regulate land use in the form of zoning, subdivision control, building inspections, the establishment of historic districts, and the like.

### **Special Governmental Units**

Five types of specially created governmental units are now authorized by general law in North Carolina. Four are separate and independent units once established, and they are discussed here. The fifth type, the county water and sewer district, is directed by the county commission-

ers because its members also serve as the district's governing board. For this reason it was classified earlier as one of the "direct management" entities.

All four special governmental units have the advantage of being focused — water and sewer services are usually their principal functions. Thus they may center their attention on a single purpose. In general, all have more limited financial flexibility and less borrowing capacity than the counties in which they are located. They do not have the authority to regulate land use and development.

### ***Sanitary District***

A sanitary district is formed with the consent of a majority of the owners of real property and has an elected governing body. Most districts' major function is to provide water and sewer services, but they also are authorized to provide solid waste collection, fire protection, ambulance and rescue services, and mosquito control. Organization of a large area is difficult because a majority petition from landowners is required. With an elected board, the sanitary district is politically accountable in the same manner as a city or a county. Its financial resources are typically not as great as those of the county in which it is located.

### ***Water and Sewer Authority***

This entity is created by other governmental units, usually cities and counties, and is governed by a board

whose members are appointed by the creating units. An authority does not have general taxing power and may not issue general obligation bonds but may issue revenue bonds. It may cover several jurisdictions or portions of jurisdictions. Its financing powers are extensive and include the authority to levy special assessments for improvements.

### ***Metropolitan Water District***

This district may be created by one or more political subdivisions, usually cities and counties, within a given county. It has appointed boards with the power to levy taxes and issue general obligation and revenue bonds; it may not impose special assessments. Like the water and sewer authority, it has no power to regulate land use and is authorized to provide only water and sewer services.

### ***Metropolitan Sewer District***

This agency is formed by cooperating political subdivisions, including unincorporated areas, and may cover more than one county or parts of more than one county. It is essentially the same type of organization as the metropolitan water district except that it may provide only sewer services. Thus it has truly special-purpose and single-purpose units. In providing sewer services, it has the same powers that metropolitan water districts possess with respect to rates and charges, taxing, and borrowing.

## **Private Entities**

Private entities may be operated for profit or may be nonprofit. Each is established under general law. Two types of private entities are regulated public utilities and certified wastewater system operators. A major disadvantage of the for-profit corporations is that they are generally not eligible to receive state and federal grants directly. They may, of course, carry out public purposes under contracts with a public agency in most cases. Thus, for example, a county could contract with a private for-profit or nonprofit company to manage small wastewater facilities. As an alternative, the contract could call for the private entity to provide the facilities and also to operate and maintain them. The basic financial stability in this case would be based on both the fees and charges that the private organization might be allowed to impose, plus any additional support forthcoming from the county under the contract for services. For example, in some North Carolina counties landfills are owned and operated by private entities that provide services for county citizens under a contract with the county government.

---

## ***Selecting the Appropriate Wastewater Management Organization***

Choice of a management organization must ultimately depend on local needs and preferences. The type of management entity required depends upon the maintenance needs of the septic system (North Carolina Administrative Code, effective June

30, 1990). The easiest management system to establish may not necessarily be the one that best serves the intended purpose. Careful research and adequate public discussion are crucial to choosing the most appropriate management unit. Technical,

financial, and legal advice should be obtained early in the process to adequately assess the options. It may be advisable to choose more than one type of management entity within a county.

# Management of Single Family and Small Community Wastewater Treatment and Disposal Systems

---

Factors to consider in choosing a management entity include:

- the ability to provide policy and management continuity;
- the ability to charge fees for service;
- the ability to compel users of the services to comply with requirements of the management plan (such as service and inspection requirements);
- the capacity for maintaining adequate financial responsibility;
- the ability to shift liability (some management entities focus all liability in one organization, while others distribute liability among organizations);
- the ability to hire and retain adequately qualified employees.

Public education and participation in decision making are vital elements of any wastewater management program. The public has a vested interest and an important role in wastewater management. Technical solutions to wastewater problems are often available. Certain social and economic obstacles, however, may limit implementation of technically sound policies and management plans. Members of the public who should be educated about and involved in wastewater management include homeowners, developers, public officials, real estate professionals, and the business community. Many of these citizens should also be encouraged to play an expanded role in wastewater management decisions. Citizens may not, however, fully understand or appreciate the complexity of wastewater management alternatives and problems. Therefore, public support and cooperation requires an educated public.

Wastewater management decisions often generate considerable public interest and potential controversy. Public concerns may be based on negative attitudes and incomplete

knowledge. Public education and participation programs are most effective when based on adequate understanding of existing public attitudes and knowledge about the technical issues and policy alternatives. Such understanding can be gained through the public participation process itself. Local leaders need different types of information to make wastewater management decisions that are acceptable to a majority of local citizens. Better understanding of how different segments of the public perceive management alternatives leads to more effective technological solutions. Decisions are ultimately more acceptable to all parties involved if they fully understand the situation and have opportunities for participation.

The process of establishing a management system in a county can either begin with the local health department or with those citizens who will benefit most from the establishment of a management entity. These management entities can be created by county commissioners, by legislative act, or by petition of the resident landholders. In any case, citizen input should be encouraged in the process of determining the scope of the management entity's territory, powers, and responsibilities. One management entity could serve residents in an entire county, or a portion of the county. Also, several different management entities could all function within one area.

More sophisticated wastewater management will likely come at some increased cost. The owner of a septic system may have to pay a monthly bill similar to those on a municipal sewer system. Even if the management entity's fee structure employs a user fee and excludes direct costs to the taxpayers, caution must be exercised to determine whether the citizens may still be affected indirectly. For instance, if the management entity is a city or

county, all citizens might assume some risk for the cost of replacing failing systems that were not maintained properly.

Another potential effect involves disruption of typical development patterns in a county if the management entity facilitates development in "unsuitable" areas. Because the suitability of a septic system site has often been used as an actual land use regulation, this could be an important issue to resolve before establishing a management entity.

## Summary

There is substantial need for more sophisticated management of both on-site septic systems and small community wastewater treatment and disposal systems. While these systems are fairly easy to maintain, it is clear from recent studies that these systems have not always been maintained properly. Better management should facilitate more extensive use of complex technological options. There are a number of institutional management entities that can be used depending upon the needs and desires of the county or local community.

For more information about wastewater treatment and disposal systems, contact your local health department or your county Extension office. You may also wish to obtain Agricultural Extension Service publication in the AG-439 series, *Septic System Options for Difficult Sites*, which describes a number of septic tank system modifications and alternatives. *Outline of Alternative Organizational Arrangements for Providing Water and Sewerage Services in North Carolina*, published by the Institute of Government at the University of North Carolina provides more detailed information on the powers, authorities, and duties of the institutional wastewater management options described here. For more information on the public participation process, contact your county Extension office.

## References

Hoover, M. T. and A. Amoozegar. 1989. "Performance of alternative and conventional septic tank systems." In: Proceedings of 6th Northwest On-site Wastewater Treatment Short Course. University of Washington. Sept. 18-19, 1989. Seattle, Washington.

North Carolina Administrative Code, Title 10, 10A Section .1900 Sewage Collection, Treatment, and Disposal Systems, effective June 30, 1990.



Helping people put knowledge to work.

Prepared by

M. T. Hoover, Extension Soil Science Specialist

W. J. Wicker, Assistant Director, Institute of Government,  
University of North Carolina at Chapel Hill

T. J. Hoban, Extension Sociology Specialist

T. A. Feitshans, Extension Economist

A. R. Rubin, Extension Agricultural Engineering Specialist

---

The North Carolina Department of Environment, Health, and Natural Resources (Division of Environmental Health), members of the On-Site Sewage Program Advisory Committee, and local county Extension and Health Department staff members provided technical review and valuable input.

Published by

**THE NORTH CAROLINA AGRICULTURAL EXTENSION SERVICE**

---

North Carolina State University at Raleigh, North Carolina Agricultural and Technical State University at Greensboro, and the U.S. Department of Agriculture, cooperating. State University Station, Raleigh, N.C., R.C. Wells, Director. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. The North Carolina Agricultural Extension Service is an equal opportunity/affirmative action employer. Its programs, activities, and employment practices are available to all people regardless of race, color, religion, sex, age, national origin, handicap, or political affiliation.