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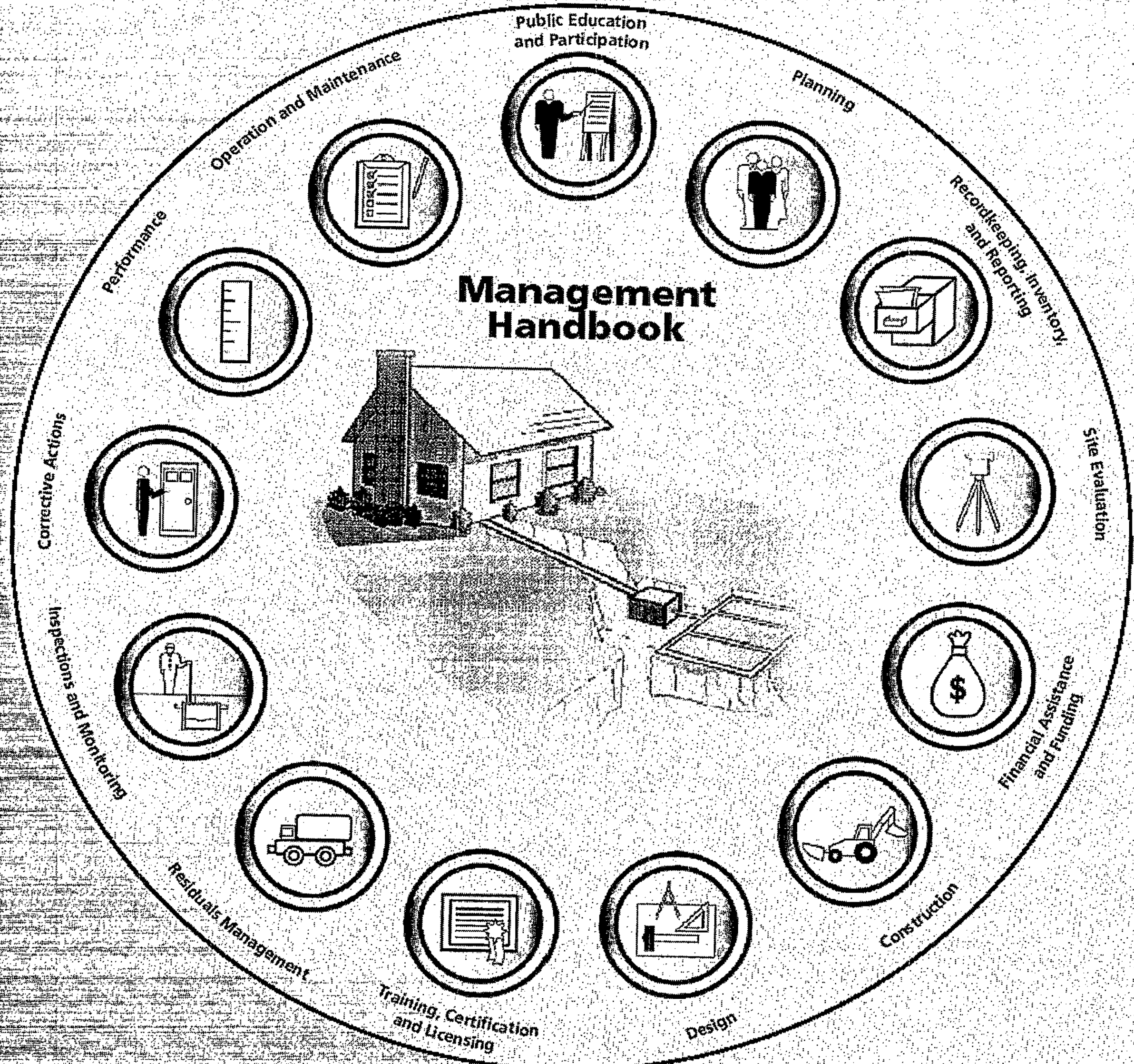
Handbook for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems



Handbook for Management

of Onsite and Clustered (Decentralized) Wastewater Treatment Systems

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Foreword

This *Management Handbook* for onsite and cluster (decentralized) wastewater treatment systems is designed to assist state and local officials, service providers, and other interested parties with improving existing and new decentralized system performance in a sustainable, long-term manner. Individual and small cluster systems currently serve approximately 25 percent of the U.S. population, treating and releasing about 4 billion gallons of wastewater per day. Managing these systems to ensure long-term protection of public health and water resources, however, is a relatively new concept because the systems were originally installed with the idea that they would receive little, if any, management.

Many new rural and suburban residents are not aware of the need for proper operation and maintenance of their onsite wastewater treatment systems (OWTS). Sensitive environmental conditions, poor soils, high water tables, increasing system densities, and the expanded use of mechanical components (e.g., electric pumps and switches) require improved *regulation* and *management*. Regulation, as prescribed by state and local codes, is typically performed by a *regulatory authority* such as a county health department or water quality agency. The more robust set of management activities—planning, system performance requirements, site evaluation, design, construction, operation/maintenance, residuals management, training and certification, public education and involvement, inspection and monitoring, compliance enforcement, record keeping and reporting, and financial assistance—can be undertaken by an enhanced regulatory authority, independent service provider, other public agency, or a public and/or private *responsible management entity* with the necessary powers and charged with responsibility for ensuring that these functions are properly carried out. In most cases, managing decentralized systems will be handled by a *cooperative management program*. Cooperative management programs can be developed by the regulatory authority or other entity (e.g., water resource agency, planning department) by organizing local resources into a web of service providers, agencies, and private entities that can ensure protection of public health and the environment. Under this approach, management activities are defined and distributed among involved partners through a formal or informal cooperative program designed to meet the needs of local communities.

> "Septic systems are no longer considered the temporary solution they once were, and many towns are realizing that they need to maintain their on-site systems as long-term, reliable options."
>
> William Heigis, Data Management Systems for On-Site System Management, 2000

The structure and operational processes local management programs will depend on the unique circumstances, capabilities, resources, and commitment of each community. Many communities will develop management programs through the involvement of several organizations, such as traditional regulatory authorities, planning departments, approved service providers, environmental agencies, design professionals, and so on. Some might opt for a more comprehensive program that vests most management responsibilities in a sanitation board, service district, or other responsible management entity that might own, maintain, or operate a number of decentralized or even centralized wastewater systems. The nature of local management programs will vary greatly across the Nation. All management programs, however, must be sustainable and responsible for ensuring the protection of human health and water resources from disease-causing bacteria, nitrates in groundwater, high nutrient levels, and other potentially harmful pollutants.

The approach discussed in this *Management Handbook* is based on a few simple but essential concepts:

- The creation and maintenance of descriptive and historical inventories of all systems
- Management, operation, and maintenance to ensure protection of public health and the environment
- Increased management for systems with mechanical components, systems installed at high densities, and systems located in sensitive (high-risk) environmental settings

This *Management Handbook* offers guidance on how to plan and implement a successful management program. Chapter 1 gives background information on the *Management Handbook* and describes the current status of wastewater treatment system management. Chapter 2 explains the five model management programs, and chapter 3 describes the essential elements of a management program. Chapter 4 provides guidance on planning and implementing a management program, from identifying key problem areas and assessing management needs through planning for implementation. The *program elements* for managing decentralized treatment systems are listed below. The activities associated with each program element should be based on local resources and capabilities, but must always address public health needs and environmental protection requirements. Under the approach discussed in this handbook, local communities are encouraged to find the appropriate mix of activities required within each program element to meet their health and environmental goals. Tools to aid this process can be found in this handbook and obtained through the organizations listed in the *Resources* section.

Elements of a Decentralized Wastewater Management Program

Public education and participation to communicate risks and develop appropriate responses.
Planning based on cumulative and other impacts on human health and water resources.
Performance requirements to ensure appropriate system design and technology selection.
Site evaluation and wastewater characterization to guide system sizing and design.
Designs that consider site conditions, cumulative loadings, and performance requirements.
Construction practices that ensure compliance with design, siting, and performance criteria.
Operation and maintenance functions that focus on performance and minimize risk.
Residuals management programs that protect health and water resources.
Training and certification/licensing of regulators and all service providers.
Inspections and monitoring to assess and document performance and initiate remediation.
Corrective actions and enforcement to ensure compliance and address failing/failed systems.
Record keeping, inventory, and reporting to support planning, management, and oversight.
Financial assistance and funding to support installation, repair, and overall management.

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Chapter 1 Introduction

1.1 Purpose of the management handbook

This *Management Handbook*, which supports the U.S. Environmental Protection Agency (USEPA) *Voluntary Guidelines for Management of Onsite and Cluster (Decentralized) Wastewater Treatment Systems*, has been developed to improve the performance of decentralized wastewater systems through better management. Decentralized wastewater treatment systems include individual onsite systems (commonly called septic systems, private sewage systems, or individual sewage systems) and cluster systems serving one or more homes or businesses not connected to centralized sewer service. Proper management is necessary for all of these systems to consistently meet site-specific performance requirements, i.e., to protect public health and water resources. USEPA has proposed a set of voluntary national guidelines to improve the quality of management programs for decentralized systems, establish minimum levels of activity, and institutionalize the concept of management.

USEPA continues to support the most cost-effective approach to wastewater treatment, which meets environmental and public health goals, whether it be centralized or decentralized. This handbook will help communities understand and implement management programs that can effectively meet their own water quality and public health goals, provide a greater range of options for cost-effectively meeting wastewater needs, and protect consumer investments in homes and businesses.

> Although adoption of the guidelines or any management approach is voluntary, USEPA encourages states and local communities to consider the guidelines as a basis for their decentralized wastewater management programs because of the continuing public health and water resource threats posed by poorly performing, unmanaged onsite systems.

The Guidelines contain a set of management approaches that rely on coordinating the responsibilities and actions of the regulatory authority, the management entity, service providers, and system owners. These approaches – presented as five model management programs – are structured to address an increasing need for more comprehensive management as the sensitivity of the environment, the number and density of system installations, and the degree of system complexity increases. The five-model management program suggested in the Guidelines (which are presented in the Appendix of this handbook) describe essential program elements, which range from planning and recordkeeping to operation/maintenance needs. The management program's responsibilities increase progressively from Model Program 1 through Model Program 5, reflecting not only the increased level of management activities needed to achieve more stringent water quality and public health goals, but also the increased capability needed to properly manage larger numbers of more complex technologies in more vulnerable watersheds.

Although adoption of the Guidelines or any management approach is voluntary, USEPA encourages states and local communities to consider the Guidelines as a basis for their decentralized wastewater management programs. A small investment in improved management of onsite and cluster systems might prevent the need for subsequent—and much larger—investments in centralized wastewater facilities or in continued repair/replacement of decentralized systems that fail because of lack of management attention. The Guidelines can be applied to both existing and new systems serving residential and commercial facilities.

1.2 What is management?

Management of decentralized systems is implementation of a comprehensive, life-cycle series of elements and activities that address public education and participation, planning, performance requirements, site evaluation, design, construction, operation and maintenance, residuals management, training and certification/licensing, inspections/monitoring, corrective actions and enforcement, recordkeeping/inventorying/reporting, and financial assistance and funding. Therefore, a management program involves, in varying degrees, regulatory and elected officials, developers and builders, soil and site evaluators, engineers and designers, contractors and installers, manufacturers, pumpers and haulers, inspectors, management entities, and property owners. Establishing distinct roles and responsibilities of the partners involved is very important to ensuring proper system management.

The voluntary management guidelines apply to both existing communities and to areas of new development that use onsite and cluster systems of any size for residential and commercial wastewater treatment and dispersal. Centralized collection and treatment facilities are not addressed here. Industrial wastewater treatment systems are also not addressed, since many industrial wastes are prohibited by federal and state regulation from using onsite treatment and dispersal, because of the potential to interfere with wastewater treatment, and/or pollute ground water resources.

The management guidelines are not intended to be used to determine appropriate or inappropriate uses of land. The information in the Guidelines is intended to be used to help select appropriate management strategies and technologies that minimize risks to human health and water resources in areas where connections to centralized wastewater collection and treatment systems are not considered appropriate. The determination of appropriate siting requirements, system density restrictions or required technologies is a state, tribal or local decision.

1.3 Why is management needed?

The performance of onsite and cluster wastewater treatment systems is a national issue of great concern to USEPA. Onsite and cluster wastewater treatment systems serve approximately 25 percent of U.S. households and approximately 33 percent of new development. Onsite and cluster systems can provide a high level of public health and natural resource protection if they are properly planned, sited, designed, constructed, operated and maintained. Unfortunately, many of the systems currently in use do not provide the level of treatment necessary to adequately protect public health and/or surface and ground water quality. Many were initially sited and installed, as temporary solutions as a result of the perception that centralized treatment and collection would soon replace them. Comprehensive, life cycle management did not play a role in the approval and/or in the ongoing operation of many systems. More than half the existing onsite systems are over 30 years old, and surveys indicate at least 10 percent of these systems backup onto the ground surface or into the home each year. Other data has shown that at least 25 percent of systems are malfunctioning to some degree.[2] In a majority of cases, the homeowner is not aware of a system failure until it backs up in the home or breaks out on the ground surface. In many areas of the country, the local authority lacks records of many of the systems within the service area.

In the National Water Quality Inventory, 1996 Report to Congress, state agencies designated the top ten potential contaminant sources, which threaten their ground water resources. The second most frequently cited contamination source is septic systems. The report states that "improperly constructed and poorly maintained septic systems are believed to cause substantial and widespread nutrient and microbial contamination to ground water." Other contaminant sources identified by states included underground storage tanks, landfills, large industrial facilities and numerous other activities. States have also identified over 500 communities in the 1996 Clean Water Needs Survey as having failed septic systems that have caused public health problems. In 1996, septic systems were reported by states as a leading source of pollution for more than one-third (36 percent) of the impaired miles of ocean shoreline surveyed. Other leading sources included urban runoff/storm sewers, municipal sewer discharges, and industrial point sources. In U.S. classified shellfish growing areas, closures and harvest restrictions have occurred primarily because of "the concentration of fecal coliform bacteria associated with human sewage and with organic wastes from livestock and wildlife." The 1995 National Shellfish Register indicated that the most common pollution source cited for shellfish restrictions was urban runoff (principal or contributing factor in 40% of all harvest-limited growing areas), followed by unidentified upstream sources (39%), wildlife (38%) and septic tanks (32%). Onsite wastewater systems also may be contributing to an overabundance of nutrients in ponds, lakes and coastal estuaries, leading to overgrowth of algae and other nuisance aquatic plants. For example, the 45,000 septic systems in Sarasota County, Florida, contribute four times more nitrogen to the Bay than the City of Sarasota's advanced wastewater treatment plant.

Onsite and cluster wastewater systems also contribute to contamination of drinking water sources. USEPA estimates that 168,000 viral and 34,000 bacterial illnesses each year occur as a result of consumption of drinking water from systems which rely on improperly treated ground water. The contaminants of primary concern in USEPA's study of ground water-based drinking water systems are waterborne pathogens from fecal contamination. Malfunctioning septic systems are identified as a potential source of this contamination; other sources could include leaking or overflowing sanitary sewer lines, as well as stormwater runoff. A recent example of contamination involved nearly 800 visitors to a fair in Washington County, New York, who became ill after consuming water from a well source which was likely contaminated by a septic system at an adjacent dormitory. Other examples in which septic systems were attributed to be the pollution source include 82 cases of shigellosis resulting from a contaminated well in Island Park, Idaho in 1995, 46 cases of hepatitis A from a privately-owned water supply in Racine, Missouri, and 49 cases of hepatitis A in Lancaster, Pennsylvania in 1980. USEPA is also concerned with the presence of nitrates in groundwater, particularly in rural areas where residents must rely on individual wells and onsite systems to serve relatively small lots.

While it is difficult to measure and document specific cause-and-effect relationships between onsite wastewater treatment systems and the quality of our water resources, it is widely accepted that improperly managed systems (resulting from inadequate siting, design, construction, installation, operation and/or maintenance) are contributors to major water quality problems. As documentation becomes available concerning the source of impairments, USEPA will be better able to determine the extent of the relationship. It is already evident that improved operation and performance of onsite and cluster systems through better management practices will be essential if the nation's water quality and public health goals are to be attained.

1.4 What are the benefits of a management program?

Benefits of a management program are accrued by both the communities developing effective management programs and the individual property owners and include:

<u>Protection of public health and local water resources</u>: Although unquantified, septic system failures in the form of yard backups have been recognized as a public health hazard and an insult to natural resources for many years. Improved management practices will minimize the occurrence of failures by ensuring (with proper planning, siting, design, installation, operation and maintenance, and monitoring) pollutants are adequately treated and dispersed into the environment, thereby reducing risks to both public health and local water resources.

<u>Protection of property values:</u> There are many documented instances over the last few decades of the increased value of property in areas formerly served by failing onsite systems after the area has been sewered. Management programs offer an opportunity to obtain the same level of service and aesthetics as

sewered communities at a fraction of the cost, thus providing property appreciation and cost savings.

Ground water conservation: A well-managed onsite system will contribute to groundwater recharge. Many areas of the United States which have undergone rapid development and sewering are experiencing rapidly declining water tables and/or water shortages because ground water is no longer being recharged by onsite systems.

Preservation of tax base: A well-managed onsite system will prevent small communities from having to finance the high cost of centralized sewers. Many small communities have exhausted their tax base at the expense of other public safety and education programs to pay for those sewers. Many communities then entice growth in an effort to pay for these systems, thus destroying the community structure, which originally attracted residents.

Life-cycle cost savings: There is a clear indication that, in many cases, management may pay for itself in terms of lower failure rates and alleviating the need for premature system replacement; however, this will depend on the types of systems that are employed and the management program chosen. Documentation of that savings is only now being initiated.

1.5 Handbook audience and use

This handbook is intended to provide a basic understanding of important elements of management programs for decentralized wastewater systems and to provide options, examples, and case studies that can help local communities address their management needs. The primary audiences for this handbook are state, tribal and local regulators that are responsible for regulating decentralized systems. Secondary audiences include service providers (designers, installers, pumpers, haulers and inspectors), elected officials, and others interested in improving the management of small wastewater systems.

USEPA recognizes that management programs will vary widely across the Nation. Some communities will elect to adopt a cooperative management program that organizes and coordinates the activities of the regulatory authority, water resource agency, planning department, service providers, and other interested parties (e.g., volunteer monitoring groups, homeowner associations, sanitation districts, etc.). Other jurisdictions might have the resources to develop a responsible management entity (RME) with the technical, managerial, and financial capacity to ensure long-term, cost-effective management, operation, and maintenance of all systems within the designated service area. The exact configuration of local management programs will be based on the resources available, the nature of public health and water resource threats posed by onsite systems, and the creativity and commitment of the regulatory authority and other interested parties.

In developing a management program, it is important to identify those interested parties vital to the success of any decentralized management program. These include not only members of the community served, local elected officials, regulators, and local service providers, but also local lenders, land developers, real estate professionals, planners, and others who are affected by the nature and vitality of the community and its environment. For example:

- *Residents* are concerned about the public health of the community, the cost of the alternative solutions, and how the program chosen will affect the quality of their daily lives and their property values.
- *Regulators* are also primarily concerned about public health and the quality of the water resources that are affected by the community.
- *Local officials* are most concerned about the economic well being of the community and the

impact of any wastewater problems, as well as community support for the program.

- *Service providers* that perform operation and maintenance on existing systems are concerned about the impact of the management program on their livelihood.
- *Land developers* want to know what areas are available for development and what wastewater treatment infrastructure requirements will be placed on those areas.
- *Lending institutions* and real estate professionals need to know how the management program will assure proper treatment and the impact of a management program on property values.
- *Planners* are concerned about land use issues, such as where development can occur and any specific performance requirements necessary for wastewater treatment in different areas.

Stakeholders and other interested parties can use the chapters that follow to develop a better understanding of the range of management program structures and operational processes. Local community leaders are encouraged to refer to the Resources section for further details on specific program elements and to be creative, cooperative, and patient in developing a management program suited to their particular circumstances.

Table 1-1. Types of decentralized wastewater treatment systems

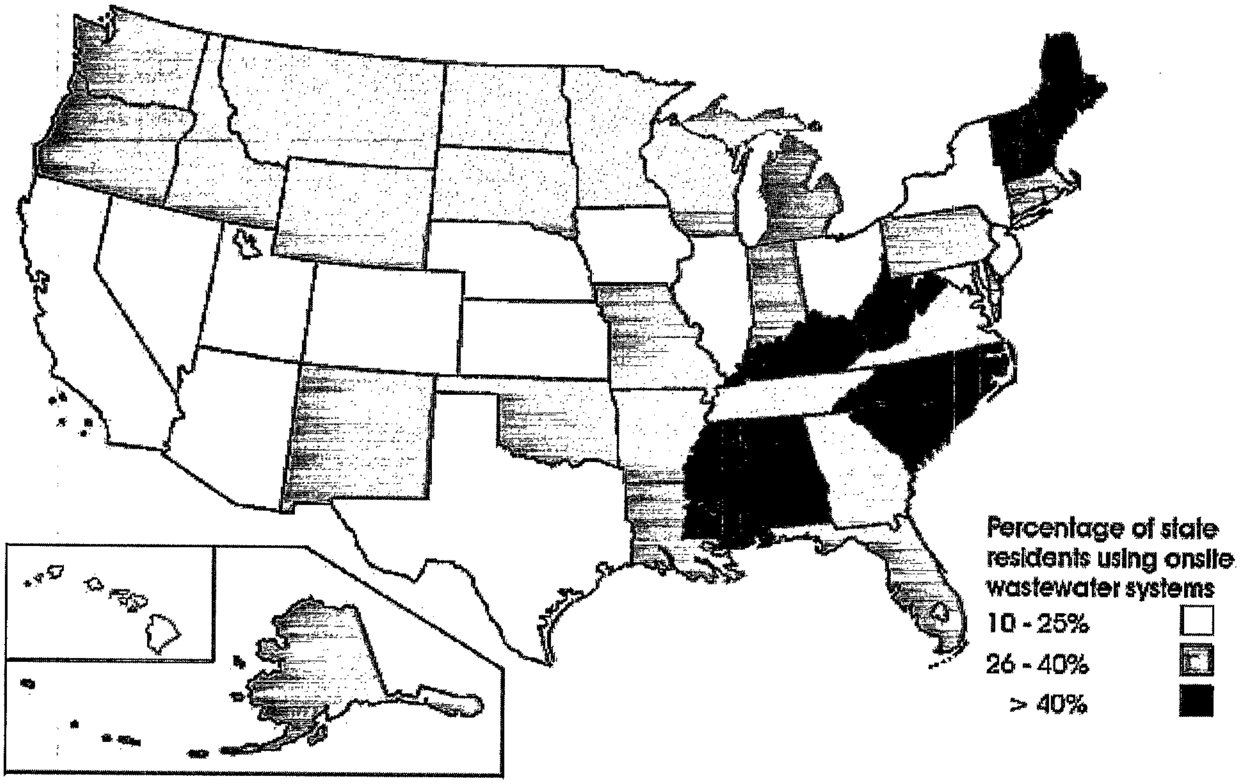
Type of system	Description
Individual onsite systems	Systems that serve an individual residence and can range from conventional septic tank/drainfield systems to systems composed of complex mechanical treatment trains.
Cluster systems	Wastewater collection and treatment systems that serve two or more dwellings or buildings, but less than an entire community, on a suitable site near the served structures.
Commercial, residential, institutional, and recreational facilities	Systems designed to treat larger and sometimes more complex wastewater sources from commercial buildings (e.g., restaurants), apartments, or institutional or recreational facilities.

1.6 Background on decentralized wastewater systems

Historically, the design and siting of onsite wastewater treatment systems has been an inconsistent process. Conventional septic tank and gravity-fed leach field systems were installed based on economic factors, the availability of adequate land area, and simple health-based measures aimed primarily at preventing direct public contact with untreated or inadequately treated wastewater. Outside of the establishment of vertical and horizontal setbacks, little attention has been devoted to mitigating the impacts of these systems on local ground and surface water resources. Only recently has there been an understanding of these issues and potential problems associated with failing to manage onsite systems in a comprehensive, holistic manner.

The common misperception that has served as a major barrier to advancement of the decentralized approach—that onsite systems are inferior, old-fashioned, less technologically advanced, and not as safe as centralized wastewater treatment systems—has caused many small communities to construct very expensive centralized sewage collection and treatment systems (USEPA, 1997). The greater distances between residences, the high cost of deep excavation and regularly spaced manholes, and the high cost of operating and maintaining lift stations and urban treatment facilities have made these systems a burden on many of those communities. These costs may be unaffordable for many, if not most, small communities and rural areas. Even when it is affordable, centralized wastewater collection and treatment systems might not be the most environmentally sound option for all situations.

Figure 1-1. Onsite treatment system distribution in the United States

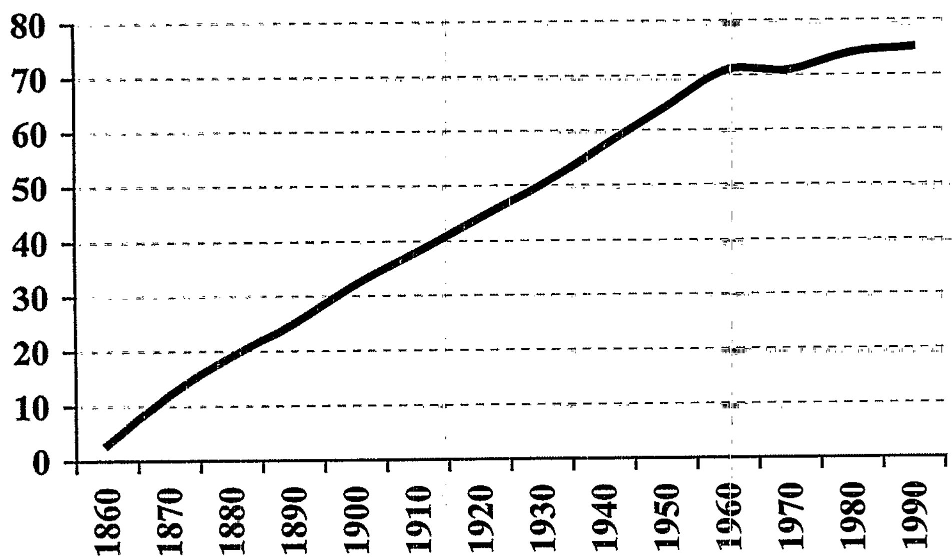


Source: U.S. Census Bureau, 1990

Conventional centralized sewers transport wastewater and often infiltrating ground water away from its natural location, thus lowering ground water tables. The frequent loss of the ability to finance other community needs because of the high capital sewage treatment costs has had irreversible negative impacts on the economic vitality of some smaller communities that have opted for these systems. In addition, centralized treatment systems have a greater capacity to contribute to unpredicted, unplanned growth and development that can cause increased pollution from storm water runoff. Finally, the consolidation of many small wastewater streams into one large one at one treatment facility increases the possibility of catastrophic damage to sensitive receiving environments when treatment or collection system failures occur.

As development patterns change and increased development occurs in rural areas and on the urban fringe, many communities are evaluating whether they should invest in centralized sewers and sewage treatment plants or continue to rely on onsite systems. Investment by small communities in conventional collection and treatment systems increases taxes and costs to consumers and may induce unwanted growth and negative impacts on water quality and society. During the 20th century the percentage of people served by centralized sewage treatment increased steadily, ultimately reaching about 75 percent by 1990 (see figure below). This was due in part to urban public works investments that were financed to a large degree by federal funds. The lure of 50 percent or more in matching funds was difficult for local authorities to resist, especially because the prevailing beliefs were that (1) the entire country would eventually be sewered and (2) sewers stimulate growth of the local economy.

Figure 1-2. Percentage of U.S. residents served by centralized treatment



Source: U.S. Census Bureau

> Although onsite wastewater disposal is a valid alternative to public sewers, particularly in rural areas; without proper design, construction, maintenance and management these systems can cause ground water or surface water contamination.
>
> Fred Bowers
> *NJ Regulator*

During the 1980s it became clear that the federal grant program might be impeding the development of cost-effective wastewater systems for smaller communities, which were at the bottom of the population-based priority system for grant monies. Also, many local governments found that for every dollar they spent on sewer extensions, less than a dollar came back in the form of increased revenues. In some cases the unplanned growth and development inducements resulting from efforts to increase the tax base to pay for the centralized sewer resulted in uncontrolled growth and additional environmental damage (NCCF, 1997). The Construction Grants Program that provided most of these funds was eventually terminated in 1990. The present distribution of onsite systems in each state is illustrated in Figure 1-1. Recent statistics indicate that the unsewered percentage of the population will rise in the near term, given that more than 32 percent of all new housing being built today is served by onsite wastewater systems (U.S. Census Bureau, 1999). The Management Guidelines and this handbook are therefore timely, especially in light of the relative cost to homeowners of central sewers and treatment facilities for smaller communities. For example, Kreissl and Otis (1999) found that centralized treatment for smaller communities costs two to four times more per customer served than treatment in urban areas for the same technologies.

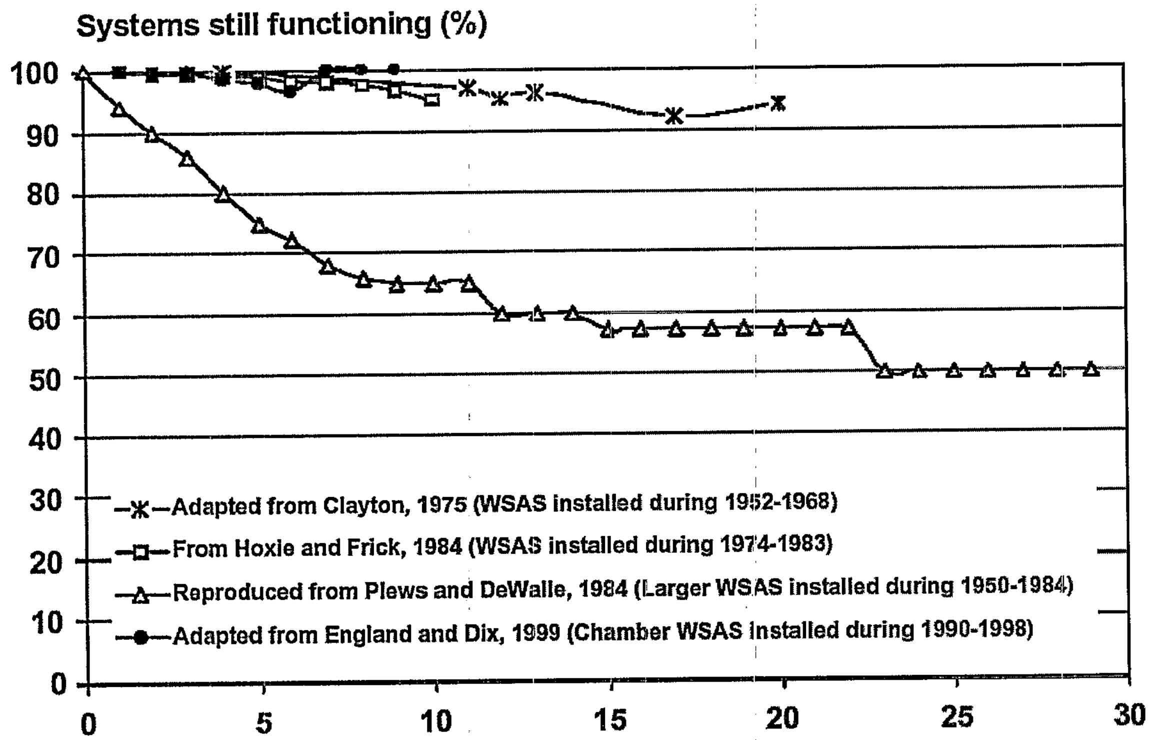
The points discussed previously beg the question of why small communities and rural developments abandon existing onsite wastewater systems and invest in expensive central collection and treatment systems. In many cases it is because partially treated effluent from some of the old onsite systems began to back up or surface, resulting in aesthetic problems and public health risks. In other cases, attractive financing packages or a lack of familiarity among consultants regarding newer, better-performing decentralized treatment options resulted in the selection of centralized service.

Table 1-2. Common definitions for OWTS failures

Type of failure	Evidence of failure
Hydraulic	Untreated or partially treated sewage pooling on ground surfaces; sewage backup in plumbing fixtures; sewage breakouts on slopes
Chemical pollutant contamination of ground water	High nitrate levels in drinking water wells; taste or odor problems in well water caused by untreated, poorly treated, or partially treated wastewater; presence of toxic substances (e.g., solvents, cleaners) in well water
Microbial contamination of ground and surface water	Shellfish bed bacterial contamination; recreational beach closures due to high bacterial levels; contamination of down-gradient drinking water wells with fecal bacteria or viruses
Nutrient contamination of surface water	Algal blooms, high aquatic plant productivity, low dissolved oxygen concentrations in nearby freshwater and marine water bodies

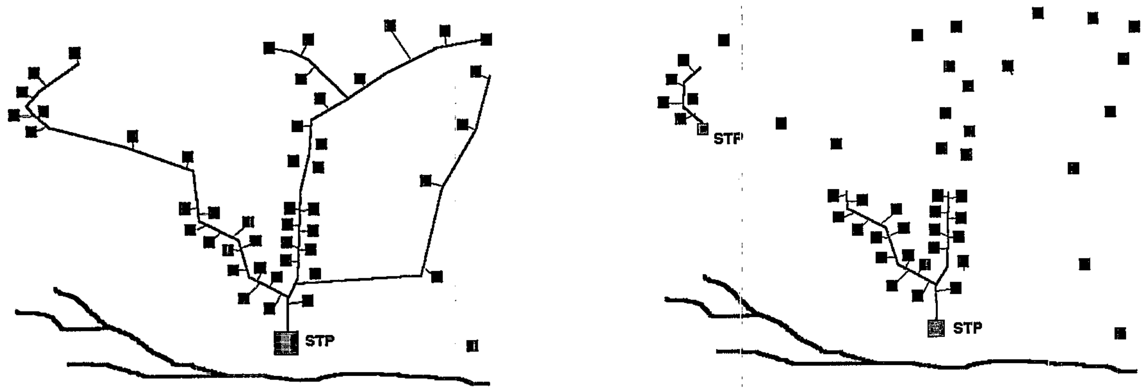
The belief that onsite systems are prone to failure has also motivated smaller communities to opt for centralized sewage collection and treatment. The actual failure rate for onsite systems varies widely across the Nation. The percentage of hydraulic backups to the surface is claimed to vary from less than 1 percent to 10 percent annually in various state studies (see Figure 1-3). Herring (2001) suggested even higher failure rates in a recent review of management program case studies. Some studies have concluded that onsite systems were contaminating otherwise potable ground water or nearby surface waters with nitrate, nutrients, and/or bacteria. For example, the New York Department of Environmental Conservation estimated in 1993 that OWTSs were the primary cause of impairment for 180 water bodies and the secondary cause for impairment in several hundred others (Herring, 2001).

Figure 1-3. A sample of studies comparing system functionality with system age



The development of modern onsite treatment technologies and comprehensive management programs, however, is starting to reverse these trends. The onsite wastewater treatment industry, state regulators, technical support organizations (e.g., National Small Flows Clearinghouse), and professional associations (e.g., National Onsite Wastewater Recycling Association) have made tremendous progress over the past 10 years in addressing the economic, technical, and managerial challenges associated with decentralized wastewater treatment. The task for implementing the treatment technologies and management programs resulting from this work is now in the hands of local communities.

Figure 1-4. Centralized wastewater treatment vs. the decentralized approach.



Centralized wastewater treatment

Decentralized approach

Decentralized wastewater management: a challenge for America's communities

The benefits of managing decentralized wastewater treatment systems are directly linked to pollution prevention. The overall strategy of a management program is to ensure that appropriate system planning, design, installation, operation, maintenance, produces treated effluents that meet local water quality requirements. Demonstrating the costs of contaminated surface or ground water can be difficult. However, consideration of the individual and cumulative impacts of treatment failure provides some context for quantifying *cost avoidances* related to preventing pollution rather than addressing the often-cascading impacts that can follow.

A number of high-profile incidences of failure, which caused significant impacts, have been identified. In addition, state and regional studies can be found throughout the Nation which indicate the importance of preventing health and water resource threats posed by inadequate wastewater treatment. For example:

- A waterborne *E. Coli* outbreak at the 1999 Washington County Fair in New York resulted in two deaths and 71 hospitalizations. A New York State Health Department investigation concluded that the outbreak might have resulted from contamination of a drinking water well by a dormitory septic system on the fairgrounds (New York Department of Health, 2000).
- Septic system failures have been documented by a counties, local health departments, regional planning commissions, and planning organizations in Colorado. Numerous reports have shown groundwater contamination and potential health risks, particularly at the subdivision level of development (Colorado Department of Public Health and Environment, 1999).
- Septic systems in Maine directly discharge the largest volume of wastewater into the subsurface environment, including contaminants such as nitrates, bacteria, viruses, and toxic chemicals from household products (Maine Department of Environmental Protection, 2002).
- A survey conducted by the Idaho Farm Bureau in three counties showed that about 4 percent of the wells sampled failed to meet the drinking water standard for nitrate. Septic systems were cited as among the three likely sources of contamination (Mahler, et.al., 2000).
- In Wayne County, Michigan, studies conducted for the Rouge River National Demonstration Project documented rapid migration of septic system effluent to nearby surface waters, particularly among older systems (Wayne County Department of Public Health, 1997).
- The Southern California Coastal Water Research Project found that bacteria from septic systems and other sources contaminates more than half of the region's shoreline, especially after heavy rains (Cone, 2000).

The high rate of failure in some communities is linked to poor system management and improper application of onsite wastewater treatment technology rather than an overall inability of onsite systems to adequately treat and disperse wastewater. Indeed, the onsite treatment industry has developed a variety of treatment units and system components capable of meeting even the most stringent performance requirements on sites with significant design limitations. However, the availability of advanced treatment technology cannot guarantee performance in the absence of effective management programs that address the full range of onsite wastewater treatment considerations. Management is the key to meeting performance requirements and protecting human health and water resources from pollutants of concern. A list of typical pollutants is provided in Table 1-3.

Table 1-3. Typical pollutants of concern from onsite systems

Pollutant	Reason for concern
Suspended Solids (TSS)	In surface waters, TSS can result in the development of sludge deposits that smother benthic macroinvertebrates and fish eggs and can contribute to benthic enrichment, toxicity, and sediment oxygen demand. Excessive turbidity can block sunlight, harming aquatic life (e.g., by blocking sunlight needed by plants) and contribute to decreased dissolved oxygen in the water column. In drinking water, turbidity is aesthetically displeasing and interferes with disinfection.
Biodegradable organics (BOD, COD, TOC)	Biological stabilization of organics in the water column can deplete dissolved oxygen in surface waters, creating anoxic conditions harmful to aquatic life. Oxygen-reducing conditions create taste and odor problems in drinking water and allow metals to leach from soil and rock in ground and surface waters.
Pathogenic organisms (virus, bacteria, parasites)	Parasites, bacteria, and viruses can cause communicable diseases through direct/indirect body contact or ingestion of contaminated water or shellfish. A particular threat when partially treated sewage pools on ground surfaces or migrates to recreational waters. Transport distances of some pathogens in ground or surface waters can be significant.
Nitrogen (N)	Nitrogen is an aquatic plant nutrient that can contribute to eutrophication and dissolved oxygen loss in surface waters, especially in lakes, estuaries, and coastal embayments. Algae and aquatic weeds can contribute trihalomethane (THM) precursors to the water column that might generate carcinogenic THMs in chlorinated drinking water. Excessive nitrate-nitrogen in drinking water can cause methemoglobinemia in infants and pregnancy complications. Livestock also can suffer health impacts from drinking water high in nitrogen. Ammonia in surface waters can be toxic to fish.
Phosphorus (P)	Phosphorus is an aquatic plant nutrient that can contribute to eutrophication of inland and coastal surface waters and reduction of dissolved oxygen.
Toxic Organic Compounds	Toxic organic compounds present in household chemicals and cleaning agents can interfere with certain biological processes in conventional and alternative OWTSs and can be persistent and bioaccumulative in the aquatic environment. They can cause damage to ecosystems and human health directly or through ingestion of contaminated aquatic organisms (e.g., fish, shellfish).
Heavy metals	Heavy metals (e.g., lead, mercury) in drinking water can cause human health problems. In the aquatic ecosystem, they also can be toxic to aquatic life and accumulate in fish that might be consumed by humans, resulting in metal toxicity health threats.
Dissolved Inorganic Compounds	Chloride and sulfide can cause taste and odor problems in drinking water. Boron, sodium, chlorides, sulfate, and other solutes might limit reuse options (e.g., irrigation).

Source: Adapted in part from Tchobanoglous and Burton, 1991.

1.7 Current status of decentralized wastewater management

In 1997 USEPA issued the *Response to Congress on Use of Decentralized Wastewater Treatment Systems*. This report was a milestone: USEPA acknowledged for the first time that sewering the entire country was not feasible and that decentralized wastewater systems were a viable alternative to centralized facilities. The report also described the inherent benefits of properly managed decentralized wastewater systems:

- More cost-effective than central sewer alternatives, except in densely populated urban centers.
- Longer service lives for managed onsite systems vs. unmanaged systems.
- Faster response to problems; smaller problem impacts.
- Increased opportunity for better watershed management.
- Better ground water protection and management capabilities.
- Increased property values.

The process of developing a cooperative or stand-alone management program is beneficial because it involves participatory action – community visioning, long-term planning and stakeholder information exchanges – and complements other wastewater planning needs. Management programs also promote professionalism among service providers, offer the opportunity for performance-based rather than prescriptive regulation, provide a vehicle for funding needed services, and make enforcement approaches more flexible. Despite the inherent advantages of properly managed decentralized systems, however, five major barriers continue to inhibit full utilization of alternative wastewater management systems:

- Lack of knowledge of the benefits and potential uses of decentralized systems on the part of regulatory and technical practitioners and local governments and citizens.
- Legislative and regulatory constraints that inhibit optimum use of decentralized systems.
- Lack of management programs that can optimize performance of decentralized technologies.
- Liability and engineering fees that discourage consideration of these alternatives.
- Financial barriers that inhibit the application of decentralized systems.

Overcoming these barriers will require significant effort on the part of federal, tribal, state, and local regulatory authorities and the management programs needed to support them. USEPA has identified the following actions as essential in addressing the barriers listed above:

- Improved education of technical practitioners, including engineers, service providers (those responsible for site evaluation, installation, and operation/maintenance), regulators, local citizens, and political leaders who need to understand how these systems work, how they should be managed, and how they affect public health and water quality. Efforts by the U.S. Department of Agriculture (USDA), USEPA, the National Decentralized Water Resources Capacity Development Project (NCDP), National Small Flows Clearinghouse (NSFC), National Environmental Services Center (NESC), National Environmental Health Association (NEHA), National Association of Counties (NACO), National Association of Waste Transporters (NAWT), and other national organizations are underway to improve education of engineers, service providers, regulators, and others who assist small communities.

- Improved state and regional regulatory programs based on system performance rather than use of restrictive codes, which rely on assumptions that certain site characteristics will protect public health and water resources. USEPA, the National Onsite Wastewater Recycling Association (NOWRA), and some states are seeking to develop management models to expand the range of technical options to address existing onsite wastewater problems.

- Development of effective management programs to ensure that performance requirements are met. The USEPA management guidelines and this handbook are part of a major effort by USEPA, NSFC, NESC, and the NCDP to gather and share information on successful management approaches that enable small communities to protect public health and environmental quality in an affordable, cost-effective manner.

- Establishment of financing programs that assist local communities in creating and implementing effective management programs. USEPA, USDA, and other organizations have developed programs to assist small communities, but more creative financing approaches are needed. For example, New York State has announced a "one stop shopping" program for all assistance programs for use by communities seeking financial assistance.

Benefits of improved decentralized wastewater management

USEPA has documented the benefits of a well-managed decentralized wastewater treatment system. Benefits accrued by communities developing onsite wastewater management programs include:

- Protection of public health and local water resources by ensuring pollutants are adequately treated and dispersed into the environment;
- Protection of a homeowner's investment in property and the ability to build home equity;
- Protection of a community's image;
- Elimination of the need to use a community's tax base to finance community wide wastewater infrastructure;
- Cost savings over the life of a system, alleviating the need for premature system replacement; and
- Elimination of the potential for major impacts due to system malfunctions and reduction in the vulnerability to system upsets.

1.8 Overview of management program structure and function

In most state, tribal, and local onsite wastewater control systems, a regulatory authority or agency is designated by statute or code to handle permitting, installation inspection, complaint response, enforcement, and other functions. Regulatory authority is typically delegated by the state agency to local health departments, but in some jurisdictions these duties may be executed by water resource agencies, planning and zoning programs, or other governmental organizations. The regulatory role usually involves permitting a system based on site conditions, executing a brief inspection, and expecting it to perform without any further intervention until a complaint is filed. The homeowner is responsible for all operation and maintenance required. This system of "benign neglect" has worked fairly well for the past century, i.e., it has addressed hydraulic failure with some regard for environmental consequences. However, any improvement in protecting public health and the environment can only be accomplished by developing management programs that address the key elements of system management, operation, and maintenance.

Management services may be provided by an enhanced regulatory authority, a group of public or private entities organized under a cooperative management program, or a responsible management entity. The management program can be supported by cooperating partners, service fees, special property assessments or other assessments, or funding from other sources. Depending on state, tribal, and/or local codes, revised enabling legislation or special agreements might be required for a responsible management entity to assume responsibility for certain program elements, such as permitting, permit holding, supplemental training/certification/licensing, monitoring, and system ownership.

The regulatory authority and the management program or entity must ensure that all onsite and cluster wastewater systems in the management jurisdiction meet the *performance requirements* established for protection of public health and ground and surface water resources. Performance requirements can be numeric (e.g., effluent nitrate concentrations must be below 15 mg/L) or narrative (e.g., no visible sewage on the ground surface or objectionable odors), or they can be based on compliance with prescriptive codes that are presumed to meet public health and water resource protection goals.

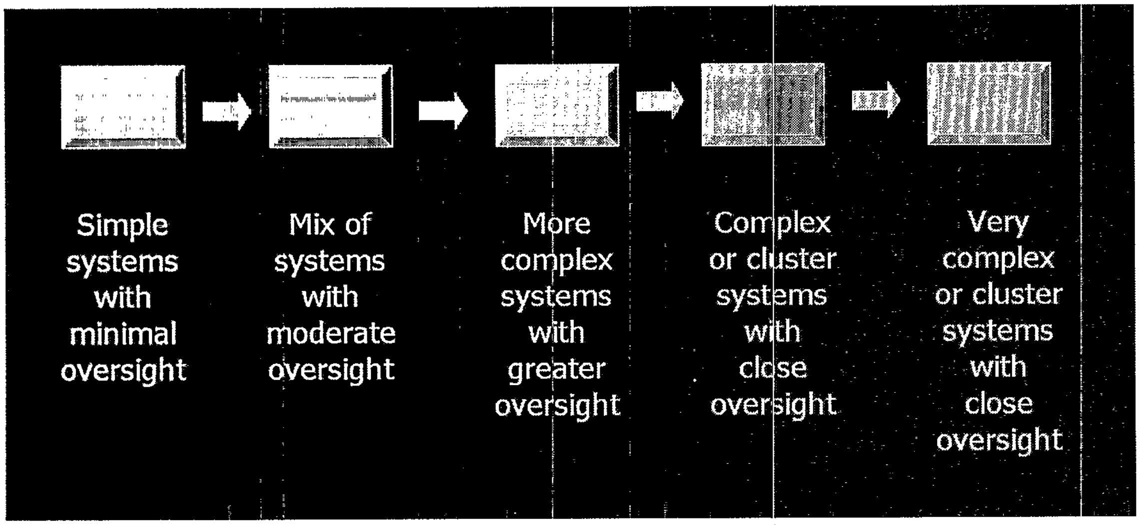
> "The benefits of good management of your wastewater system include:
> - Reduced costs for repairs, maintenance and replacement
> - Longer system life
> - Improved system performance
> - Increased reliability and overall satisfaction"
>
> *Small Community Wastewater Solutions: A Guide to Making Treatment, Management and Financing Decisions*

An example of how a performance-based program might function would be a jurisdiction where a local/regional cooperative management program works with the regulatory authority and state water and natural resource programs to assess surface and ground waters, identify areas where water quality criteria (i.e., under the federal Clean Water Act) are not being met, and designate critical areas where decentralized systems pose elevated risks (e.g., sites with poor soils, high water tables, high densities of existing systems, near sensitive surface waters, or in floodplains). The management program would then work with the regulatory authority and the community to develop onsite system performance requirements tailored to mitigate potential decentralized wastewater treatment system impacts on the receiving waters. The regulatory authority might choose to retain its power to issue system construction and operating permits, but delegate responsibilities for system design, inspection, and operation and maintenance to a management entity that could collect fees, enter into contracts, or receive funding for their services through other means. In all cases, the management entity must of itself or in concert with its partners have the required powers listed below to effectively accomplish its goals. For example, a stand-alone responsible management entity might be charged with:

- Authority to own, purchase, lease and rent both real and personal property;
- Right of access to the systems it governs by covenant, ordinance, or other suitable instrument;
- Eligibility for loans and grants for construction of facilities;
- Ability to enter into contracts and to undertake debt obligations, either by borrowing or issuing stocks or bonds;
- Authority to set and collect charges for system usage and/or oversight, set the value of such benefit, and assess or collect the cost from each property owner that is benefited;
- Power to make rules and regulations regarding use of on-site/small-scale systems; and
- Power to require the abatement of malfunctioning systems.

Management programs that require system owners to assume full responsibility for operation and maintenance have proven to be largely ineffective (Herring, 2001). Therefore, the management models presented in the USEPA voluntary guidelines recommend system inventories and maintenance reminders to system owners as the foundation upon which management programs should be built. At the other end of the management continuum, the guidelines suggest a program wherein a sanitation district or other entity owns, operates, and maintains onsite and cluster systems and charges users a monthly fee in a manner similar to conventional sewage collection and treatment operations. The middle ranges of the management continuum recommend required maintenance contracts for higher risk systems and revocable, renewable operating permits where appropriate. Again, the key consideration in developing, implementing, and sustaining a management program is protecting public health and water resources.

Figure 1-5. The decentralized wastewater management continuum.



Local communities can tailor their management approach in accordance with their resources, management capabilities, and the necessary level of protection for health and sensitive water resources as expressed by statutes, codes, and community input. The decentralized management continuum can accommodate a wide range of program activities as long as each of the program elements are addressed during the planning and periodically throughout the implementation phase. A matrix that can be used to match program elements (see Chapter 2 for description) to entities partnering in the management program is presented as Table 1-4. This table is valuable for assessing the status of management at the start of management program planning, checking the management options chosen for consideration, and reviewing the program periodically to determine the need for changes.

Figure 1-6. Management intensity as a function of environmental sensitivity and resource value.

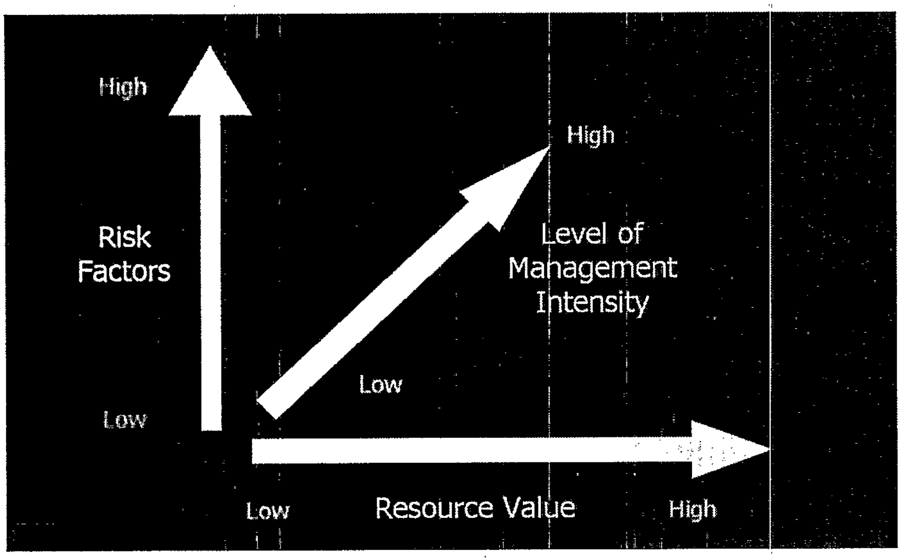


Table 1-4. Management program elements and suggested entities to support management activities.

	State Health Dept.	State Water Agency	District/County/ Local Health Dept.	County or Local Government Office	Local/Regional Planning Office	Public/Private Management Entity	System Owner (Homeowner)	Private Contractor or Service Provider
Public Education and Participation								
System owner/operator education and training								
Public outreach, education, involvement programs								
Planning								
Stakeholder and partner agency involvement process								
Watershed and groundwater assessments								
Sensitive and critical area designations								
Performance Requirements								
Public health and water resource protection goals								
General requirements for all systems								
Requirements for systems in sensitive/critical areas								
Training, Certification and Licensing								
Type of staff and service providers covered								
Certification/licensing requirements								
Training for staff and service providers								
Site Evaluation								
Wastewater characterization procedures								
Site investigation and suitability analyses								
Design								
Prescriptive or performance-based criteria								
Design review and approval process								

Construction								
Permitting requirements and process								
Construction and/or installation oversight								
Operation and Maintenance								
Owner/operator requirements								
Performance certification approaches								
Residuals Management								
Residuals removal/disposal requirements								
Tracking and reporting system								
Inspections and Monitoring								
Routine and emergency inspections								
Targeted surface and ground water monitoring								
Corrective Actions and Enforcement								
Compliance schedules and enforcement program								
Repair, upgrade, or replacement oversight								
Record Keeping, Inventory, and Reporting								
Existing and new systems inventory								
Tracking system for permits, inspections, maintenance								
Financial, administrative, and program management								
Financial Assistance and Funding								
Funding source development								
Administration/management funding								
Installation and O&M assistance								

Chapter 2 Developing and implementing elements of the management program

2.1 Program elements and the management continuum

Onsite wastewater management programs can strengthen public health and water resource protection by ensuring that treatment systems meet performance requirements established by the community. The program elements (components) of a comprehensive management program will be fairly universal across the Nation, regardless of the environmental conditions, economic situation, or available resources of the community. How each element of a site-specific management program is developed, supported, and implemented, however, will vary significantly.

A community should develop management programs in response to its needs, resources, and goals. Communities should evaluate their environmental and public health goals, the condition and performance of the systems to be managed, the value and vulnerability of their water resources, and their support capabilities during the management program development process. The regulatory authority (e.g., local health department), service providers, water resource agencies, planning offices, and citizens of the community will all be important sources of support for developing and implementing selected activities under each program element.

> How each element of a site-specific management program is developed, supported, and implemented will vary significantly.

The management program development group should recognize that for each program element there is a range of possible approaches and that the appropriate activities for each element should be based on the needs and capabilities of the community. For example, rural jurisdictions with little new residential or commercial construction will likely have a less developed planning function than a jurisdiction outside a major city facing large-scale development pressure. Some jurisdictions might have a rigorous program for certifying and licensing design professionals, while others might allow only health department staff and certified/licensed designers to design systems. The wide array of different management programs becomes obvious when one considers the list of program elements and the range of activities under each.

Table 2-1 lists the various major categories of management program functions along with the program elements of each. Table 2-2 provides further detail on each program element. The key point in developing a management program is to address real, perceived, and developing problems with actual, on-the-ground resources and programmatic capabilities. Prioritizing, targeting, and addressing human health and water resource threats will likely drive development of program element activities.

In most state, tribal, and local onsite wastewater control systems, a regulatory authority or agency is designated by statute or code to handle permitting, installation inspection, complaint response, enforcement, and other functions. Regulatory authority is typically delegated by the state agency to local health departments, but in some jurisdictions these duties may be executed by water resource agencies, planning and zoning programs, or other governmental organizations. The regulatory role usually involves permitting a system based on site conditions, executing a brief final inspection, and expecting it to perform without any further intervention until a complaint is filed. The homeowner is responsible for all operation and maintenance required. This system of "benign neglect" has worked fairly well for the past century, i.e., it has addressed hydraulic failure with some regard for environmental consequences. However, any improvement in protecting public health and the environment can only be accomplished by developing management programs that address a more comprehensive set of key management program elements.

The elements comprising a comprehensive management program have been under development for several decades, and include sets of activities focused within the following functional categories: 1)program planning and administration, 2) treatment system installation and operation oversight, and 3) compliance assistance and assurance see Table 2-1).

Table 2-1. Functional categories of management and program elements.

Category	Management program elements
Program administration	Public education and participation Planning Establishment of performance requirements Record keeping, inventories, and reporting Financial assistance and funding
System installation and operation oversight	Site evaluation System design Construction or installation Operation and maintenance Residuals management
Compliance assistance/assurance	Training and certification/licensing of service providers Inspections and monitoring Corrective actions and enforcement

Clearly, management programs will vary widely across the Nation. Many communities will elect to adopt a cooperative management program that organizes and coordinates the activities of the regulatory authority, water resource agency, planning department, service providers, and other interested parties (e.g., volunteer monitoring groups, homeowner associations, sanitation districts, etc.). Some jurisdictions might have the resources to develop a responsible management entity (RME) with the technical, managerial, and financial capacity to ensure long-term, cost-effective management, operation, and maintenance of all systems within the designated service area. The exact configuration of local management programs will be based on the resources available, the nature of public health and water resource threats posed by onsite systems, and the creativity and commitment of the regulatory authority and other interested parties.

Table 2-2. Summary of management program elements and possible approaches

Program element	Purpose	Basic activities	Advanced activities
Public education and participation	To maximize public involvement in the need for and implementation of the management program.	Provide public meetings, forums, updates, and education programs.	Provide public advisory groups, review groups, and other involvement opportunities in addition to basic program.
Planning	Consider regional and site conditions and impacts, long-term watershed, and public health protection.	Establish minimum lot sizes, surface/ground water setbacks and/or identify critical areas requiring more protection.	Monitor and model regional pollutant loads of different development scenarios; tailor development patterns and requirements to receiver site environmental conditions and technological capabilities.
Performance requirements	Link treatment standards and relative risk to health and water resource goals.	Prescribe acceptable site characteristics and/or system types allowed.	Require system performance to meet standards that consider water resource values, vulnerabilities, and risks.
Site evaluation	Assess site and relationship to other features.	Characterize landscape position, soils, ground & surface water location, size, and other site conditions.	Assess site and cumulative watershed impacts, ground water mounding potential, long-term specific pollutant trends, and cluster system potential.
Design	Ensure system is appropriate for site, watershed, and wastewater flow/strength.	Prescribe a limited number of acceptable designs for specific site conditions.	Implement requirements for developing alternative designs that meet performance requirements for each site, position in watershed, and wastewater flow/strength.
Construction	Ensure installation as designed; record as-built drawings.	Inspect installation prior to covering with soil and enter as-builts into record.	Provide supplemental training, certification & licensing programs; provide more comprehensive inspection of installations; verify & enter as-builts into record.
Operation and maintenance	Ensure systems perform as designed.	Initiate homeowner education/ reminder programs that promote regular O&M (pumping).	Require renewable, revocable operating permits with reporting requirements; verifiable responsibility for proper O&M activities.

Residuals management	Minimize health or environmental risks from residuals handling/dispersal.	Require compliance with federal and state residuals disposal codes.	Conduct analysis and oversight of residuals program; Web-based reporting and inspection of pumping and ultimate disposal facility activities.
Training and certification/licensing	Promote excellence in site evaluation, design, installation, and other service provider areas.	Recommend use of only state licensed/certified service providers.	Provide supplemental training and certification/licensing programs in addition to state programs; offer continuing education opportunities, and monitor performance through inspections.
Inspections and monitoring	Document proper service provider performance, functioning of systems, and environmental impacts.	Inspection prior to covering; inspections prior to property title transfer; complaint response.	Require regional surface and ground water monitoring; Web-based system and operational monitoring; required periodic operational & installation inspections.
Corrective actions and enforcement	Ensure timely return to compliance with applicable codes and performance requirements.	Complaint reporting under nuisance laws, inspection and prompt response procedures; penalties.	Denial and/or revocation of operating permit until compliance measures satisfied; set violation response protocol & legal response actions, including correction and liens against property by RME.
Record keeping, inventory, and reporting	Provide inventory development and maintenance for administrative, O&M, planning and reporting to oversight agencies.	Provide inventory information on all systems; performance reports to health agency as required.	Provide GIS-enabled, comprehensive inventories, including Web-based monitoring and O&M data for use in administration, O&M, compliance achievement and reporting activities.
Financial assistance and funding	Provide financial and legal support for management program.	Implement basic powers, revenue-generation and legal backup for a sustainable program.	Initiate monthly/quarterly service fees; cost-share or other repair/replacement program; full financial and legal support for management program; equitable revenue base and assistance programs; implementation of regular reviews and modifications.

2.2 Overview of management program elements

Onsite/decentralized systems can be managed by a variety of public or private entities, including health departments, neighborhood associations, special districts, private service providers, and existing centralized wastewater collection and treatment programs (e.g., sanitation districts). This chapter outlines the primary program elements of onsite wastewater management programs across the management continuum, from the smallest to the largest. As noted previously, the mix of regulatory authorities, management entities, and other organizations overseeing the various program elements described in this chapter will vary considerably from place to place. The key consideration in system management is ensuring that these program elements are addressed at the appropriate level so that systems operate properly and public health and environmental resources are protected. Soil-based onsite or cluster systems that serve 20 or more people or treat wastes from certain commercial facilities are subject to state or tribal regulation under the EPA Class V Underground Injection Control Program (EPA, 2001).

Effective management programs issue clear directives, provide technical and other requested assistance to stakeholders, and fairly apply community and regulatory authority oversight controls. Integrating the decentralized systems management program with other watershed or regional planning programs can help clarify program goals, define performance requirements, solidify community support, ensure that the management program elements are appropriate, and address the entire array of environmental challenges. Technical, financial, and other incentives can help ease cost and other burdens for service providers and system owners. Finally, an effective inspection and enforcement program ensures that systems requiring repair, expansion, or replacement are addressed promptly to minimize public health and ecological risks.

2.3 Issues to consider in assigning program element responsibilities

The overarching purpose of the EPA voluntary guidelines for onsite/decentralized systems is to provide guidance that will assist communities in providing an adequate level of management to assure long-term protection of public health and water resources in a cost-effective manner that also protects property values. How this is accomplished will be a product of the creativity, commitment, and capabilities of each local community and regulatory authority. In general, the management program for onsite/decentralized wastewater systems should be evaluated on how it responds to the issues raised by each of the program elements. The extent to which each program element is addressed and how it is implemented is dependent on the management program objectives, the various physical settings, the mix of technologies, jurisdictional boundaries, environmental conditions, and the desired role of the regulatory authority and management entity.

In any locale, the regulatory authority will play a key role in the creation of the management program. The powers and responsibilities of regulatory authorities vary from state to state, but in general, they allow for developing and implementing most activities associated with various elements of the management program (see Table 2-1 and the box below). Staffing, funding, or other limitations will likely prompt regulatory authorities to invite the interest and involvement of public and/or private partners in management program development. These stakeholders ! which might include planning departments, water resource agencies, private firms, service providers, college environmental science programs ! can help the regulatory authority address activities associated with some program elements through a cooperative, coordinated approach.

The distribution of tasks between the regulatory authority, management entity and service providers will vary depending on local circumstances, conditions, and the level of management desired. At higher levels of management (e.g., Management Programs 4 and 5) a RME is typically developed to be responsible for most or all activities associated with various elements of the management program. This facilitates the regulatory authority to focus on permit enforcement, broad oversight, policy development, and cumulative impact analyses.

In this chapter, tables illustrate the distribution of responsible parties for each program element between stakeholders, (e.g., regulatory authority (RA), responsible management entity (RME), service provider (SP) and homeowner (O). These distributions or assignments of responsibility are merely illustrative and are based on certain assumptions by the authors of the USEPA Voluntary Management Guidelines (2003). They may not reflect local political climates, public perceptions, or legal codes of users seeking to create the most appropriate management program for their circumstances.

Responsibilities of an onsite regulatory authority may include some or all of the following:

- Power to propose legislation and establish program rules and regulations
- Land use planning, review and approval of system designs, permit issuing
- Construction and installation oversight
- Routine inspection and maintenance of all systems
- Management and regulation of septage handling and disposal
- Local water quality monitoring
- Administrative functions (e.g., bookkeeping, public education, billing)
- Grant writing, fund raising, staff management, outreach
- Authority to set rates, collect fees, levy taxes, acquire debt, issue bonds, make purchases
- Authority to obtain easements for access to property, enforce regulations, require repairs
- Conduct education, training, certification, and licensing programs for staff and contractors
- Record keeping and database maintenance

(Source: NSFC, 1996)

The management models described in the 2003 *Voluntary Guidelines for Management of Onsite and Cluster (Decentralized) Wastewater Treatment Systems* provides suggested approaches for assigning responsibilities among the many parties interested in improving system management. The models, which feature management tools such as program inventories, operating permits, maintenance contracts, and use of third party management entities, provide a flexible framework for managing systems in relation to environmental and public health risks posed by decentralized systems. Regulatory authorities and other stakeholders can use the models to build their management programs by adapting various features of the models to fit their unique needs, resources, and capabilities.

2.4 Description of management program elements

This section of the handbook discusses the various components of an onsite/decentralized wastewater management program. These components, or *program elements* ! public involvement, planning, design, installation, operation, maintenance, etc. ! comprise discrete focal points for developing a management program. Each program element is presented and reviewed below to provide general information on the range of options available when creating new management programs or enhancing existing ones. The following sections outline some typical approaches for implementing each program element, and provide examples of how activities have been addressed in certain situations across the nation. Each program element is accompanied by suggested approaches for basic, intermediate, or advanced management programs. Selection of the approaches used for any locality should be based on the consensus of the regulatory authority, the management entity, and the community wherever possible. Users of this handbook are encouraged to use the model programs and the range of options presented for each program element in developing their onsite management programs.

2.4.1 Public involvement and education

The success and indeed the existence of any onsite management entity are intertwined with its ability to involve and educate the system owners and the public at large. Unless the public understands the need for a management program there is little chance for its success. Historically, most management entities have come into existence not because of their inherent value in protecting public health and the environment, but because of external forces that threatened to have far greater consequences. Usually, those external forces have been the state regulatory agencies seeking to abate some water quality or public health problem. Indeed, Allee, et al. (2001) point out that effective management is usually the result of the recognition of a local crisis that requires it. The response to the crisis brings together the local officials, the state or regional regulators, and the community to attempt to solve the identified problems that have resulted at least in part because of failing OWTSs. The resulting cooperative efforts on the part of those stakeholders become a relationship-building process that then becomes the basis for subsequent management programs. Even if the process proves to be imperfect, that relationship provides a climate for adjustment and ultimate success of a management program. Olson, et al. (2002) discusses the pitfalls in the early stages of management program formation, pointing out that failure to include inputs from the entire community can be fatal to the process. The management program formation process is discussed in Chapter 4.

In addition to public involvement in the development and implementation of the management program, there needs to be an accompanying effective public outreach and education function. Failure to effectively initiate and perform these tasks risks the spread of misinformation and loss of confidence in the management entity. Mancl (2001) reports that a common characteristic of long-term successful management entities is the hiring of inspectors who have an outgoing, empathetic character and who take the time to chat and explain issues with homeowners. The University of Rhode Island Extension has developed some materials designed to get homeowners involved in creating and participating as volunteers in ongoing management programs (Dow and Loomis,1998).

Gaining public support for onsite maintenance programs

In south Deschutes County, Oregon, a decentralized wastewater demonstration project funded by US EPA determined that education was the key to public support of the onsite maintenance program. The project team determined that homeowners were not the only stakeholders in the education program, and also targeted real estate professionals and contractors working in the onsite industry. The project team held a one-hour training session that could be counted towards the continuing education program. The response from the participants was overwhelmingly positive and some participants suggested that the training be required for all realtors.

(Source: Rich, 2001)

No matter which level of management chosen, the public needs to be kept informed and involved.

With lower management levels (Management Model 1 and sometimes Management Model 2) there are fewer resources and staff to perform outreach activities, but the importance of keeping the community involved is still very important. Higher-level programs with RMEs can more readily perform these functions because of greater resources and staffing.

Even though the role of the homeowner in lower-level management programs may be less than in higher-level programs, their expectations are the same. Therefore, public involvement and education is universally necessary for continued success of the management program. One part of that involvement is to make accessible to all homeowners their onsite system inventory records upon request. Another very important public involvement role is to have a stakeholder review committee that regularly (e.g., on an annual basis) reviews the management program activities and recommends improvements. The makeup of such a review body should be similar to the program initiation steering committee in order to represent the spectrum or diversity of the stakeholders in the district. Some concepts of the variability in this program element are illustrated in Table 2-3.

Table 2-3. Public education and participation activities

Program element	Basic approach	Intermediate approach	Advanced approach
Public education and participation activities	Involved in program development and rule revisions with management entity.	Involved in program development and annual program reviews of the management entity.	Involved in program development, annual program reviews, and public education and outreach efforts with management entity.

Public education is difficult to separate from the public participation or public involvement program element already discussed. In the context of this handbook, education is defined more as an outreach or communications program from the management program to the homeowners. Since the lower-level management programs have a strong dependency on the role of the system owners in providing maintenance, there is a solid basis for this program element, as viewed by the near century of experience with unmanaged onsite systems that homeowners almost universally ignored, with the consequence being a significant and continuous rate of failure.

Caudill (1998) provides an example of an effective public education program developed by Clermont County, Ohio health department staff with assistance from a state regulatory authority. Public education and outreach by the Clermont County outreach program included advisory groups, homeowner education meetings, news media releases and interview programs, meetings with real estate agents, presentations at farm bureau meetings, displays at public events, and targeted publications. Olson and Gustafson (2001) have outlined a comprehensive public education system for homeowners in management programs that provide minimal services. In all management entities, homeowners must be educated about the needs or signs to watch for that require professional servicing, activities that they can undertake to make their systems work better and longer, and property activities to be avoided that would have the opposite impact.

Table 2-4. Public education approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Education/training for homeowners	Acquire and circulate multimedia materials on basic system operation and maintenance needs; send reminders to owners when O/M should be scheduled.	Develop locally specific educational materials with information on local impacts and currently approved service providers. Provide information for system owners on system O/M, health and environmental impacts, causes of failure, and management program procedures at workshops, fairs, schools, etc.	Educate homeowners about management program advisory boards, variance and complaint review panels, etc. Work with homeowners in system design phase and in regular reviews to optimize management program performance and acceptability. Conduct outreach programs at civic, school, and other events to answer questions and obtain feedback from homeowners.

2.4.2 Planning

There are two types of planning related to decentralized wastewater management entities. The first type is the planning that is integral to the development of the management entity discussed in Chapter 4. The second type is participation in the comprehensive land use planning of the potential growth scenarios for the area.

At lower management levels the regulatory authority provides some minimal input upon request to the comprehensive land use planning process. In the past, this has resulted in comprehensive plans that reflect soil maps and minimum lot size regulations, often resulting in undesirable land-intensive development patterns that are either relatively insensitive to or overly restrictive of development in the context of the watershed. In the former case, a plan may emerge that considers only soil types and minimum lot sizes, with no concern for sensitivity of the water resources. In the second case, growth may be restricted in sensitive areas based only on the limitations of conventional onsite systems. More sophisticated risk assessments and risk management plans have been successfully employed by certain locations such as New Shoreham, RI, where the MANAGE risk assessment model was applied to determine relative risks and the degree of onsite treatment required to minimize those risks (Loomis, et al., 1999). In similar efforts, Massachusetts Department of Environmental Protection has identified "nitrogen sensitive zones" that limit the amount of nitrogen that can be discharged from onsite pretreatment systems in the designated zones, thus encouraging alternative onsite/cluster approaches in a performance-based requirement (Mass. Environmental Code, 1996). Hoover, et al. (1998) and Otis (1999) has also proposed methods risk assessment for areas served by onsite and/or cluster systems that use soil infiltration (see Chapter 4). Table 2-4 describes a range of land use planning activities in which the management program may be involved.

Table 2-5. Planning activities

Program element	Basic approach	Intermediate approach	Advanced approach
Planning	Coordinate wastewater program with regional planning office by sharing rules and soils data.	Identify critical areas and sites requiring higher levels of treatment based on soils and hydrogeological information or requiring restricted development.	Assess vulnerabilities of receiving waters and identify treatment standards for each zone based on health/water resource risks. Establish overlay treatment zones based on environmental sensitivity and health impact potential for evaluation of proposed developments.

Comprehensive land use planning, if available in the area, can provide valuable information and support for onsite system management and regulatory programs and should serve as the basis for managing existing systems and permitting future installations. At a minimum, planning should include the identification of the planning region, development of program goals, and coordination of multiple agencies involved in health, resource protection, and economic development activities. Comprehensive planning provides one of the best vehicles available for ensuring that onsite management issues are seamlessly integrated into future growth and development scenarios. Comprehensive planning and zoning are closely related and are usually integrated. Comprehensive planning sets overall guidance and policies, while zoning provides the detailed regulatory framework for implementation. Comprehensive planning that addresses environmental protection can be administered through zoning regulations that

- Specify performance requirements for onsite or clustered systems, preferably related to each surface and ground water resource in the area.
- Limit development on sensitive natural resource lands and critical areas.
- Encourage development within urban growth areas serviced by cluster or sewer systems, if adequate capacity exists.
- Require consideration of factors such as system densities, hydraulic and pollutant output, proximity to water bodies, soil and hydrogeological conditions, and water quality for all new development or system repairs.

Even relatively simple planning approaches can consider existing and potential public health and water quality problems and combine them with the physical characteristics of the problem area and input from regulators and the public in developing management strategies. If an RME exists or is developed, it should be intimately involved in land use planning and zoning program decisions. Traditional approaches to land use planning have relied upon soil maps and minimum lot size ordinances, resulting from prescriptive onsite wastewater treatment codes. Lot size restrictions and prescribed conditions for treatment sites have unintentionally served to misguide development in many cases. Performance requirements are based on actual site limitations and locations in the watershed to assure that systems are designed to meet site conditions rather than requiring site conditions to meet the treatment capabilities of a limited number of onsite system types. Thus, planning decisions can be made on a rational watershed basis, rather than on arbitrary site-alone requirements.

Maryland partnership develops septic system impact study

The Department of Environmental Resources and Health Department in Maryland's Prince George County worked together to develop geographic information system (GIS) tools to quantify and mitigate nonpoint source nutrient loadings to the lower Patuxent River, which empties into the Chesapeake Bay. The agencies developed a database of information on existing onsite systems, including system age, type, and location, with additional data layers for depth to ground water and soils. The resulting GIS framework allows users to quantify nitrogen loadings and visualize likely impacts under a range of management scenarios. Information from GIS outputs is provided to decision makers for use in planning development and devising county management strategies.

(Source: *County Environmental Quarterly*, 1997)

A regular review of the planning and zoning activities and development proposals by the management program will help the planners to anticipate growth and development trends and the roles of onsite, cluster, and central sewer systems in minimizing impacts on the watershed and on public health. For example, proposed development and land use plans may require the application of new technologies for wastewater management. Recognition of this fact in internal planning allows the management program to investigate the performance of technological alternatives that appear to be able to appropriately treat and disperse wastewater under locally specific circumstances, thus permitting informed review of proposals from equipment purveyors in the future. Another specific example of value added to planning would be development of an evaluation protocol for new development proposals that can be used to determine if the development is best served by clustered or individual systems, or some combination of the two, in the context of performance requirements that must be met. Such a protocol could be shared with developers to assist them in planning new developments, knowing that they will be judged accordingly.

More advanced planning approaches ! through an enhanced effort led by the regulatory authority, regional planning department, or RME ! might involved other, more complex issues. There is a general movement on the part of the states and federal agencies to manage water resources based on watersheds. At present most states utilize watershed models to determine pollutant loadings allowable from sewage treatment plant discharges in their NPDES permits. For the last few years all the states have been evaluating their watersheds and stream segments to determine the pollutants that exceed required levels in order to develop plans to bring them into compliance with their designated uses. Approximately 40 percent of the Nation's waterways fall into this category, with the primary pollutants causing noncompliance being sediments, nutrients, pathogens, metals, lack of dissolved oxygen, and altered habitat. Although this analysis is part of a proposed and controversial regulatory process called TMDLs, the watershed assessment process has been found to be valuable to the states and tribes in that it allows them to identify the primary sources of pollutants and to create strategies for improving those affected streams. This approach will surely impact the role of onsite wastewater technologies in regional watersheds.

Besides watershed/TMDL efforts, drinking water source protection studies are leading to consideration of onsite wastewater system restrictions in order to protect groundwater resources. In Washington County, Utah, a mass balance approach based on the assumed loading of nitrates from conventional septic tank systems to shallow, unconfined ground water is being applied. Based on this analysis, the county is considering imposing minimum lot sizes for future development relying on this technology. The more rational performance-based approach is the use of appropriately managed nitrogen-reduction onsite and/or cluster technology. Certain counties in Colorado and Minnesota are similarly approaching ground water protection in this manner. Although both will accomplish the protective needs of those areas, the performance approach invites more creative and less land-intensive (and revenue-generating) development.

The role of a comprehensive onsite management program (i.e., an RME) in watershed or ground water protection planning creates an additional means of effecting change in the overall water pollution abatement strategy since onsite wastewater systems can be a significant source of certain pollutants. This is particularly true where a metropolitan sewerage agency takes management responsibility for regional onsite and cluster systems. By having this increased flexibility to control all or most of the sources of certain pollutants, the management entity can find and implement the most cost-effective pollutant management plan for the region (Kreissl and Otis, 1999).

Planning is further enhanced when the entire spectrum of wastewater (onsite, cluster, and central sewer systems) and storm water pollution abatement measures are managed by a single RME working closely with the planning agency. As the watershed approach becomes more predominant in water resources management, the value of broad wastewater management approaches will become more evident. Existing municipal sewer authorities should be reviewing the potential for incorporating small and onsite systems in their immediate proximity to take advantage of the efficiencies and effectiveness of such a comprehensive approach (Kreissl and Otis, 1999).

2.4.3 Performance requirements

Performance requirements are established by regulatory authorities to ensure compliance with the public health needs of the community and water quality in the watershed. Performance requirements are based on broad goals (e.g., eliminating health threats from contact with inadequately treated effluent or direct/indirect ingestion of contaminants), standards for water quality and restoration or protection, and can be both quantitative (e.g., total mass load or concentration of pollutants per unit of time) and qualitative (e.g., no odors or color in discharges). Water-quality performance requirements normally state the specific location at which water quality criteria are to be met. The means of meeting the requirements becomes the responsibility of the designer.

Performance requirements for OWTSs can be grouped into two general categories: numeric requirements and narrative criteria. Numeric requirements set measurable concentration or mass loading limits for specific pollutants (e.g., nitrates, nutrients, or pathogen concentrations). Narrative requirements describe acceptable qualitative aspects of the wastewater (e.g., no color or odor). A numeric performance requirement might be that all septic systems in environmentally sensitive areas must discharge no more than 5 pounds of nitrogen per year or that concentrations of total nitrogen in the pretreatment system effluent can be no greater than 10 mg/L. Some of the parameters for which performance requirements are commonly set for OWTSs include:

- Fecal coliform bacteria (as an indicator of pathogens).
- Biochemical oxygen demand (as an indicator of biodegradable organic content).
- Nitrogen (major estuarine and marine water nutrient).
- Phosphorus (major fresh and marine water nutrient).
- Nuisance parameters (e.g., floating matter, fats, oils, grease).

Performance requirements may explicitly state treatment effluent standards, and should be based on risk assessments that consider the potential hazards of each pollutant in the wastewater by estimating its transport and fate, potential exposure opportunities, and projected effects on humans and environmental resources. Water quality standards already have been established by a variety of governmental agencies for a wide range of surface water uses. These include standards for waters used for recreation, aquatic life support, shellfish propagation, aquatic habitat, and drinking water.

Local needs or goals must be considered when performance requirements are established (see Table 2-5). Watershed or ground water site-specific conditions may warrant lower pollutant discharge concentrations or mass pollutant limits than those required by existing water quality standards. Existing water quality standards, however, provide a good starting point for selecting appropriate decentralized system performance requirements. By estimating cumulative mass contributions of a pollutant from all sources discharging to the receiving water, the relative contributions from and the location of each source, and calculating the assimilative capacity of the receiving waters, a determination of the maximum mass of pollutants that can be contributed by wastewater sources can be made. From this total allotment, any point sources already permitted will be subtracted. The rest is allotted to decentralized wastewater systems, and forms the basis for the performance standard. Other significant contributing nonpoint sources of pollutants in rural watersheds include yards and landscaped areas, agricultural crop lands, forests, and animal feeding operations.

Performance requirements related to onsite system discharges are evaluated at a specified performance or design boundary, which can be a physical boundary or a property boundary. Physical boundaries are wastewater migration transport points where conditions abruptly change. A physical boundary can be at the intersection of treatment unit processes or between soil conditions, (e.g., the infiltrative surface, the unsaturated soil (vadose zone), the saturated soil (ground water) zone), or at another designated physical location, such as a property line, drinking water well or nearby surface water body.

The establishment of performance requirements for onsite treatment systems should be based on established water quality standards for the receiving waters and the assimilative capacity of the environment between the point of wastewater release (soil) and the performance boundary designated by the management agency. If the assimilative capacity of the receiving environment is overwhelmed because of increases in pollutant loadings, pretreatment system performance should be improved. High-density developments located near sensitive receiving waters may be subject to more stringent requirements than those serving lower-density housing farther away from sensitive water resources. Nitrogen, for example, exhibits only minor removal in conventional soil infiltration systems, and would therefore require special pretreatment in onsite systems located nearby nitrogen-sensitive surface waters or in the receiving aquifer that is the source of local drinking water supplies for which a nitrate limit is codified.

Many other pollutants are almost completely removed in a properly designed septic tank and soil absorption system (including vadose or unsaturated soil treatment). These pollutants include biodegradable organics, total suspended solids, certain toxic organics, heavy metals, and parasites. If these pollutants were the main concern of the regulatory agencies, there would be little value in considering special pretreatment needs. Other pollutants, such as viruses, bacteria, and phosphorus, can fall somewhere in between these two examples, which suggests the need for a comprehensive evaluation of the onsite wastewater contributions in a watershed or wellhead protection zone for which performance requirements may be needed.

Table 2-6. Performance requirements approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Performance requirements	Prevent direct and indirect contact with raw or partially treated wastewater through prescribed hydraulic loading restrictions, setbacks and separation distances.	Specify alternative technologies for certain sites or conditions that do not meet prescribed separations or other physical requirements. Establish inspection and maintenance reporting requirements to ensure proper system functioning or to renew revocable operating permit.	Characterize watershed water resources against quality designations. Evaluate cumulative impacts/allotments for all sources and or key pollutants. Establish numeric and/or narrative performance requirements for onsite/decentralized systems. Develop protocols for measuring (monitoring/ inspections) compliance against performance requirements.

Establishing performance requirements at a watershed scale

Establishing performance requirements involves a series of steps that move from landscape-level to site scale considerations. The following steps describe the general process of establishing performance requirements for onsite systems:

- Identify receiving waters (ground water, surface water) for OWTS effluent.
- Define existing and planned uses for receiving waters (e.g., drinking water, recreation, habitat).
- Identify water quality criteria associated with designated uses (check with state water agency).
- Determine types of OWTS pollutants (e.g., nutrients, bacteria) that might exceed water quality criteria.
- Identify confirmed problem areas and areas likely to be at risk in the future.
- Determine whether OWTS pollutants pose risks to receiving waters; if so, then:
    - Estimate existing and projected onsite wastewater contributions to pollutant loads
    - Determine if OWTS pollutant loads will cause or contribute to water quality violations.
    - Establish maximum output level (mass or concentration) for specified OWTS effluent pollutants.
    - Define performance boundaries for measurement of OWTS effluent and pollutant concentrations.

Performance requirements for onsite wastewater systems are a subject of much discussion. Depending on the level of management, this issue could be either unimportant or extremely important. With most state regulations prescriptive restrictions, there is an assumption that if the site meets stated prescriptive requirements, the system will be protective of public health. The only protections provided for ground water and nearby surface water quality are minimum horizontal and vertical separations. Evaluations of waterborne disease outbreaks have not shown these separations to be consistently effective due to hydrogeological conditions that were not evaluated as part of the prescribed site evaluation process (Kreissl, 1983). Similarly, surface and subsurface water quality studies do not correlate well to these arbitrary horizontal separation distances.

The last resort of most states with severe soils restrictions has been to permit direct discharge of onsite systems. Because of the enormity of the problem of regulating and permitting large numbers of very small systems under the NPDES program, these states employ what is known as a general permit. In essence, the state provides a set of standards for a variety of pollutants and the required frequency of monitoring for compliance with these standards. This is a true performance standard in that a set of effluent limitations is provided without direction on how they shall be met. The penalties for not meeting them are clearly specified in the permit. For example, the new draft Ohio General Permit for household systems specifies concentration limits for TSS, carbonaceous biochemical oxygen demand, fecal coliform, ammonia-nitrogen, dissolved oxygen, and total residual chlorine, along with the frequency and type of sampling necessary to monitor compliance (Ohio EPA, 2001). The samples analyzed for those constituents are also to be evaluated with regard to turbidity, odor, and color.

At a minimum, the management program should meet a performance goal of eliminating surface seepage and backups that directly threaten public health. This performance requirement generally calls for a minimum of Model Programs 1 or 2. When ground water and surface water quality problems are evident and they need to be abated, it will generally require a management program resembling Management Programs 3 or higher. In either case, the operation and maintenance needs of the technologies employed must be analyzed and a plan should be developed to ensure that those are met.

One of the primary benefits of a comprehensive management program implemented by an RME is the ability to meet performance requirements, (i.e., system technologies are chosen, managed, and monitored that meet public health and ecosystem (watershed) goals based on established risk management standards, at specific locations in the watershed). In simple terms, the system can be designed, operated and managed to meet whatever public health or ecosystem requirements imposed by the regulatory authorities. Since performance requirements are not yet in place in most states and regions, a comprehensive management program can also operate under the more common prescriptive regulatory framework presently in use. Prescriptive standards are less exacting for the RME since they are based on assumptions of safety (which may be either overestimated or underestimated) based on certain site condition measurements and reduce the demand for technically skilled staffing.

2.4.4 Site evaluation

Evaluating a proposed site in terms of its environmental conditions (climate, ground water, and surface water aspects), physical features (geology, slopes, soils, property lines, wells, and structures), and wastewater characteristics (anticipated flows, pollutant content, and generation patterns) provides the information needed to size, select, and locate the appropriate wastewater treatment system. Onsite regulatory authorities issue permits—legal authorizations to install a particular system at a specific site—based on the information collected and analyses performed during the site evaluation and the designer's interpretation of that information. Prescriptive site evaluation, design, and construction requirements are based on experience with conventional septic tank/soil absorption systems and empirical relationships that have evolved over the years. Site evaluation approaches can vary from total dependence on percolation tests to total dependence on soil and subsurface analyses via deep pits, and a number of permutations that may incorporate aspects of these and other site measurements.

Effective site evaluations are crucial to meeting the treatment objectives of the system and the public health and water quality goals of any management entity. There are many excellent site evaluation references in the literature (e.g., WEF, 2001; Tyler and Converse, 1994; Tyler, 2001; NSFC, 2000). Nearly all of these, however, are geared to determining hydraulic acceptance for systems that rely on treatment in the soil. Existing state codes are primarily prescriptive in that they provide the system design that must be used if the site fits the conditions determined by prescribed site evaluation procedures. These codes do not directly deal with ground and surface water impacts, but assume that certain vertical and horizontal setback distances will protect these waters. Significant variation is evident among these empirically determined state setback requirements (Kreissl, 1982), and the likelihood of under or over protection is great. Typical site evaluation program element content is provided in Table 2-8.

Table 2-7. Site evaluation approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Site evaluation	Require assessment of site hydraulic acceptance and other physical features, including slope and vertical and horizontal setbacks for soil-based systems to determine compliance with prescriptive rules. Require licensed/certified site evaluators.	Prescribe broader set of site conditions to permit prescribed alternative technologies. Require licensed/certified site evaluators. Designate alternative systems for sites not meeting conditions prescribed for conventional systems.	Provide protocol for comprehensive site assimilative and treatment capacity. Characterize critical design and performance requirements and boundaries. Provide supplemental certification/licensing training for site evaluators to meet local needs.

Performance-based approaches require a more comprehensive site evaluation to ensure that onsite systems do not adversely affect water resources. Site evaluation protocols may include presently employed empirical tests, tests that evaluate specific soil properties such as texture, bulk density, consistence, structure, etc., and soil pits to characterize soil horizons, mottling, and a variety of other properties. Usually, prescriptive codes are designed to determine the hydraulic capacity of the soil and empirically "assure" proper treatment by specifying horizontal and vertical separations. Generally, all management programs allow conventional onsite systems to be sited in areas with appropriate soil conditions and specified setback/separation distances and unsaturated soil depths. Higher-level management entities should specify which site evaluation tests and procedures are to be followed for each area of identified vulnerability and class of technology allowed or possible. Table 2-9 provides a guide for the general progression of a site evaluation processes. Site evaluation for alternative technologies should be based on demonstrated past performance at similar sites or performance requirements that specify the type of pollutant to be controlled and how and where it will be measured (i.e., the performance boundary).

Site evaluation (in the absence of performance requirements) should include:

- Vertical distance to seasonal high water table, bedrock, or other restrictive layer.
- Soil characteristics versus related infiltration area size requirements for each approved treatment and distribution technology.
- Site slope, cover, terrain position, and hydrogeology.
- Horizontal distances and direction of surface water bodies or groundwater wells and their present and designated quality requirements.
- Horizontal distances to other physical features, particularly those in likely plume path.
- Site location and geometric orientation possibilities.

Because of the difficulty in properly characterizing wastewater flow and pollutant loads, evaluating critical site conditions, a significant level of education, training, and experience is required of personnel conducting these tasks.

Many states and local management programs require that onsite system service providers be specifically trained, licensed and/or certified. Angoli (2001) reported that 68 percent of the onsite regulatory agencies that responded to a NSFC survey stated that they required site evaluators to be licensed/certified. In many cases, local regulatory staff performs site evaluations, which is a questionable concept since it represents a conflict of interest. Some states require registered soil scientists to conduct the necessary assessment of soil conditions and site suitability. All onsite management programs should require licensing or certification of both private sector and staff site evaluators. All onsite programs should benefit from this requirement, but no quantification of these benefits has been published at this time.

Site evaluations and performance requirements in Texas

The state of Texas in 1997 eliminated percolation test requirements for onsite systems and instituted new performance requirements for alternative systems (e.g., drip systems, intermittent sand filters, leaching chambers). Site evaluations in Texas are now based on soil and site analyses, and service providers must be certified. Officials in the Lone Star State took these actions after onsite system installations nearly tripled between 1990 and 1997.

(Source: Texas Natural Resource Conservation Commission, 1997).

Table 2-8. Site evaluation and assessment activities for SWIS applications

Preliminary activities	**Information from research**
Preliminary review	▪ Site survey map ▪ Soil survey, U.S. Geographical Society topographic map ▪ Aerial photos, wetland maps ▪ Source water protection areas ▪ Natural resource inventories ▪ Applicable regulations/setbacks ▪ Hydraulic loading rates ▪ Criteria for alternative OWTS ▪ Size of house/facility ▪ Loading rates, discharge types ▪ Planned location of water well
Scheduling	▪ Planned construction schedule ▪ Date and time for meeting
Field activities	**Information from field study**
Identification of unsuitable areas	▪ Water supply separation distances ▪ Regulatory buffer zones/setbacks ▪ Limiting physiographic features
Subsurface investigations	▪ Ground water depth from pit/auger ▪ Soil profile from backhoe pit ▪ Presence of high water table ▪ Percolation tests
Identification of recommended SWIS site	▪ Integration of all collected data ▪ Identification of preferred areas ▪ Assessment of gravity-based flow ▪ Final selection of SWIS site

(Source: Adapted from ASTM, 1993).

Logically, a management entity could build upon good conventional SWIS site evaluation for other soil-based systems by adding other tests that would be dictated by the type of wastewater, the treatment system characteristics, specific soil properties, ground water movement and hydrogeology, and the performance requirements to be met at a specific location. For example, nitrogen removal could be significant if soil/aquifer materials were high in organic content. Similarly, phosphorus removal is usually excellent in the soil immediately surrounding the SWIS, but an estimate of long-term removal capacity might be needed if that is the pollutant of concern. For advanced pretreatment systems, the soil may only be a means of effluent dispersal into the surrounding environment, necessitating a similar site evaluation to that presently performed for conventional systems.

2.4.5 Design

The design program element provides a means of ensuring that new or replacement onsite systems have the capability of meeting performance requirements to protect public health and water quality through the establishment of credible protocols for design evaluation. With low-level management programs prescriptive codes restrict the choices to either the conventional system or a few approved alternative systems, and system components are specified with little allowance for variation. Use of prescriptive codes limits the potential for matching site conditions with a treatment system capable of meeting whatever performance requirements are needed to meet health or water quality goals.

Most lower intensity management programs rely on the state code for design, thus there is usually no need to develop any special design protocol. However, in sensitive environments where performance codes are employed, there is a requirement to develop a design protocol, but it may or may not be prescriptive in its allowable designs (see Table 2-10). Under a performance-based approach, performance requirements, site conditions, and wastewater characterization information drive the selection of treatment technologies at each site.

For known technologies with extensive testing and field data, the management agency can institute performance requirements prescriptively by designating system type, size, construction practices, materials to be used, acceptable site conditions, and siting requirements. For example, the Arizona Department of Environmental Quality has proposed an onsite rule that establishes definitions, permit requirements, restrictions, and performance criteria for a wide range of conventional and alternative treatment systems (Swanson, 2000).

Table 2-9. Design program approaches

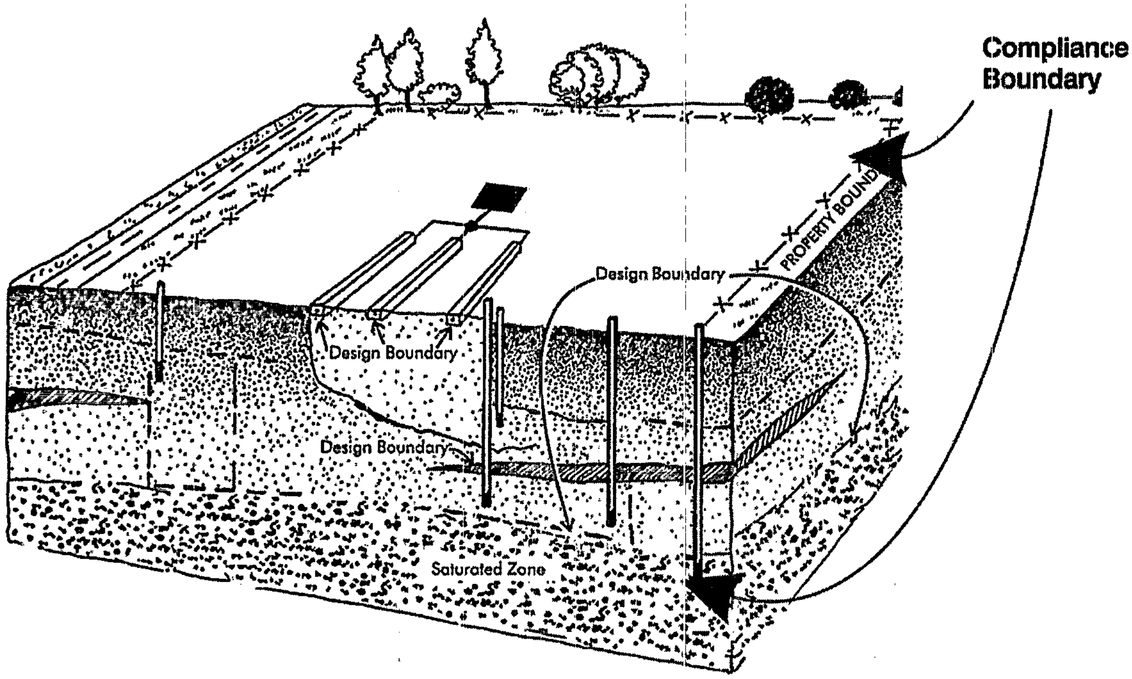
Program element	Basic approach	Intermediate approach	Advanced approach
Design	Design only conventional septic tank/gravity fed soil discharging systems on sites meeting code-described prescriptive criteria. Require state certified/licensed designers.	Allow limited number of alternative designs on certain specific non-compliant sites. Require state certified designers. Provide potential for engineered alternative designs for large systems.	Institute protocols for use of risk-based designs based on site evaluation results and specific wastewater sources. Provide supplemental training and licensing/certification for designers based on specific needs of local water resources.

True performance codes merely note that specific water quality goals must be met at specific locations, and leave how those goals are attained to the designer. Some permitting programs broadly characterize required performance requirements for onsite installations in sensitive areas by designating overlay zones. These zones are based on soil type, topography, hydrology, or other characteristics and can specify maximum system densities, system design, performance requirements, and operation/maintenance requirements. Establishing onsite system overlay zones requires making some broad assumptions and generalizations, however, and should be supplemented with comprehensive site-specific evaluations.

Some states have recently developed performance-type codes consisting of a series of accepted or approved design packages for a variety of site conditions. These packages and performance assumptions represent a significant advance over the more restrictive prescriptive codes, but they are not true performance-based codes. They do, however, simplify the regulatory role by allowing implementation of a broader array of technologies without demanding the level of staff expertise that a true performance code would.

Design protocols should address the potential implications of water conservation fixtures, impacts of different pretreatment levels on hydraulic and treatment performance of soil-based systems, and the operation and maintenance requirements of different treatment and soil dispersal technologies. They should include a required pre-design or pre-construction meeting between the permitting agency, the management entity (if it does not have permitting powers), the designer and the owner of the property. All of these parties have a stake in the design and questions for which they need answers before the installation proceeds. The protocol should be as complete as possible, but should feature a rational, defensible evaluation procedure for proposed designs and materials specifications that were not anticipated at the time that the review protocol was developed in order to encourage innovation and advancement. Also, the protocol should be dynamic and should be regularly reviewed and updated as new information and experience is gained.

Figure 2-1 Example of design boundaries for onsite wastewater treatment systems



Source: EPA, 2002

A cooperative approach for approving innovative/alternative designs in New England

The New England Interstate Water Pollution Control Commission (NEIWPCC)is a forum for consultation and cooperative action among six New England state environmental agencies. NEIWPCC has adopted an interstate process for reviewing proposed wastewater treatment technologies. A technical review committee composed of representatives from New England state onsite wastewater programs and other experts evaluates innovative or alternative technologies or system components that replace part of a conventional system, modify conventional operation or performance, or provide a higher level of treatment than conventional onsite systems.

Three sets of evaluation criteria have been developed to assess proposed replacement, modification, or advanced treatment units. Review teams from NEIWPCC assess the information provided and make determinations that are referred to the full committee. The criteria are tailored for each category, but in general include:

- Treatment system or treatment unit size, function, and applicability or placement in the treatment train.
- Structural integrity, composition, durability, strength, and corresponding independent test results.
- Cost and life expectancy, including comparisons to conventional systems/units.
- Availability of parts, service, and technical assistance and costs thereof.
- Test data on prior installations or uses, test conditions, failure analysis, and tester identity.

(Source: NEIWPCC, 2000).

2.4.6 Construction

Poor installation can be devastating to the performance of both conventional and advanced systems that rely on soil dispersion and treatment. Installation can start after issuance of a construction permit, which occurs after the design and site evaluation reports have been reviewed and approved. Installation should conform to existing protocols to ensure proper system performance.

There are numerous sources of information on proper installation in a variety of soil types, including the problems associated with certain climatological conditions, soil moisture conditions, precautions on the use of certain types of construction equipment, construction procedures required to avoid structural damage, and appropriate overall construction practices (Tyler, et al., 1985). The impacts of improper installation of soil-based systems generally occur within the first year of operation in the form of wastewater backups. Some improper practices, however, may not exhibit this relatively quick and obvious form of failure. These problems are often related to poor treatment performance, and may take years to manifest themselves in the form of degraded ground water or nearby surface water.

Table 2-10. Construction/installation approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Construction/installation	Construction permit granted based on site evaluation, system design and installation by licensed/certified site evaluators, designers ,and installers. Inspect system prior to backfilling to confirm that installation or complies with design.	Use more proactive inspection program during the construction phase Maintain and disseminate list of locally approved installers based on performance.	Create protocols for installation procedures and contingencies with proactive inspection. Provide extensive construction oversight for all critical steps. Develop supplemental training and licensing programs for installers that deal with local conditions and requirements.

Construction/installation should conform to the approved plan and use appropriate methods, materials, and equipment. Typical program element provisions are presented in Table 2-11. Mechanisms to verify compliance with performance requirements should be established to ensure that practices meet expectations. The typical regulatory mechanisms presently employed to ensure proper installation include precovering inspections of systems near the end of the construction/installation phase and submission of as-built drawings. A more thorough inspection would include:

- Pre-construction meeting with owner and contractor (described in the preceding section).
- Field verification and staking of each component (to prevent damage from equipment).
- Inspections at random times during construction.
- Verification and database entry of as-built drawings.
- A permit to operate the system as designed and built.

Inspections should be conducted at several stages during the system installation process to ensure compliance with regulatory requirements. During the construction process, inspections before and after backfilling can help verify compliance with approved construction procedures. If there are insufficient management program resources to conduct these inspections, an approved, independent design professional could be required to oversee installation and certify that it has been conducted and recorded properly. The construction process for soil-based systems must be flexible to accommodate weather events, since construction during wet weather may compact soils at the infiltrative surface or otherwise alter soil structure. Arbitrary changes in trench depth or location and other improper construction techniques can have serious consequences on performance (University of Wisconsin, 1978). Similar problems occur from the travel of heavy equipment over infiltrative surfaces and down-gradient areas or by silt and clay residues on unwashed trench aggregate (Tyler, et al., 1985). If uniform distribution and dosing are incorporated in the design, improper installation can negate the added performance benefits that the designer would have claimed in the approval process.

Installation of soil-based conventional systems has received inadequate attention under the present system of prescriptive codes. Commonly, the local health department will provide a field inspection prior to backfilling the soil absorption system after which an occupancy permit is issued. Compaction of certain soils or damage to the infiltrative surface during excavation and installation tasks is not obvious during this type of spot inspection and can go unnoticed until system hydraulic failure occurs. In many places (26 percent of the agencies responding to the NSFC survey), training and certification/licensing of installers is not required. Some licensing/certification programs exempt veteran installers through grandfather clauses in the regulation. All management programs should ensure that installers are licensed/certified, but they should also monitor system performance records to further screen recommended practitioners within their jurisdictions. All installer/contractors should receive some type of training on an ongoing basis to prevent or minimize problems associated with inappropriate installation, but enforcement of this requirement is more difficult with lower-level management programs. Even the lowest level management entity should review the qualifications of installers and require submission of final as-built drawings. This recorded documentation should include the names of the site evaluators, designers, and installers and the dates of each event for each onsite system.

2.4.7 Operation and maintenance

The homeowner is the lynchpin of most O/M efforts, particularly in the lower level management programs. There are very useful guides available to conventional system owners in most states through their extension services and through national organizations such as the NSFC. In all management programs the homeowner must be cognizant of the damage that can be caused to soil-based systems by driving heavy vehicles over the ground surface or by paving those areas which results in cutting off the free-flow of oxygen to those systems. The homeowner must also be aware of the effects of adding strong acids or alkalis, toxic compounds, oils, and greases on the performance of these systems and on the receiving waters. The system owners and service providers should also know the effects of water conservation, illegal stormwater connections, garbage grinders, and water softeners.

Operation and maintenance needs of different onsite technologies vary considerably. The conventional septic tank and SWIS usually require only a tank pump-out once every few years with an accompanying inspection of structural appurtenances. Mechanical systems such as activated sludge-based units require servicing three to four times per year to assure that aeration tank solids concentrations do not increase to the point that they are "belched" out with the effluent and cause infiltrative surface clogging or receiving water quality problems, depending on the unit's discharge designation. Other mechanical/electrical systems also require more frequent (usually annual) inspection to assure proper operation of electro-mechanical components. Newer, modem or internet-based packages can monitor and control many of these mechanical components, thus reducing the frequency of inspection and keeping labor costs affordable for larger and more sophisticated management programs.

Complaints generally provide the only formal notification to the oversight agency that problems exist with unmanaged onsite wastewater systems. Inspection programs that monitor system performance, as employed in Management Programs 3 ! 5, can help reduce the risk of premature system failure, thus decreasing long-term costs and the risk of ground water or surface water contamination (Washington DEQ/PSWQA, 1996). Also, better managed O/M programs can eliminate unnecessary expenses such as purchasing unproven and sometimes dangerous compounds under the guise of improving septic tank and soil absorption system performance. Well-conceived O/M programs are facilitated by better design (e.g., risers that are easily accessible from the surface), real-time accessibility to system records by field personnel, and automated monitoring that can warn or even adjust operational sequences to avoid imminent problems in pretreatment systems. Many states do not allow alternative onsite treatment technologies because they cannot require the increased O/M required to keep them performing as designed. Examples of how this program element can be implemented are shown in Table 2-12.

Table 2-11. Operation and maintenance approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Operation and maintenance	O/M educational materials circulated to system owners; complaint response protocols published; O/M reminders sent to system owners; and use of only certified/licensed O/M providers.	Maintenance contracts and reporting required for mechanical systems; operating permits renewable upon reported completion of required O/M tasks and inspections; disseminate list of acceptable licensed/certified O/M providers based on complaint investigations.	Trained, certified service providers handle O/M tasks for all systems in accordance with established protocols; supplemental training and certification programs provided or supported by RME through training centers or other means; O/M provider performance reviews frequently-updated and approval list dissemination.

Most, if not all, management programs are likely to use private service providers to implement this management element. Therefore, there is a universal need for trained and certified/licensed O/M service providers. Fewer than 40 percent of the responding jurisdictions to the NSFC survey required training and licensing/certification of O/M service providers. Therefore, until these requirements become more common, the low- to mid-level management programs in areas where they do not exist will have to rely on performance records based on complaints. They should also work with their state oversight agencies to rectify this need. There are established training centers and existing training/certification programs available from the NAWT, NSF International, and the National Environmental Training Center for Small Communities that may be able to assist in solving this problem.

Management Program 3 and higher-level management programs feature renewable/revocable operating permits. Permits are reissued at specified intervals (e.g., 1!5 years) after documentation is submitted that all required operation, maintenance, and monitoring tasks have been completed. Lower level management entities should require verification that licensed/certified service providers are retained by system owners. Service providers should be encouraged to report to the management program if contracts are allowed to lapse.

Requiring pump-outs to ensure proper maintenance

Periodic pumping of septic tanks is now required by law in some jurisdictions and is becoming established practice for many public and private management entities. In 1991 Fairfax County, Virginia amended its onsite systems management code to require pumping at least every 5 years. This action, based upon provisions of the Chesapeake Bay Preservation Act, was accompanied by public outreach notices and news articles. System owners must provide the county health department with a written notification within 10 days of the pump-out. A receipt from the pump-out contractor, who must be licensed to handle septic tank residuals, must accompany the notification.

(Source: Fairfax County Health Department, 1995).

Wisconsin's Private Onsite Wastewater Treatment System Rule (Wisconsin Administrative Code, 2001) requires management plans for all onsite treatment systems. The plans must include information and procedures for maintaining the systems in accordance with the standards of the code as designed and approved. Any new or existing system that is not maintained in accordance with the approved management plan is considered a human health hazard and subject to enforcement actions. Individual management plans for conventional residential septic tank/subsurface infiltration systems are not required. The maintenance requirements specified in the code include the following: 1) all septic tanks are to be pumped when the combined sludge and scum volume equals one-third of the tank volume; 2) existing systems have the added requirement of visual inspections every 3 years for wastewater ponding on the ground surface; 3) only persons certified by the department may perform the inspections or maintenance; and 4) the system owner or designated agent of the owner must report to the department each inspection or maintenance action specified in the management plan at its completion. A data management system is used to allow certified inspectors/operators direct telephone access to the system records for reporting and facilitating compliance tracking by the department. This, in effect, creates a statewide program similar to Levels 2 and 3 for Wisconsin.

2.4.8 Residuals management

Private O/M service providers periodically pump residual material under an oversight program established by the regulatory authority. Management entities (i.e., private or public RMEs) often contract with private service providers to handle this task for a number of systems in the managed area. Transport and disposal/reuse of residuals are governed by federal, state, and local codes. Many governmental units have addressed the challenge of residuals management by designating approved sites for disposal. Detailed guidance for identifying, selecting, developing, and operating reuse or disposal sites for residuals can be found in *Process Design Manual: Land Application of Sewage Sludge and Domestic Septage* (EPA, 1995), which is posted on the Internet at http://www.epa.gov/ORD/WebPubs/sludge.pdf. Additional information on septage (residuals pumped from septic tanks) can be found in *Guide to Septage Treatment and Disposal (EPA, 1994)* and *Domestic Septage Regulatory Guidance* (EPA, 1993), which are posted at http://www.epa.gov/oia/tips/scws.htm. The Water Environment Federation is also an excellent source of information on residuals (http://www.wef.org).

In general, regulations strive to minimize exposure of humans, animals, groundwater, and ecological resources to potentially toxic or hazardous chemicals and pathogenic organisms found in these residuals. The primary objective of a residuals management program is to establish procedures and rules for handling and dispersing accumulated materials removed from treatment processes in an affordable manner that protects public health and ecological resources. Residuals management programs include tracking or manifest systems that identify sources, pumpers, transport equipment, final destination, and treatment/reuse techniques employed at that site, as well as procedures for controlling human exposure to residuals, including vector control, wet weather runoff, and controlled access to disposal sites. Examples of this program element are depicted in Table 2-13.

Table 2-12. Residuals management approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Residuals management	Assure that residuals are being reused or managed in compliance with applicable rules; educate and remind owners of the need to inspect and/or pump treatment tanks at regular intervals; and require only state-certified/licensed O/M residuals handlers and approved sites.	Require homeowners and licensed/certified service providers to report when residuals are removed and tanks inspected in order to renew operating permit; maintain and disseminate list of acceptable O/M service providers based on investigated complaints.	Create and administer tracking, inspection and monitoring plan for all aspects of residuals removal, hauling and reuse/disposal; provide any necessary supplemental training and registration/licensing programs for local O/M providers or arrange it with training centers and universities; and employ only approved providers.

At present, almost all onsite system residuals are in the form of septage. Most septage is dispersed onto the land, but a significant percentage is received and processed in sewage treatment plants. In addition to regulations, practical limitations such as land availability, site conditions, buffer zone requirements, treatment plant loading versus capacity, hauling distances, fuel costs, and labor costs play a major role in evaluating septage or other residuals reuse/disposal options. The above options generally account for nearly 90 percent of the septage generated. However, there are some special septage treatment facilities. Initial steps in the residuals reuse/disposal decision-making process include characterizing the quality of the septage and determining potential adverse impacts associated with various reuse/disposal scenarios. Protocols for crafting an environmental management system (EMS) are useful in developing and implementing a residuals management program. Even though residuals management is almost always performed by private O/M service providers, the management entity must assure the regulatory authority (i.e., at some level of government) of compliance with all regulations.

Typically the amount of septage produced per person served in the management entity is 50 to 70 gallons per year (EPA,1994b; WEF,1997). Therefore, if there were 1,000 people in a management zone a rough estimate would be 50,000 to 70,000 gallons per year to be pumped, transported, and treated for dispersal back into the environment. Certain alternative onsite systems like ATUs should produce significantly greater quantities of residuals if properly serviced, but the characteristics of the additional residuals are less onerous. An important task for the management entity is to identify approved sites with sufficient capacity to properly treat, reuse, or dispose of the residuals that the O/M service providers remove and transport. Concerns about odors and pathogens associated with septage increase the need for public education on the management options chosen and how they will be monitored and compliance enforced.

Working with stakeholders early in the management program planning stage to develop the optimal residuals management program is recommended. Capacity needs should be extrapolated from the types of technologies to be employed and the estimated numbers of each type, rather than from present septage generation rates, which will likely yield a lower estimate of capacity needed.

2.4.9 *Training and certification/licensing*

States and tribes are responsible for developing programs that elevate the quality of service provided by the onsite industry, just as they do for central sewer systems by conducting certification/licensing programs for treatment plant operators or for the drinking water treatment plant operators. State regulatory authorities often set minimum criteria for certifying and/or licensing various service providers (e.g., septic tank pumpers/haulers, site evaluators, system designers, installers, inspectors). In the absence of a rigorous state, tribal, or territorial program, local management entities should consider developing one. The level of development of such a program will vary according to the comprehensiveness and capabilities of the management program partners. Even at the most minimum level, a form of such a program can be implemented by requiring trained and state or tribal licensed/certified service providers to perform these tasks.

Angoli (2001) reported that most onsite regulatory agencies surveyed do have some form of licensing/certification for installers (74 percent), soil/site evaluators (50!68 percent), inspectors (67 percent), and designers (64 percent). Operations and maintenance training/certification is significantly lower (19!37 percent). Even if the management entity is located in a state that does not have or has a less-rigorous certification/licensing program, the entity can still alert other owners of verified complaints against service providers.

Even in states that do have licensing/certification programs, the management program can pass on such information to the state department responsible for the program. Higher-level management programs with comprehensive inspection programs can either warn or decertify service providers who consistently evoke complaints from homeowners. Since the O/M tasks, particularly the pumping task, are the most frequent and personal contacts with homeowners, a swift response on the part of the management entity to such complaints is vital in retaining public confidence. Some examples of management program approaches to certification/licensing are provided in Table 2-14.

There are several entities working to address the need for better trained and qualified service providers, including the waste transport industry, states, training centers, and national organizations. Washington State is attempting to institute a homeowner insurance program (NSFC, 2001) wherein the entire onsite industry is attempting to rid itself of inadequately performing service providers by identifying reasons for system failure and the responsible parties. This concept is being considered for wider application by the National Onsite Wastewater Recycling Association. NAWT also offers a form of conventional onsite system warranty that could have a positive effect in eliminating poor performers.

Table 2-13. Certification and licensing approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Certification/licensing of service providers	Require homeowners to use only state or tribal registered/licensed service providers.	Support more comprehensive state/tribal requirements for certificate or license.	Develop inspections and performance reviews for approval of service providers in district.
		Create and disseminate lists of acceptable service providers contingent on their accuracy of reporting and service complaint investigations.	Implement supplemental programs specific to district for service providers seeking to perform services based on local protocols.

For those states that do not have training centers there are programs offered by NSF International, the National Environmental Training Center for Small Communities at West Virginia University, and NAWT that certify service providers. Always check with state and tribal authorities to determine whether they recognize or accept these training and accreditation programs. Onsite wastewater system training centers exist or are being developed in several states, and are cooperating with the Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT) and the National Decentralized Water Resources Capacity Development Project (NCDP) in creating new and improved training programs that can be provided at the centers.

The State of Maine requires that site evaluators be permitted and that designers of systems treating more than 2,000 gallons per day or systems with nondomestic wastewater characteristics be registered professional engineers. Prerequisites for applying for a permit and taking the certification examination are either a degree in engineering, soils, geology, or similar field, plus one year of experience, or a high school diploma or equivalent and four years of experience (Maine Department of Human Services, 1996). After the state implemented the program in 1974, OWTS failure rates dropped significantly (Kreissl, 1982). At present, requirements for site evaluators, system designers, installers, inspectors, and maintenance service providers presently vary widely among the states. For example, some states issue permits or grant exemptions that allow homeowners to design and install onsite treatment systems at their primary residence.

These code provisions, which are linked to farmstead or homestead exemptions, should be eliminated or revised to require some demonstration of competency on the part of the prospective homeowner designer/installer. For example, Alaska allows homeowners to design and install systems at their residence if they complete an approved training course and comply with state design, construction, and siting requirements. Approval is granted after the homeowner submits an infiltration field size estimate based on a professional analysis (i.e., by an engineer or laboratory) of soils at the proposed site (Alaska Administrative Code, 1999).

NSF Onsite Wastewater Inspector Accreditation Program

NSF International has developed an accreditation program to verify the proficiency of persons performing inspections on existing OWTSs. The accreditation program includes written and field tests and provides credit for continuing education. Inspectors who pass the tests and receive accreditation are listed on the NSF International Web site and in the NSF Listing Book, which is circulated among industry, government, and other groups.

The accreditation process includes four components. A written examination, conducted at designated locations around the country, covers a broad range of topics relating to system inspections, including equipment, evaluation procedures, trouble-shooting, and the NSF International Certification Policies. The field examination includes an evaluation of an existing OWTS. An ethics statement, required as part of the accreditation, includes a pledge by the applicant to maintain a high level of honesty and integrity in the performance of evaluation activities. Finally, the continuing education component requires requalification every 5 years through retesting or earning requalification credits through training or other activities.

To pass the written examination, applicants must answer correctly at least 75 of the 100 multiple-choice questions and score at least 70 percent on the field evaluation. A 30-day wait is required for retesting if the applicant fails either the written or field examinations.

(Source: NSF International, 2000).

Professional standards programs include either licensing or certification, both of which are usually based on required course work or training; an assessment of knowledge, skills, and professional judgment; past experience; and demonstrated competency. Some certification and licensing programs require at least some college-level course work. For example, Kentucky requires a 4-year college degree with 24 hours of science course work, completion of a week-long soils characterization class, and another week of in-service training for all site evaluators and permit writers (Kentucky Revised Statutes, 1992). Regular training sessions are also important in keeping site evaluators, permit writers, designers, and other service personnel effective. The Minnesota Cooperative Extension Service administers 2-day workshops on basic and advanced inspection and maintenance practices, which are now required for certification in 35 counties and most cities in the state (Shephard, 1996).

Comprehensive training programs have been developed in other states, including North Carolina, West Virginia, and Rhode Island. Most licensing programs require continuing education through recommended or required workshops at specified intervals. For example, the Minnesota program requires 3 additional days of training every 3 years.

Certification programs for inspectors, installers, and septage haulers provide assurance that systems are installed and maintained properly. States are beginning to require training, certification, and/or licensing for all service providers to ensure that activities conducted by providers comply with program requirements. Violation of program requirements or poor performance can lead to revocation of certification and prohibitions on installing or servicing onsite systems. This approach, which links professional performance with economic incentives, is highly effective in maintaining compliance with onsite program requirements. Programs that simply register service providers or fail to take disciplinary action against poor performers cannot provide such assurances.

Installer and designer permitting in New Hampshire

Onsite system designers and installers in New Hampshire have required state-issued permits since 1979. The New Hampshire Department of Environmental Services Subsurface Systems Bureau issues the permits, which must be renewed annually. Permits are issued after successful completion of written examinations. The designer's test consists of three written sections and a field test for soil analysis and interpretation. The installer's test consists of a written examination only.

The tests are broadly comprehensive and assess candidate knowledge of system design, regulatory setbacks, methods of construction, types of effluent disposal systems, and new technology. Designers must take three tests that take about 5 hours to complete. The passing grade is 80 percent. The field test measures competency in soil science through an analysis of a backhoe pit, determination of hydric soils, and recognition of wetland conditions. Installers must pass a 2-hour written exam that measures understanding of topography, regulatory setbacks, seasonal high water table determination, and acceptable methods of system construction.

(Source: New Hampshire Department of Environmental Services, 1991).

More information on training programs for onsite wastewater professionals, including a calendar of planned training events and links to training providers nationwide, can be found on web sites maintained by the NESC and EPA-OWM (see Appendix).

NAWT onsite inspector training and certification program

The National Association of Waste Transporters (NAWT) has developed and implemented a training and certification program for inspectors of OWTSs. The program consists of two days of classroom training followed by a certification examination. NAWT-certified inspectors are required to participate in continuing education offerings to maintain their certification. The goal for this program is to develop a capacity to evaluate the functionality of wastewater treatment system components. The inspection process consists of documenting the existence of critical components of conventional septic tank and soil absorption systems, inspect them for their operability, and document deficiencies where they exist. The inspection process does not include any warranty for the system or guarantee for its service life.

(Source: NAWT)

3.4.10 Inspections and monitoring

Onsite wastewater system performance should be periodically monitored and inspected by system owners, private service providers, and/or management program staff to ensure proper performance. Inspections are a basic form of monitoring the performance of individual systems. The impact of a group or cluster of systems (e.g., for a subdivision or portion of a town) can be ascertained via aquifer or watershed monitoring and assessment of trends.

Inspections can take several forms. Typically, there is a qualitative evaluation based on appearance, odor, or noise attributes, followed by some means of below ground system inspection through passage or observation ports that extend to the surface. Based on the outcome of the inspection, a problem may be identified that calls for scheduling repairs or servicing, (e.g., pumping). The management entity should develop a compliance schedule that clearly outlines the sequence of events and their time limits to correct (and certify the correction) identified problems. Many higher-level programs will, after a specified period, perform the required tasks to attain compliance and bill the homeowner. If the owner fails to pay within some designated time period, a lien is placed against the property. Example inspection/monitoring program elements are shown in Table 2-15.

Table 2-14. Inspection and monitoring approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Inspection/ monitoring	Educate and request homeowners on how to conduct basic inspections, (e.g., monitor sludge/ scum buildup in septic tank). Require inspections by licensed/certified persons at time of property transfer, change in use, and complaint investigation.	Specify regular inspection of all systems as part of operating permits; develop inspection reporting program via O/M provider/homeowner inputs; and permit only licensed/certified inspectors to perform them.	Conduct aquifer or watershed monitoring in addition to pretreatment system inspections. Regularly evaluate monitoring data and permit requirements to determine if any program adjustments are needed. Develop supplemental training programs specific to local needs for approved inspectors.

NSFC offers a compilation of regulations regarding inspections from the states that have them and some other public education products that describe what the homeowner can expect from an inspection of their system. Some states have developed handbooks for inspection that deal with most aspects of a possible inspection protocol. Basic onsite system operation and performance inspections should be documented on standardized forms that include checks for:

- Evidence of vehicles being driven over the septic tank or reserve field.
- Installation of pavement, driveways, or structures over the septic tank or reserve field.
- Wet areas or poor drainage in or around the infiltration field.
- Slow flushing or gurgling of water in plumbing fixtures.
- Leaking toilets or addition of significant wastewater-generating fixtures such as water softeners.
- Additions to the house or building since the system was installed.
- Surface drainage patterns in the area of the tank and infiltration field.
- Broken or open tank access covers or doors.
- Sludge/scum buildup in septic tank; clogging of tank outlet screens.
- Effluent quality to confirm compliance with design assumptions.
- Physical condition of all treatment components.

Inspections of onsite systems are normally performed by a trained homeowner, an independent licensed/certified inspector, or staff member of the management entity. Lower level management program inspections are generally limited to a pre-cover inspection during construction and prior to property sale or change in use. Comprehensive management programs feature inspections that can be conducted randomly or at preset times during system construction or operation. Onsite system inspections can be one of the most effective tools of management to monitor the performance of service providers and to assure that required O/M is properly performed.

Some management entities and states require mandatory inspections or disclosure of system operating condition upon property transfer (e.g., Minnesota, Wisconsin, Massachusetts), and/or periodic monitoring by licensed inspectors. Renewable operating permits might require system owners to have a contract with a certified inspection/maintenance contractor or otherwise demonstrate that periodic inspection and required operation and maintenance procedures have been performed for permit renewal (Wisconsin Department of Commerce, 2001). Minnesota, Wisconsin, Massachusetts, and some counties (e.g., Cayuga and other counties in New York; Washtenaw County in Michigan) require that sellers of property disclose or verify system performance (e.g., disclosure statement, inspection by the local oversight entity or other approved inspector) prior to property transfer.

Financial incentives usually aid compliance and can vary from small fines for poor system maintenance to preventing the sale of a house if the OWTS is not functioning properly. Inspection fees might be one way to cover or defray these program costs. Lending institutions nationwide have influenced the adoption of a more aggressive approach toward requiring system inspections before home or property loans are approved. In some areas, inspections at the time of property transfer are common despite the absence of regulatory requirements. This practice is incorporated into the loan and asset protection policies of local banks and other lending institutions.

If regional aquifer or watershed monitoring/assessment detects some degradation of receiving waters, an RME, in concert with the regulatory authority, may need to readjust certain system design requirements to assure compliance with their permit. Monitoring of downstream ground water has been attempted in research studies, but this type of monitoring is both expensive and difficult (Pask, 2000) because of uncertainties in predicting effluent plume migration pathways in nonuniform geology. Sandison, et al. (1992), Burnell (1992), Nelson and Ward (1980) and Eliasson, et al. (2001) discusses monitoring program issues that may be useful in developing monitoring programs for decentralized management program use. Gunnison County, CO, requires periodic monitoring of septic tank effluent and shallow unconfined aquifers downgradient of the discharge to determine impacts on the latter's nitrogen, BOD, and phosphorus concentrations. An axiom for cost-effectiveness is to maximize use of existing wells and existing monitoring activities by various other agencies. Usual characteristics monitored include nitrates, fecal coliforms, and phosphorus, but local conditions will dictate the exact type and frequency of measurements required.

2.4.11 Corrective actions and enforcement

Various types of legal instruments are available (see Table 2-16) to ensure compliance with onsite system regulations. Regulatory programs can be enacted as ordinances, system management agreements, local or state codes, or simply as guidelines. State code requirements can often be modified or strengthened by local health boards or other units of government in concert with state authorities to better address local conditions through the passage of local ordinances.

Table 2-15. Approaches to ensuring compliance and their implications

Collection method	Description	Advantages	Disadvantages
Liens on property	Local governing entity (with taxing powers) may add the costs of performing a service or past unpaid bills as a tax on the property.	Has serious enforcement ramifications and is enforceable.	Local government may be reluctant to apply this approach unless the amount owed is substantial.
Recording violations on property deed	Copies of violations can, through administrative or legislature requirement, be attached to the property title (via registrar of deed).	Relatively simple procedure. Effectively limits the transfer of property ownership.	Can be applied to enforce sanitary code violations; may be ineffective in collecting unpaid bills.
Presale inspections	Inspections of onsite wastewater systems are conducted prior to transfer of property, or when property use changes significantly.	Notice of violation may be given to potential buyer at the time of system inspection; seller may be liable for repairs.	Can be difficult to implement due to additional resources needed. Inspection fees can help cover cost.
Termination of public services	A customer's water, electric, or gas service may be terminated (as applicable).	Effective procedure, especially if management entity is responsible for water supply.	Termination of public services is potential health risk and requires political will; does not apply if property owner has well.
Fines	Monetary penalties for each day of violation, or as a surcharge on unpaid bills.	Fines can be levied through judicial system as a result of enforcement of violations.	Effectiveness will depend on willingness of the authority vested to issue the fine.

(Source: Ciotoli and Wiswall, 1982.)

Local ordinances that promote performance-based approaches can reference technical manuals for more detailed criteria on system design and operation. Approaches for enforcing requirements and enabling corrective actions by a management program include

- Responding promptly to complaints.
- Providing meaningful performance inspections.
- Reviewing required documentation and reporting.
- Issuing notices of violation (NOVs).
- Implementing consent orders and court orders.
- Holding formal and informal hearings.
- Issuing civil and criminal actions or injunctions.
- Condemning systems and/or property.

- Correcting system failures.
- Restricting real estate transactions
- Issuance of fines and penalties

Even the most basic management program should have the ability to adopt rules and assure compliance with them by levying fines, fees, assessments, or by engaging service providers to respond to failed/failing systems. Enforcement programs need not be based solely on fines to be effective. Information stressing public health protection and the monetary benefits of clean water can provide additional incentives to homeowners for program compliance. Active and effective outreach programs that focus on awareness, education, and training can reduce noncompliance. There are, however, some requirements that must be enforceable to ensure program effectiveness. They include both construction and operating permits, licensing and certification requirements to demonstrate the necessary skills to perform services, the right to require or carry out repairs or replacement, and, if necessary, levy monetary penalties. Examples of the variety of approaches to enable corrective actions are provided in Table 2-17.

Table 2-16. Corrective action approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Corrective actions/ Enforcement	Issue NOV and negotiate compliance schedules for documented problems; administer enforcement program with fines and/or penalties for failure to comply with requirements in a timely manner.	Develop revocable operating permit program to assure corrective actions through required inspections and enforce it. Create electronic reporting system to track corrective measures with real-time input from staff and service providers.	Develop clear and concise protocols with citizen input and review to provide step-by-step definition of enforcement action sequence. Enable corrective actions to be implemented by RME or third-party service providers with payment ensured by power to impose property liens or other enforceable instruments.

All of the tools in Table 2-17 can be time-consuming and generate negative publicity. Any attempt to force compliance on a reticent homeowner will not produce a positive outcome if not supported by the public. Involvement of stakeholders in development of this program element is vital to the viability of the management program. This public involvement, with input from the oversight agencies, can ensure that the corrective actions/enforcement provisions are appropriate for the management area and effectively protect human health and water resources. It is important that program expectations by the serviced population are clear, consistent, and specific. It is also important to involve the public in corrective actions/enforcement activities, possibly through an appeals board or some form of program performance review committee, to minimize any misinformation or other negative feedback from this sensitive activity. Most states establish regulatory programs and leave enforcement up to the local agencies, subject to periodic oversight reviews.

To have validity, all enforcement approaches seeking to implement corrective actions must have the necessary force of law. Therefore, the legal basis and enabling language for the existence of the district or other enforcing agency must have that power. In most states that power is vested in the local governments through certain "home rule" provisions, but there are numerous variations when dealing with onsite wastewater systems. In some states the power to enforce these rules is granted by the states, but real power to impose user fees and fines may still be limited to the local government. Therefore, the necessary legal power must be ensured before the management entity can be formed. The two key roles in effective management entity enforcement are the citizen's willingness to be part of the entity and the local or state government's cooperation in the enforcement of rules to assure compliance.

The RME cannot exist without these policing powers, which may be granted by state and/or local government or by state enabling legislation that facilitates its formation. However, Otis, et al. (2001) stress that the focus of a successful program must be to maintain compliance, rather than to be punitive, in order to gain public support. In most cases, the RME will be able to enforce its agreements with customers through standard contract law, in the case of a Model Program 4 approach, or through termination of wastewater treatment services under Model Program 5, which features RME ownership of the treatment system.

2.4.12 Record keeping, inventory, and reporting

Record keeping and reporting programs are among the most important activities of all management programs. Record keeping includes every aspect of management and at a minimum should include information on ownership, type, and location of the system on the property (often referred to as a lot plan), as-built drawings, site evaluation results and when and by whom it was performed; permit approver and date; name of the designer; date of installation, name of the installer and the inspector of the installation; dates and details of each inspection, any maintenance contracts, pumping and/or repair; monitoring data; and all other information such as dates of complaints and enforcement responses to them that pertain to each system. It includes all information originally gathered during the inventory of existing systems in creating the management entity and should be kept in a readily accessible database or filing system. Examples of these program element contents are given in Table 2-18.

As the management program increases in sophistication these databases can be used for automatic tracking of maintenance contracts, dates of upcoming inspections or operating permit expiration, and other time-dependent activities. In Texas alternative systems with required O/M tasks are recorded on the property deed in order to make subsequent owners aware of these requirements. With an RME, such tracking systems can virtually drive a large portion of the day-to-day activities, and they should allow real-time entry of field information and protected access to data by field personnel. Hantzsche, et al. (1991) described objectives for the data management system at Sea Ranch, CA, that could be used as guidance for any RME. Heigis, et al., (2001) and Mayer (2001) have also described advanced onsite management record-keeping tools for creating and maintaining databases for possible application by an RME.

Table 2-17. Record keeping, inventory, and reporting approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Record keeping, inventory, and reporting	Maintain system inventory, site evaluation, construction permit and inspection files.	Develop reporting approaches to collect O/M information from all service providers and inspections in addition to system inventory.	Provide system inventory and tracking system as in intermediate approach with watershed characterization information and data to assist planning staff.
	Administer maintenance reminder and public education programs.	Institute electronic reporting and database system for operating permit program actions.	Develop interactive, real-time information tracking programs to maximize field productivity, track watershed and ground water trends, facilitate reporting to oversight agencies, and to maximize public education/involvement.

The basic foundation for all record keeping systems in all management entities is the initial inventory of onsite wastewater systems within the boundaries of the program (Burnell 1992; Clemans, et al., 1992). Clermont County, Ohio, developed an OWTS owner database by cross-referencing water line and sewer service customers. Contact information from the database was used for a mass mailing of information on system operation and maintenance and the county's new inspection program to 70 percent of the target audience (Caudill, 1998). Where operating permits are employed or even where they are not, a system of information sharing with the homeowner is an excellent approach. Homeowners can be valuable in identifying inaccurate entries to assure that the records are accurate.

Cuyahoga County Board of Health, Ohio, computer database management

To improve their sewage program filing system, Cuyahoga County Board of Health developed a Microsoft Access-based format to access and track drawings, evaluation results, permits, and other correspondence pertaining to the sewage system serving for a specific address. This database enables the Board of Health to respond to homeowners and service provider's questions and send out septic tank pumping reminders as needed.

(Source: Novickis, 2001).

Where point-of-sale inspections are dictated, such information must be regularly recorded and added to the inventory to ensure an up-to-date inventory of systems. These inspection reports are part of the deed recording system, but unless the inspection is funded by the management entity or legally required, it may not be made public for inventory entry. Problems have occurred in the past where the management program did not automatically receive a copy of the inspection report, thus precluding it from being entered into the database. Some Management Program 2 systems have used property transfer and change-in-use inspections to identify lapses in maintenance contracts, but most request maintenance contractors to report those lapses.

Washtenaw County, Michigan, time-of-sale program

Washtenaw County has a time of sale program with the following features:

- Inspectors must be approved (licensed through training/exam) by the RME.
- RME staff must verify needs identified within 5 days of submission.
- Corrective actions identified by the inspection must be submitted to RME in 30 days.
- Repairs must be completed or contract entered into (with 150 percent of estimate in escrow) before sale.

(Source: Johnson, et al., 2001).

All program reviews and regulatory oversight procedures are dependent upon the records maintained as part of the management program. Therefore, all record-keeping programs must accommodate these functions. As the size and level of the management program increase, electronic, interactive record keeping becomes not only attractive, but also necessary. In all management programs at all levels, the information on any specific system must be accessible to the system owner upon request. The types of information that should be maintained in the program records (databases) include:

- System owner and contact numbers.
- System location and components from as-built drawings on lot plans (installer and dates).
- Site evaluation information and provider.
- System designer, inspector & permitting official (capacity, design basis, and caveats).
- O/M activities (dates, performing individuals, and reports).
- Complaints (dates, responding personnel, and reports).
- System rehabilitations (dates, as-builts, contractors, and approving official).
- Monitoring data (dates, reports, and sampling, and analytical performers).

A number of private and public software packages are available for application to the management program needs. Interested parties are directed to the EPA-OWM and the NSFC Web sites for an up-to-date listing.

2.4.13 Financial assistance and funding

In the context of an operational onsite wastewater management entity, this program element is a catch-all for a variety of financial and legal support requirements, as well as community assistance programs to assist homeowners in financing required repairs to achieve compliance. Lower-level management programs require homeowners to take much greater responsibility for compliance than more comprehensive programs. The need to develop financing opportunities for system upgrades and repairs, however, can be significant for all levels, except for Management Program 5. Public-private partnerships are considered to be one of the most often cited forms of such assistance. In some cases the management entity makes arrangements with local lending institutions to offer special terms ! such as lower interest or longer payback periods ! to their service population who are unable to pay the cost for required repairs or upgrading in order to come into compliance in a timely manner. In effect, the entity is a co-signer of such loans and guarantees them against default. In areas where there are major commercial wastewater sources, the potential of using private financing through a partnership arrangement should be investigated since these contributors may have the most to gain from participating in a successful decentralized management program. Typical program element contents are shown in Table 2-19.

Table 2-18. Financial assistance and funding approaches

Program element	Basic approach	Intermediate approach	Advanced approach
Financial assistance and funding	Program revenues must suffice to provide necessary legal and administrative support to conduct all aspects of the management program. Seek grants or other funding to help owners upgrade or replace systems.	Program revenues must suffice to provide necessary legal and administrative support to conduct all aspects of the management program. Work with state, tribal, or local governments and local lending institutions to develop low interest loan programs. Seek grants or other funding to help owners upgrade or replace systems.	Program revenues must suffice to provide necessary legal and administrative support to conduct all aspects of the management program. Create cost-share program to help low income owners pay for system repairs or replacement as part of the user fee structure. Implement management fees that cover inspections, repair, replacement, O/M costs, and a sinking fund to cover future infrastructure needs. Seek grants or other funding to help owners upgrade or replace systems.

A public or privately owned/operated decentralized RME is eligible to receive EPA Clean Water State Revolving Fund (SRF) loans , but not all states have implemented the rules needed to implement these loans. Numerous other federal and state loan and grant programs exist, and one of the primary roles of the RME is to actively seek out such funding sources for their constituents.

A possible approach for a RME is to create an equitable program of user fees that provides a financial assistance program for eligible homeowners to regain compliance with applicable performance requirements. Although there are excellent guides available for developing rate structures by management entities in small communities (University of Tennessee,1991; Ciotoli and Wiswall,1982; Shephard,1996; RCAP,1995), creating a management program financed by user fees is particularly difficult without strong public involvement.

The RME can work with local lending institutions to provide low interest loans to owners needing to upgrade their systems or work with local businesses within the onsite management district to develop a public/private partnership to assist those individuals. Such opportunities are maximized with use of citizen advisory boards and citizen membership in the management entity's board of directors. Mancl (2001) reports that five long-term successful management entities have charged homeowners between $100 and $365 per year. Pickney and Pickney (2001) report that the Tennessee Public Utilities Commission established fees for their privately owned and operated Model 5 RME at $35.11/month, which covers costs associated with managing and financing future infrastructure repairs, primarily for cluster systems. These systems are built according to the specifications provided by the firm and are then deeded over to the firm upon completion of construction. The revenue streams created to sustain the RME are generally from property assessments, user fees, taxes, fees for specific services, fines, and developer-paid fees such as connection fees and impact fees. The advantages and disadvantages of each of these revenue sources are presented in Table 2-18

Development company sponsors management district in Colorado

The Crystal Lakes Development Company has been building a residential community 40 miles northwest of Fort Collins, Colorado, since 1969. In 1972, the company sponsored the creation of the Crystal Lakes Water and Sewer Association to provide drinking water and sewage treatment services. Membership in the association is required of all lot owners, who must also obtain a permit for onsite systems from the Larimer County Health Department. The association enforces county health covenants, aids property owners in the development of onsite water and wastewater treatment systems, monitors surface and ground waters, and has developed guidelines for inspection of onsite water and wastewater systems. System inspections are conducted at the time of property transfer. The association conducts preliminary site evaluations for proposed onsite systems, including inspection of a 7-foot deep backhoe pit excavated by association staff with equipment owned by the association. The county health department has also authorized the association to design proposed systems. The association currently manages systems for more than 100 permanent dwellings and 600 seasonal residences. Management services are provided for all onsite systems in the development including 300 holding tanks, seven community vault toilets, recreational vehicle dump stations, and a cluster system that serves 25 homes on small lots and the development's lodge, restaurant, and office buildings. The association is financed by annual property owner dues of $90 !$180 and a $25 property transfer fee, which covers inspections.

(Source: Mancl, 1999).

PENNVEST: Financing onsite wastewater systems in the Keystone State

The Pennsylvania Infrastructure Investment Authority (PENNVEST) provides low-cost financing for systems on individual lots or within entire communities. Teaming with the Pennsylvania Housing Finance Agency and the Department of Environmental Protection, PENNVEST created a low-interest onsite system loan program for low- to moderate-income (i.e., 150 percent of the statewide median household income) homeowners. The $65 application fee is refundable if the project is approved. The program can save system owners $3,000 to $6,000 in interest payments on a 15-year loan of $10,000. As of 1999, PENNVEST has approved 230 loans totaling $3.5 million. Funds for the program come from state revenue bonds, special statewide referenda, the state general fund, and the State Revolving Fund.

(Source: Pennsylvania Department of Environmental Protection, 1998.)

Table 2-19. Advantages and disadvantages of various funding sources

Funding source	Description	Advantages	Disadvantages
Loans	Money lent with interest; can be obtained from federal, state, and commercial lending institution sources.	State and federal agencies can often issue low-interest loans with a long repayment period. Loans can be used for short-term financing while waiting for grants or bonds.	Loans must be repaid with interest. Lending agency might require certain provisions (e.g., power to levy taxes) to assure managing agency of ability to repay the debt. Commercial loans generally are available at higher interest rates and might be difficult to obtain without adequate collateral.
Grants	Funds awarded to pay for some or all of a community project.	Funds need not be repaid. Small communities might be eligible for many different grants to build or upgrade their environmental facilities.	Applying for grants and managing grant money require time and money. Sometimes grant-imposed wage standards apply to an entire project even if the grant is only partially funding the project; this increases project expense. Some grants require use of material and design requirements that exceed local standards and might result in higher costs. Grant funds are quite scarce in comparison with loan funds.
General obligation bonds	Bonds backed by the full faith and credit of the issuing entity. Secured by the taxing powers of the issuing entity. Commonly used by local governments.	Interest rates are usually lower than those of other bonds. Offers considerable flexibility to local governments.	Community debt limitations might restrict use. Voters often must approve of using these bonds. Usually used for facilities that do not generate revenues.
Revenue bonds	Bonds repaid by the revenue of the facility.	Can be used to circumvent local debt limitation.	Do not have full faith and credit of the local government. Interest rates are typically higher than those of general obligation bonds.
Special assessment bonds	Bonds payable only from collection of special assessments. Property taxes cannot be used to pay for these.	Removes financial burden from local government. Useful when direct benefits can be readily identified.	Can be costly to individual landowners. Might be inappropriate in areas with nonuniform lot sizes. Interest rate might be relatively high.
Bond bank monies	States use taxing power to secure a large bond issue that can be divided among communities.	States can get the large issue bond at a lower interest rate. The state can issue the bond in anticipation of community need.	Many communities compete for limited amount of bond bank funds.

Certificates of participation (COPs)	COPs can be issued by a community instead of bonds. COPs are issued to several lenders that participate in the same loan.	Costs and risks of loan spread out over several lenders. When allowed by state law, COPs can be issued when bonds would exceed debt limitations.	Requires complicated agreements among participating lenders.
Note	A written promise to pay a debt. Can include grant and bond anticipation notes.	Method of short-term financing while a community is waiting for a grant or bond.	Community must be certain of receipt of the grant money. Bond notes are risky because voters must approve general obligation bonds before they are issued. Voter support must be overwhelming if bond notes are used.
Property assessment	Direct fees or taxes on property. Sometimes referred to as an improvement fee.	Useful where benefits from capital improvements are identifiable. Can be used to reduce local share debt requirements for financing. Can be used to establish a fund for future capital investments.	Initial lump sum payment of assessment might be a significant burden on individual property owners. Some states and localities restrict the allowable burden on individuals.
User fee	Fee charged for using the wastewater system.	Generates steady flow of revenue. Graduated fees encourage water conservation.	Flat fees discourage water conservation. Graduated fee could discourage high-volume water using industries or businesses from locating in an area.
Service fee	Fee charged for a specific service, such as pumping the septic tank.	Generates funds to pay for O&M. Fees not imposed on people not connected to the system.	Revenue flow not always continuous.
Punitive fees	Charges assessed for releasing pollutants into the system.	Generates revenue while discouraging pollution.	Generation of funds not always reliable. Could encourage business to change location or participate in illegal activities to avoid fees. Could generate opposition to O&M scheme.
Connection fees	Charges assessed for connection to existing system.	Connection funded by beneficiary. All connection costs might be paid.	Might discourage development. Can be restricted by state and local laws.
Impact fees	Fees charged to developers.	Paid for only by those who profit. Funds can be used to offset costs.	Might reduce potential for development. Can be restricted by state/local laws.

(Source: EPA, 1982, 1994).

Management Model	Objectives	Basic features
Management Model 4 Responsible management entity operation and maintenance	▪ Responsible public or private entity assumes O/M and inspection/monitoring responsibilities for all systems in management area.	Performance governs acceptability. Operating permits ensure compliance. All systems are inspected regularly. Monthly/yearly fees support program. Owner responsible for all costs. Create and maintain inventory.
Management Model 5 Responsible management entity ownership	▪ Public or private RME owns and operates all systems in management area. ▪ Similar to centralized sewer system service approach.	▪ Performance governs acceptability. ▪ All systems are inspected regularly. ▪ Monthly/yearly fees support program. ▪ Users relieved of all O&M responsibilities. ▪ RME funds installation & repairs. ▪ Create and maintain inventory.

Chapter 3 Management program models

3.1 Introduction to the management models

USEPA has developed five models to characterize what programs might look like at various intervals along the management continuum. The management models, which are part of the *Voluntary Guidelines for Management of Onsite and Cluster (Decentralized) Wastewater Treatment Systems* (USEPA, 2003), are presented as a series of progressive steps in the management continuum. The management models are crafted so that the management requirements for wastewater systems become more rigorous as system technologies become more complex and/or the sensitivity of the environment increases. This concept is a key to management program development.

This chapter discusses management program objectives, presents brief descriptions of the types of systems targeted under each model, and outlines the major benefits and limitations of each of the five models. The reader should note that these five conceptual models are presented for illustration purposes only. The array of management program activities for any community must be based on its goals, regulatory requirements, and resources and the overall environmental setting in which the regulatory authority and management entities (or service providers) operate. Thus, the management program developed by a local community might not exactly reflect one of these five models but might borrow elements from two or more to better respond to unique community concerns (e.g., lake eutrophication, ground water contamination) or address other issues that local citizens describe as important.

> *"The sewage management program is as necessary as any other component of the onsite system. A good sewage management program will extend the life of the onsite system and eliminate or delay the need for public sewer systems."*
>
> *David V. Linahan, Sewage Management Programs for Decentralized Wastewater Treatment Systems, 2000*

The models share the common goal of ensuring that human health and the environment are protected. Effective implementation of any management program requires ongoing coordination among appropriate regulatory authorities, the community, and other partners in the management program. This coordination is necessary to help ensure that state and local OWTS programs are managed to protect public health and the environment and to meet state, tribal, or local water quality standards, such as applicable pathogen and nutrient criteria.

Each management model includes a set of management objectives and related program elements and activities targeted toward the satisfactory achievement of the objectives. The management models are benchmarks for a state, tribal, or local unit of government to (1) identify management needs, (2) evaluate whether the current management program is adequate, and (3) develop an appropriate management program or necessary program enhancements to achieve public health and environmental goals. USEPA recognizes that states, tribes, and local governments need a flexible framework to best tailor their programs to the specific needs of their communities. These management models are not intended to supersede existing federal, state, tribal, or local laws and regulations, but rather to facilitate compliance with them.

The management models summarized in Table 3-2 and described in the following sections span the management continuum, from simple inventory and maintenance awareness programs for system owners to programs with comprehensive management entities that own and operate a number of systems. As noted previously, local programs will vary depending on the unique regulatory, ecological, and economic conditions of each community.

3.2 Description of the management models

The Management Guidelines consist of a series of five management models. As the models progress from The Homeowner Awareness Model to The Responsible Management Entity (RME) Ownership Model, they reflect the need for improved management practices and increased oversight as determined by the complexity of treatment systems employed and the potential risks to public health and water resources. For example, The Homeowner Awareness Model recommends management practices for areas where the risks to public health and water resources are low and the suitable treatment technologies are passive and robust. The RME Ownership Model, on the other hand, defines an appropriate level of practice and oversight for communities where there are significant risks to public health or water resources. Table 3-1 presents a brief description of each management model; detailed information on how each program element discussed in Chapter 3 might be addressed under each model can be found in Appendix D. Table 3-1 presents the management program objectives, provides a brief description of the types of systems applicable, and lists major benefits and limitations for each of the five management models.

The Guidelines contain certain key concepts that are the foundation of changes needed to improve the performance of decentralized wastewater treatment systems. These concepts are imbedded in the activities of each management model and have the potential for making the difference in the field. These concepts include:

- an increase in the level of management as the level of risk and technical complexity increase,
- inventorying existing systems and their level of performance as a minimum,
- operating permits for large systems and clusters of onsite systems,
- discharge permits for systems which discharge to surface waters,
- increased requirements for certification and licensing of practitioners, and
- elimination of illicit discharges to storm drains or sewers.

The management models provide benchmarks for a state, tribal, or local unit of government to 1) select appropriate management objectives to meets its wastewater treatment needs; 2) evaluate the strengths and weaknesses of its current program in achieving the desired objectives; 3) design a management program and activities needed to meet unique local objectives; and 4) develop a plan for implementing the management program.

In deciding whether or not to use on-site systems, it is important to consider the risks they may pose to the environment and public health. There may be cases where on-site systems are not appropriate due to the environmental sensitivity or public health concerns of an area. In the cases where on-site systems are appropriate, it is critical that they are managed to prevent environmental and public health impacts. All of the management models share the common goal of ensuring that public health and water resources are protected. Effective implementation of management programs requires coordination among state, tribal, and local water quality, public health and planning and zoning agencies, and community officials. USEPA continues to encourage this coordination on a watershed basis. Zoning ordinances and land use planning are also mechanisms used by state, tribal and local governments to address water resources issues. Coordination is necessary also to help ensure that state, tribal, and local decentralized wastewater programs are managed on a watershed basis to achieve protection consistent with applicable state and tribal water quality standards, including pathogen and nutrient criteria. These goals are best achieved where performance-based management of onsite and cluster systems has been implemented to protect the quality of the receiving watershed and/or aquifer.

The legal authority for regulating onsite and cluster systems generally rests with state, tribal and local governments. USEPA recognizes that these units of government need a flexible framework and guidance to best tailor their management programs to the specific needs of the community and the needs of the watershed. While each management model stands alone, the models are intended only to be guides in developing an appropriate management program. Activities shown in program elements from one management model may be incorporated into another model to enhance the effectiveness of local programs in achieving the desired objectives under the prevailing circumstances. However, substituting activities from higher levels into lower level management programs should be carefully considered because of the interdependence of many activities on overall program capabilities. It is also possible to implement more than one management model, as appropriate, within a jurisdiction for the circumstances encountered (housing density, site and soil characteristics, and treatment technology complexity). Further, it is important to note that these management models are not intended to supersede existing federal, state, tribal and local laws and regulations, but rather to complement their role in protecting public health and water quality.

Governmental roles and authority in implementation of management programs based on the Guidelines will vary from jurisdiction to jurisdiction. **Application of the NPDES program under the Clean Water Act is required if there is a discharge of pollutants from a point source to a water of the U.S.** This requirement also covers systems that discharge to ditches, pipes, or other conveyances that ultimately discharge to waters of the U.S. Similarly, application of the Underground Injection Control (UIC) program under the Safe Drinking Water Act is required if a large capacity system is subject to UIC controls. The provisions of the program elements in each model may inform the State, Tribe, or USEPA in establishing NPDES permit requirements, if the NPDES program is applicable.

In many cases, states will establish the authority for creation of management entities, provide funding, and provide technical assistance and training to local governments. The local governments would then have primary responsibility for implementation of the management program. If a decentralized system is required to have an NPDES permit and an authorized state or tribe is administering a decentralized management program under this strategy, the requirements of the program should be incorporated into the applicable NPDES permit which is the primary regulatory instrument. If a state or tribe administering the program is not an authorized NPDES authority, the requirements of the program should be submitted to the NPDES permit issuing authority as a 401 water quality certification requirement. If the program is being administered by a local authority, or a tribe without 401 certification ability, the requirements of the program should be recommended to the NPDES permitting issuing authority for inclusion in the facilities permit. However, there are some cases where the states themselves have the primary role and authority to implement the regulatory program at the local level. In most cases where a tribe chooses to implement the program, there is no Federal restriction to prevent local tribal authorities from implementing the program, if the tribal code allows.

State, tribal, and local governments must recognize that there likely will be increased costs experienced by both the regulatory authority and the property owner in improving management practices and programs. The cost impacts may increase as the level of management increases, however, there are tradeoffs that exist. Costs incurred by the regulatory authority and/or management entity may be offset by increased permit fees and more efficient data management tools while the costs to the property owner may be offset by reduced repair and replacement costs, cost avoidance of environmental restoration, and increased property values and quality of life.

hybrid or combination programs may be appropriate where site conditions vary within the community and/or institutional capacity is not uniform within the jurisdiction. It is also recommended that appropriate levels of management for decentralized systems be established in jurisdictions, which have both centralized and decentralized wastewater treatment. In some cases, it may be feasible for the entity, which manages the centralized wastewater treatment facility to also manage the decentralized systems.

Targeting of specific types of systems for improved management may also be appropriate when resources are limited and a phased approach that focuses on priority systems is preferred. A widely used approach has been to initially target higher density or environmentally sensitive areas when there are limited resources for monitoring efforts. Examples of environmentally sensitive areas include those used for drinking water sources, areas adjacent to heavily used lakes and beaches, and areas that impact coral reefs or shellfish beds. Any approach taken should include input from all the stakeholders in a local jurisdiction or watershed.

The implementation of higher levels of management will often occur in progressive stages, as more performance data and experience with systems develops, public awareness and support increase, and the capacity of state, tribal, and local institutions to deal with management challenges builds over time. Implementation of the elements and activities recommended by The Homeowner Awareness Model as the threshold level of management will not only raise the quality of management practices for most existing programs, but also initiate activities (such as an inventory of systems) that allow the community to identify and address circumstances that may require upgrading to higher levels of management.

While the Homeowner Awareness Model may adequately address conventional systems within low-risk segments of a service area, there may be other areas of higher risk, which require higher levels of management. For these areas, a higher level management model, more appropriate for areas with higher sensitivities, may be incorporated into the overall management program to customize system management to the needs of the community or service area. It is important that the management program be structured to adequately manage an appropriate set of onsite and cluster systems for the full range of environmental conditions. For example, The Operating Permit Model might be selected for the more sensitive areas such as those along lake fronts or estuaries shown to have poor water quality, while a lower level management model may still be appropriate where the receiving environment is not as sensitive and conventional systems are acceptable.

It must be stressed that each management entity—whether assembled from partner agencies and service providers or created especially to handle the full range of program elements—will have unique requirements that will likely require some hybridization of one or more of the management models discussed previously. Ciotoli and Wiswall (1982) found that voluntary levels of management, such as a homeowners' association, were inadequate for cluster systems because they could not legally enforce rules to maintain or restore compliance with their discharge permit. Herring (2001) concluded that homeowners were unlikely to conduct routine maintenance tasks unless gross failure occurred, and then it was too late. Providing higher levels of management attention (inspections, monitoring, maintenance) to even simple treatment systems can extend the life of the systems, improve performance, contribute to maintenance, and increase in property values.

The best way of looking at the array of management program models is to consider first the local problems and needs. If improved public health protection is the primary concern because of a high rate of existing system backups to the ground surface or into buildings and the vulnerability of the watershed is moderate to minimal, a basic program (e.g., Management Model 1) might suffice where onsite systems can be upgraded. In more ecologically vulnerable areas where problems have been demonstrated from existing unmanaged onsite systems and their upgrading is technically feasible, Management Model 3

> **Management Model 2: Maintenance contracts**
>
> Owners of onsite/cluster systems with electro-mechanical components must secure permanent maintenance contracts in Wisconsin and Florida. Maintenance contracts specify minimum inspection and monitoring requirements, tank pump out schedules, and other tasks required under state rules. Maintenance task requirements are specific to the type of system, design capacity, receiving environment, and other factors.

3.5 Operating permit model

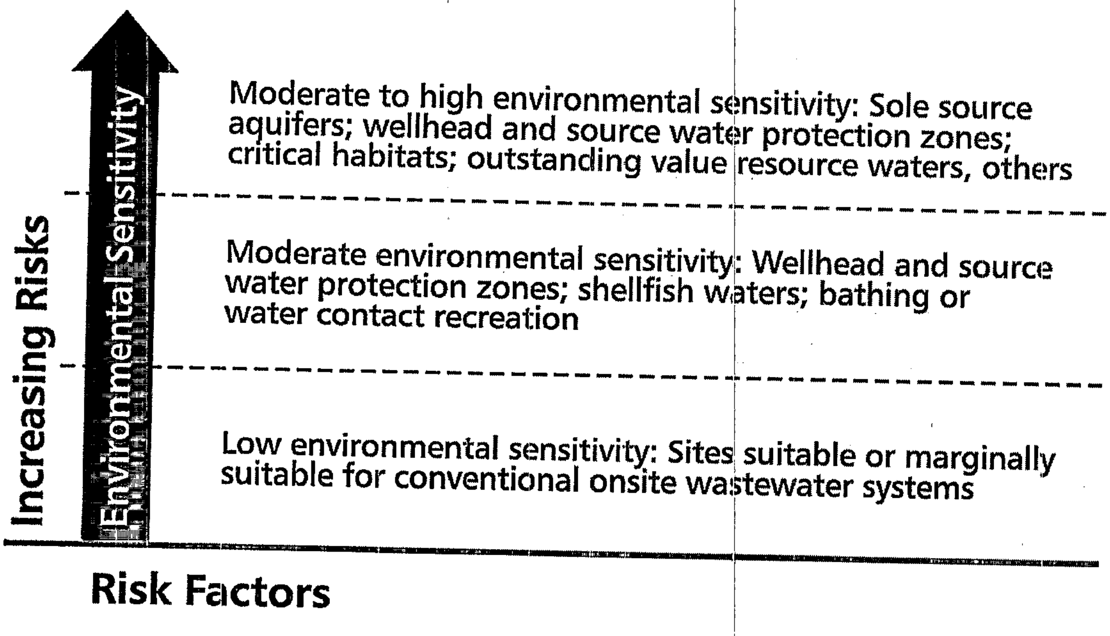
The **Operating Permit Model** is recommended where sustained performance of onsite wastewater treatment systems is critical to protect public health and water quality. Examples of locations where this program might be appropriate include areas adjacent to estuaries or lakes where excessive nutrient concentrations may be a concern or situations where a source water assessment has identified onsite systems as potential threats to drinking water supplies. USEPA strongly recommends that this be the minimum model used where large capacity systems or systems treating high strength wastewaters exist. EPA has determined not to regulate large capacity onsite systems at this time based on the belief that implementation of these Management Guidelines can assure adequate protection of public health and the environment.

A principal objective of this management program is to ensure that the onsite wastewater treatment systems continuously meet their performance requirements. Limited term operating permits are issued to the property owner and are renewable for another term if the owner demonstrates that the system is in compliance with the terms and conditions of the permit. In sub areas where it is appropriate to use conventional onsite system designs, the operating permit may only contain a requirement that routine maintenance is performed in a timely manner and the condition of the system be inspected periodically. With complex systems, the treatment process will require more frequent inspections and adjustments, so process monitoring may be required.

> **Management Model 3: Cranberry Lake, New Jersey**
>
> Residents adjacent to Cranberry Lake in New Jersey must obtain a permit to install an onsite system. They must provide a plot plan with the well, septic tank, and drain field delineated. Residents must renew their operating permit every three years by submitting proof that the tank was pumped by a licensed service provider or submit a waiver from the Board of Health. The fee for the 3-year operating permit is $15.

An advantage to implementing the program elements and activities of this management program is that the design of treatment systems is based on performance requirements that are less dependent on site characteristics and conditions. Therefore, systems can be used safely in more sensitive environments if their performance meets those requirements reliably and consistently. The operating permit provides a mechanism for continuous oversight of system performance and negotiating timely corrective actions or levying penalties if compliance with the permit is not maintained. To comply with these performance standards, the property owner should be encouraged to hire a licensed maintenance provider or operator.

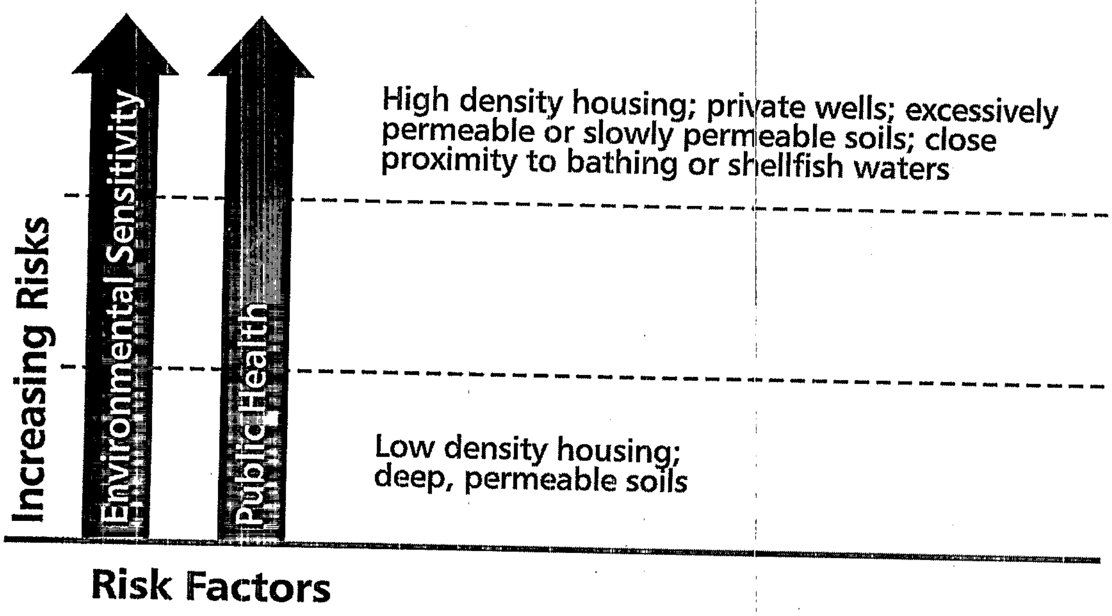
Figure 4-4. Environmental sensitivity risk factors



Source: Otis, 2002

Public health risk factors include system density, which increases wastewater loadings in concentrated residential areas; soil permeability, which affects treatment processes and effluent plume migration; and water resource uses (see figure below).

Figure 4-5. Public health risk factors



Source: Otis, 2002

Management Model 5: Sanitation district management of onsite systems in New Mexico

Residents and public agency officials in Peña Blanca, New Mexico sought to improve the management of systems in the community after a 1985 study found that 86% of existing systems required upgrades, repair, or replacement. The Peña Blanca Water and Sanitation District was designated as the lead agency for managing OWTSs because it already provided domestic water service to the community and had an established administrative structure. The Water and Sanitation District is organized under state statutes requiring a petition signed by 25 percent of the registered voters and a public referendum prior to district formation. Once formed, water and sanitation districts in New Mexico are considered subdivisions of the state and have the power to levy and collect ad valorem taxes and the right to issue general obligation and revenue bonds. The sanitation district relies on the New Mexico Environment Department to issue permits and monitor installation, while the district provides biannual pumping services through an outside contractor for a monthly fee of $10.64 for a 1,000-gallon tank. The district also supervises the community's onsite system ordinance, which prohibits untreated and unauthorized discharges, lists substances that may not be discharged into onsite systems (e.g., pesticides, heavy metals), and provides for sampling and testing. Penalties for noncompliance are set at $300 per violation and not more than 90 days imprisonment. Liens may be placed on property for nonpayment of monthly pumping fees. The program has been in operation since 1991 and serves nearly 200 homes and businesses. Sampling of private wells in the area in 1999 found nitrate nitrogen levels below 1 mg/L. Septic tank effluent pooling on ground surfaces, a problem identified in the 1985 study, has been eliminated.

Source: Rose, 1999

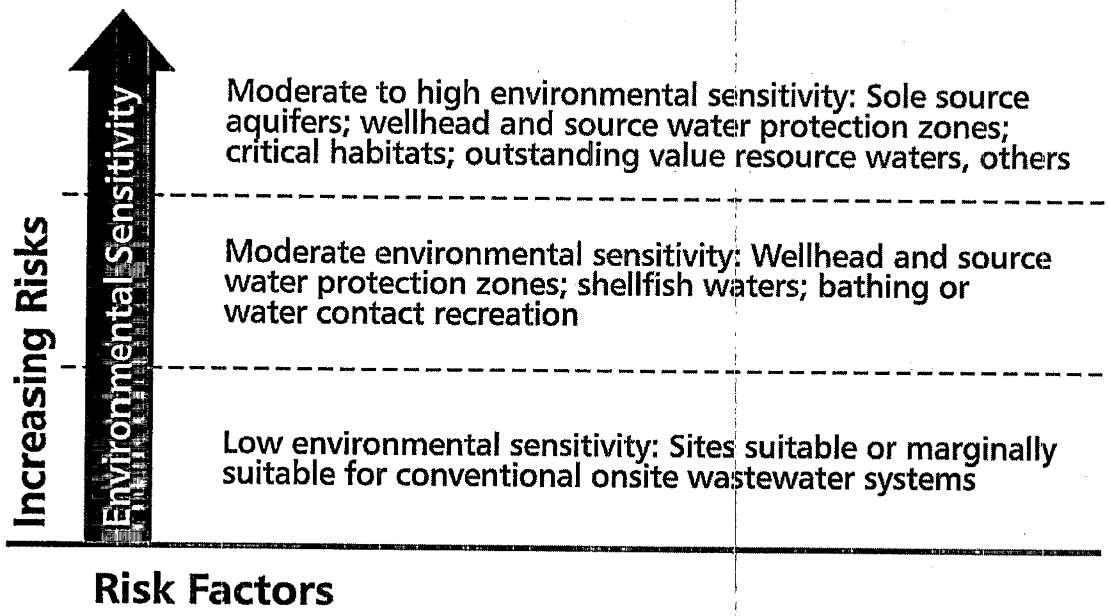
3.8 Applying the management models

Tables 1 through 5 in Appendix D provide descriptions of specific activities to be undertaken for the various program elements of a management model. The party that has primary responsibility for the activities is also identified. The program elements and activities listed for each management model are considered to be the minimum elements and activities necessary to achieve the stated management objectives for each model.

As previously indicated, the management model selected by a particular community or service area should be based on environmental sensitivity, public health risks, the complexities of the wastewater treatment technologies that might or should be implemented, and size and/or density of development. Selection of the management model is made after the decision to use decentralized wastewater treatment is made. The tables generally describe recommended activities for each of the management elements associated with the management models. How each of these elements and activities will be implemented will depend on decisions by the local community and regulatory authority, based on generally accepted onsite wastewater science and practice, locally appropriate statutes, ordinances, institutional structures, technical capabilities, public preferences and other factors. Thus, the general framework for a local management program should be derived from the tables but it must be tailored to suit local circumstances and preferences.

USEPA recognizes the varied nature of management needed across the country and within states and localities, the need for flexibility in adopting recommendations of the Guidelines and the lack of resources for implementation. While states, tribes and local communities are encouraged to implement management models; an individual program may properly include elements of several management models. These

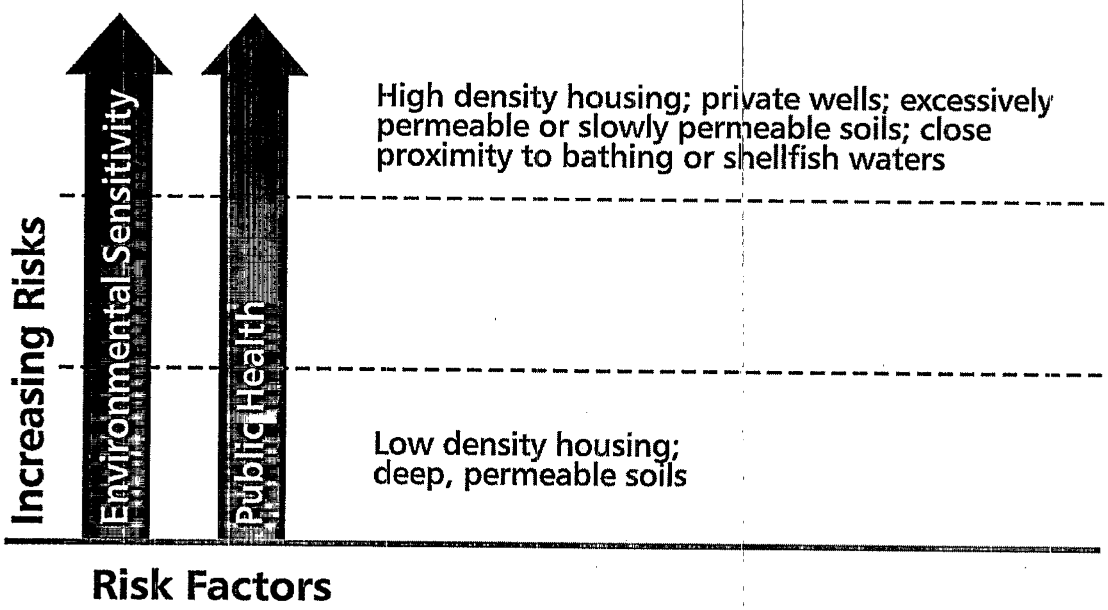
Figure 4-4. Environmental sensitivity risk factors



Source: Otis, 2002

Public health risk factors include system density, which increases wastewater loadings in concentrated residential areas; soil permeability, which affects treatment processes and effluent plume migration; and water resource uses (see figure below).

Figure 4-5. Public health risk factors



Source: Otis, 2002

entity might help to mitigate degradation and satisfy the oversight agencies. Where system density is high and/or inadequate lot sizes are common and have resulted in environmental and public health problems, Management Models 3-5 may be able to address these problems.

The implementation of management programs over time will often occur in progressive stages as more monitoring information becomes available, public awareness and support increase, and the ability of state, local, and tribal institutions to deal with management challenges improves. Implementation of Management Program 1, which is considered a minimal level of management, provides a basis for raising awareness of maintenance needs, identifying and characterizing existing onsite systems and potential problem areas, and building support for higher levels of management if they are needed.

3.9 Environmental sensitivity and public health risk

The locally developed management program should be based upon the potential risk of onsite wastewater treatment system discharges impacting the public health or the quality of local water resources. The level of oversight incorporated into the management program should increase as the potential for negative impacts to public health or for environmental degradation increases. Examples of parameters to consider in assessing public health and environmental sensitivity include soil permeability, depth to a restrictive horizon and groundwater, aquifer type, receiving water use, proximity to surface waters, topography, geology, location of critical habitat under the Endangered Species Act, and density of development. Another useful parameter to consider is the "susceptibility determinations" that states and tribes will make as part of their source water assessments. These assessments determine which potential sources of pollution, including decentralized wastewater systems, pose the greatest threats to drinking water.

Other issues to consider that may have a direct impact on public health include the need to protect shellfish harvesting and direct contact recreational waters. An area with moderately permeable soils and a groundwater table that is sufficiently isolated from the effects of onsite discharges may be designated as an area of low public health risk and environmental sensitivity, while an area with excessively permeable soils with a shallow water table used for a drinking water source would be designated as an area of high concern. For those watersheds where a determination has been made that the onsite wastewater treatment system is contributing to a violation of water quality standards, the elements and activities of the Operating Permit Model, the RME Operation and Maintenance Model, or the RME Ownership Model should be selected to address restoration of the watershed. More detailed information on these factors is provided the Management Handbook.

3.10 Complexity of treatment systems

The complexity of the treatment system also influences the management program selected. As the complexity of a treatment system increases to meet management objectives or system performance standards, the need for a higher level of operation and maintenance and monitoring increases to ensure that the system does not malfunction to create an unacceptable risk to public health or water resources. A less complex treatment system, such as a conventional onsite septic system, depends upon passive, natural processes for the movement, treatment, and dispersal of wastewater. The prescriptive elements of The Homeowner Awareness Model, where properly applied, may be sufficient for conventional onsite technologies to consistently function as effective wastewater treatment systems. A more complex treatment system, such as a surface discharging aerobic treatment system with filtration and disinfection, will require routine monitoring and attention from a professional technician to maintain its performance, and therefore requires a higher level of oversight. EPA's updated Onsite Wastewater Treatment Systems Design Manual[11], provides guidance on performance and management requirements for a broad range of

Table 4-5. Environmental sensitivity assessment key for preceding figure.

A	**Wastewater management zone** Includes the entire service area of the district.
B	**Receiving environment** Receiving water to which the wastewater is discharged.
C	**Fate of ground water discharge** The treated discharge to ground water may enter the regional flow or become base flow to surface water. Ground water flow direction can be roughly estimated from ground surface topography if other sources of information are not available. In some instances both regional flow and base flow routes should be assessed to determine the controlling point of use.
D	**Planning area density (population equivalents per acre)** The risk of higher contaminate concentrations in the ground water from ground water-discharging treatment facilities will increase with increasing numbers of people served. Where building lots are served by individual infiltration systems, the population served divided by the total area composed by contiguous existing and planned lots would determine population equivalents per acre (p.e./acre). For a large cluster system, the p.e./acre would be determined by the population served divided by the area of the infiltration surface of the cluster system.
E	**Well construction** Wells developed in an unconfined aquifer with direct hydraulic connections to the wastewater discharge have a higher probability of impact from the wastewater discharge than wells developed in a confined aquifer. Wells that are considered within the zone of influence from the wastewater discharge should be identified and their construction determined from well logs.
F	**Travel time to base flow discharge, T_{bf}** Treated wastewater discharges in ground water can affect surface waters through base flow. The potential impacts of base flows are inversely proportional to the travel time in the ground water, T_{bf}, because of the dispersion and dilution (except in karst areas) that will occur. Where aquifer characteristics necessary to estimate travel times are unknown, distance can be substituted as a measure. If travel time, T_{bf}, is greater than time to a ground water point of use, T_a, the ground water should be assumed to be the receiving environment.
G	**Stream flow** Stream flow will provide dilution of the wastewater discharges. The mixing and dilution provided are directly proportional to the stream flow. Stream flow could be based on the 7-day, 10-year low-flow condition ($_7Q_{10}$) as a worst case. "High" and "low" stream flow values would be defined by the ratio of the $_7Q_{10}$ to the daily wastewater discharge. For example, ratios greater than 100:1 might be "high," whereas those less than 100:1 might be "low." Stream flow based on the watershed area might also be used (cfs/acre).
H	**Travel time to aquifer or surface water point of use, T_a or T_s** The potential impacts of wastewater discharges on points of use (wells, coastal embayments, recreational areas, etc.) are inversely proportional to the travel time. Except for karst areas, distance could be used as a substitute for travel time if aquifer or stream characteristics necessary to estimate travel times are unknown.
I	**Relative probability of impact** The relative probability of impact is a qualitative estimate of expected impact from a wastewater discharge on a point of use. The risk posed by the impact will vary with the intended use of the water resource and the nature of contaminants of concern.

Source: Otis, 1999.

Table 3-1: SUMMARY OF THE VOLUNTARY GUIDELINES FOR MANAGEMENT OF ONSITE AND CLUSTERED (DECENTRALIZED) WASTEWATER TREATMENT SYSTEMS

TYPICAL APPLICATIONS	PROGRAM DESCRIPTION	BENEFITS	LIMITATIONS
HOMEOWNER AWARENESS MODEL			
• Areas of low environmental sensitivity where sites are suitable for conventional onsite systems.	Systems properly sited and constructed based on prescribed criteria. Owners made aware of maintenance needs through reminders. Inventory of all systems.	Code compliant system. Ease of implementation; based on existing, prescriptive system design and site criteria. Provides an inventory of systems that is useful in system tracking and area wide planning.	No compliance/problem identification mechanism. Sites must meet siting requirements. Cost to maintain database and owner education program.
MAINTENANCE CONTRACT MODEL			
• Areas of low to moderate environmental sensitivity where sites are marginally suitable for conventional onsite systems due to small lots, shallow soils, or low permeability soils. • Small cluster systems.	Systems properly sited and constructed. More complex treatment options, including mechanical components or small clusters of homes. Requires service contracts to be maintained. Inventory of all systems. Service contract tracking system.	Reduces the risk of treatment system malfunctions. Protects homeowners' investment.	Difficulty in tracking and enforcing compliance because it must rely on the owner or contractor to report a lapse in a valid contract for services. No mechanism provided to assess the effectiveness of the maintenance program.
OPERATING PERMIT MODEL			
• Areas of moderate environmental sensitivity such as wellhead or source water protection zones, shellfish growing waters, or bathing/water contact recreation. • Systems treating high strength wastes or large capacity systems.	Establishes system performance and monitoring requirements. Allows engineered designs but may provide prescriptive designs for specific receiving environments. Regulatory oversight by issuing renewable operating permits that may be revoked for noncompliance. Inventory of all systems. Tracking system for operating permit and compliance monitoring. Minimum for large capacity systems.	Allows systems in more environmentally sensitive areas. Operating permit requires regular compliance monitoring reports. Identifies noncompliant systems and initiates corrective actions. Decreases need for regulation of large systems. Protects homeowner investment.	Higher level of expertise and resources for regulatory authority to implement. Requires permit tracking system. Regulatory authority needs enforcement powers.
RESPONSIBLE MANAGEMENT ENTITY (RME) OPERATION AND MAINTENANCE (O&M) MODEL			
• Areas of moderate to high environmental sensitivity where reliable and sustainable system operation and maintenance is required, e.g., sole source aquifers, wellhead or source water protection zones, critical aquatic habitats, or outstanding value resource waters. • Cluster systems.	Establishes system performance and monitoring requirements. Professional O&M services through RME (either public or private). Provides regulatory oversight by issuing operating or NPDES permits directly to the RME (system ownership remains with the property owner). Inventory of all systems. Tracking system for operating permit and compliance monitoring.	O&M responsibility transferred from the system owner to a professional RME that is the holder of the operating permit. Identifies problems needing attention before failures occur. Allows use of onsite treatment in more environmentally sensitive areas or for treatment of high strength wastes. Can issue one permit for a group of systems. Protects homeowner investment.	Enabling legislation may be necessary to allow RME to hold the operating permit for an individual system owner. RME must have owner approval for repairs; may be conflict if performance problems are identified and not corrected. Need for easement/right of entry. Need for oversight of RME by the regulatory authority.
RESPONSIBLE MANAGEMENT ENTITY (RME) OWNERSHIP MODEL			
• Areas of greatest environmental sensitivity where reliable management is required. Includes sole source aquifers, wellhead or source water protection zones, critical aquatic habitats, or outstanding value resource waters. • Preferred management program for cluster systems serving multiple properties under different ownership (e.g., subdivisions).	Establishes system performance and monitoring requirements. Professional management of all aspects of decentralized systems through public/private RMEs that own/manage individual systems. Qualified, trained and licensed professional owner/operators. Provides regulatory oversight by issuing operating or NPDES permit. Inventory of all systems. Tracking system for operating permit and compliance monitoring.	High level of oversight if system performance problems occur. Simulates model of central sewerage, reducing the risk of noncompliance. Allows use of onsite treatment in more environmentally sensitive areas. Allows effective area wide planning/watershed management. Removes potential conflicts between the user and RME. Greatest protection of environmental resources and owner investment.	Enabling legislation and/or formation of special district may be required. May require greater financial investment by RME for installation and/or purchase of existing systems or components. Need for oversight of RME by the regulatory authority. Private RMEs may limit competition. Homeowner associations may not have adequate authority.

Table 4-5. Environmental sensitivity assessment key for preceding figure.

A	**Wastewater management zone** Includes the entire service area of the district.
B	**Receiving environment** Receiving water to which the wastewater is discharged.
C	**Fate of ground water discharge** The treated discharge to ground water may enter the regional flow or become base flow to surface water. Ground water flow direction can be roughly estimated from ground surface topography if other sources of information are not available. In some instances both regional flow and base flow routes should be assessed to determine the controlling point of use.
D	**Planning area density (population equivalents per acre)** The risk of higher contaminate concentrations in the ground water from ground water-discharging treatment facilities will increase with increasing numbers of people served. Where building lots are served by individual infiltration systems, the population served divided by the total area composed by contiguous existing and planned lots would determine population equivalents per acre (p.e./acre). For a large cluster system, the p.e./acre would be determined by the population served divided by the area of the infiltration surface of the cluster system.
E	**Well construction** Wells developed in an unconfined aquifer with direct hydraulic connections to the wastewater discharge have a higher probability of impact from the wastewater discharge than wells developed in a confined aquifer. Wells that are considered within the zone of influence from the wastewater discharge should be identified and their construction determined from well logs.
F	**Travel time to base flow discharge, T_{bf}** Treated wastewater discharges in ground water can affect surface waters through base flow. The potential impacts of base flows are inversely proportional to the travel time in the ground water, T_{bf}, because of the dispersion and dilution (except in karst areas) that will occur. Where aquifer characteristics necessary to estimate travel times are unknown, distance can be substituted as a measure. If travel time, T_{bf}, is greater than time to a ground water point of use, T_a, the ground water should be assumed to be the receiving environment.
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H	**Travel time to aquifer or surface water point of use, T_a or T_s** The potential impacts of wastewater discharges on points of use (wells, coastal embayments, recreational areas, etc.) are inversely proportional to the travel time. Except for karst areas, distance could be used as a substitute for travel time if aquifer or stream characteristics necessary to estimate travel times are unknown.
I	**Relative probability of impact** The relative probability of impact is a qualitative estimate of expected impact from a wastewater discharge on a point of use. The risk posed by the impact will vary with the intended use of the water resource and the nature of contaminants of concern.

Source: Otis, 1999.

Chapter 4 Sustainable management program development and implementation

4.1 Developing and implementing a management program

The purpose of this chapter is to assist local communities with creating and sustaining a management program for decentralized wastewater treatment systems, as an alternative or in addition to central sewers. The five program models outlined in this handbook describe a series of management levels, ranging from a scenario in which homeowners are reminded to maintain their septic tanks to one that resembles a typical sewer district where all necessary services are provided in return for a monthly or quarterly user fee paid by the homeowner. Higher levels of management are characterized by more comprehensive development of various program elements; (e.g., enhanced planning to identify system performance requirements, periodic inspections or monitoring).

Management programs can range from an informal network of private service providers, public agency staffs, and other partners operating under a coordinated framework to a highly structured entity founded specifically to own, operate, and maintain a defined set of treatment systems. The key objective in developing the program is to ensure that it reflects the community's best effort to deal with potential public health and water resource threats given the human, programmatic, and other assets available. Forging local resources into a viable management program is by definition a case-specific process, highly dependent upon the commitment, creativity, and cooperation of participants.

There are a number of critical ingredients for developing an effective and sustainable decentralized wastewater management program (Ciotoli and Wiswall, 1982; Mancl, 2001):

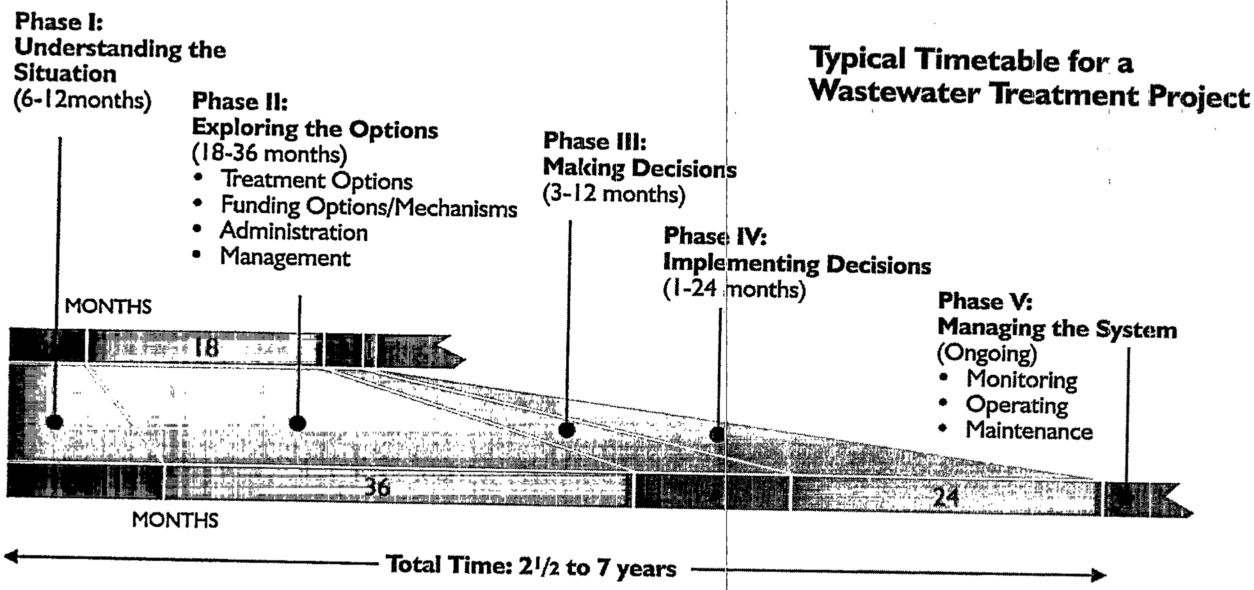
- Public acceptance and local political support
- Funding availability and/or reasonable costs
- Visibility and accountability of local leaders
- Capability and attitude of technical/field staff
- Availability of creative, professional advisors
- Clear and concise legal authority, regulations, and enforcement mechanisms

A successful management program development sequence follows these basic steps:

- Identify and engage stakeholders and interested parties
- Organize those involved through formal or informal processes
- Develop and implement a public education and outreach program
- Assess decentralized wastewater facilities and impacts
- Determine current trends regarding facilities and impacts
- Project future scenarios as indicated by the trends analysis
- Create a community vision incorporating preferred outcomes
- Conduct a reality check to determine availability of technical, financial, etc. resources
- Explore options under existing and/or revised regulatory structure(s)
- Select the preferred option(s), identify success indicators, and develop a work plan
- Implement the work plan; adapt as suggested by monitoring of success indicators

Realistically incorporating these key ingredients into a functional and sustainable management program is a difficult and slow process, Olson et al.. (2002) Estimate to take 2.5 to 7 years (see Figure 4-1). But it is well worth the effort.

Figure 4-1. Typical timetable for a wastewater treatment project



Source: Olson et al 2002

Onsite system management services are provided through an identifiable program—a mix of institutions and procedures, developed through a process that consists of a series of phases, (i.e., initiation, planning, and implementation). Smaller communities with unpaid or part-time officials may develop management programs by coordinating existing resources and perhaps developing new capabilities or owner requirements as necessary. As noted by Allee, et al., (1999), the process of enhancing system management entails building relationships among local policy or governing entities, informed regulatory staff, property owners, service providers, and citizens. Management programs that are more formalized and structured will follow a similar developmental process, but will likely include additional considerations such as program funding and staffing. All programs should:

- Have sufficient local support and legal authority
- Be flexible in adapting to changing demands
- Ensure reasonable homeowner costs
- Have the ability to achieve public health and environmental objectives

This chapter draws upon information presented in previous chapters pertaining to the five Management Models (see Chapter 3), the key program elements or components (see Chapter 2), and the necessary cooperative relationships and/or regulatory powers that must be considered in the development of all management programs. The approach discussed in this chapter focuses on how development of new or enhanced decentralized wastewater system management programs can be undertaken by creating partnerships, assessing health and environmental risks, and building consensus among stakeholders on program goals, preferred actions, and implementation.

Traditionally, local residents have been unwilling to commit funds and resources to address decentralized wastewater problems unless they are convinced that 1) a problem actually exists; 2) there are unacceptable consequences of not solving the problem; and 3) the relative costs can be accommodated. Therefore, involving stakeholders, other interested parties, and the public in the early stages of program development is paramount. Successful management programs are created by building capabilities, cooperation, and coordination among system users, service providers, and public agencies.

The implementation of any successful effort to manage decentralized systems is more dependent on the program development process than on the treatment technologies available (Olson, et al., 2002). Table 4-1 summarizes a generalized approach for tailoring a management program to a community's specific needs. This approach, which is similar to conventional watershed assessment/planning/management protocols used across the Nation, can be (and has been) adapted in any number of ways to meet the wastewater management needs of local communities.

Figure 4-2. Key attributes of the management concept

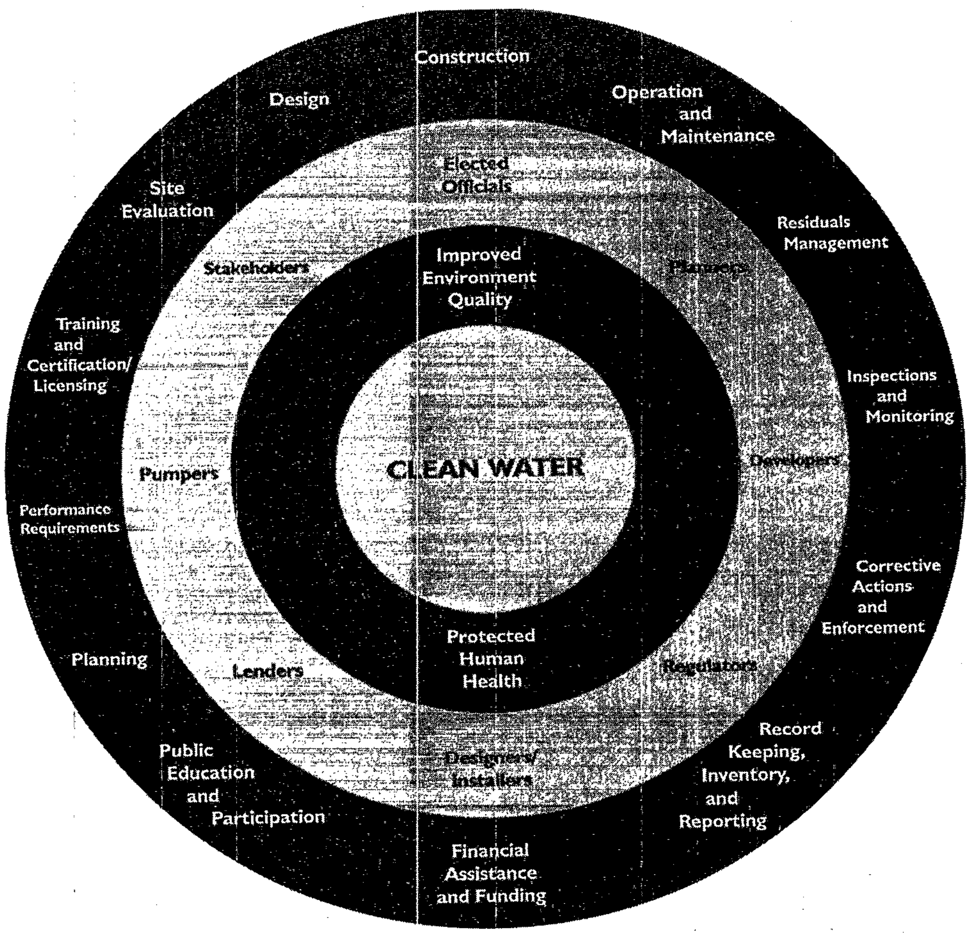


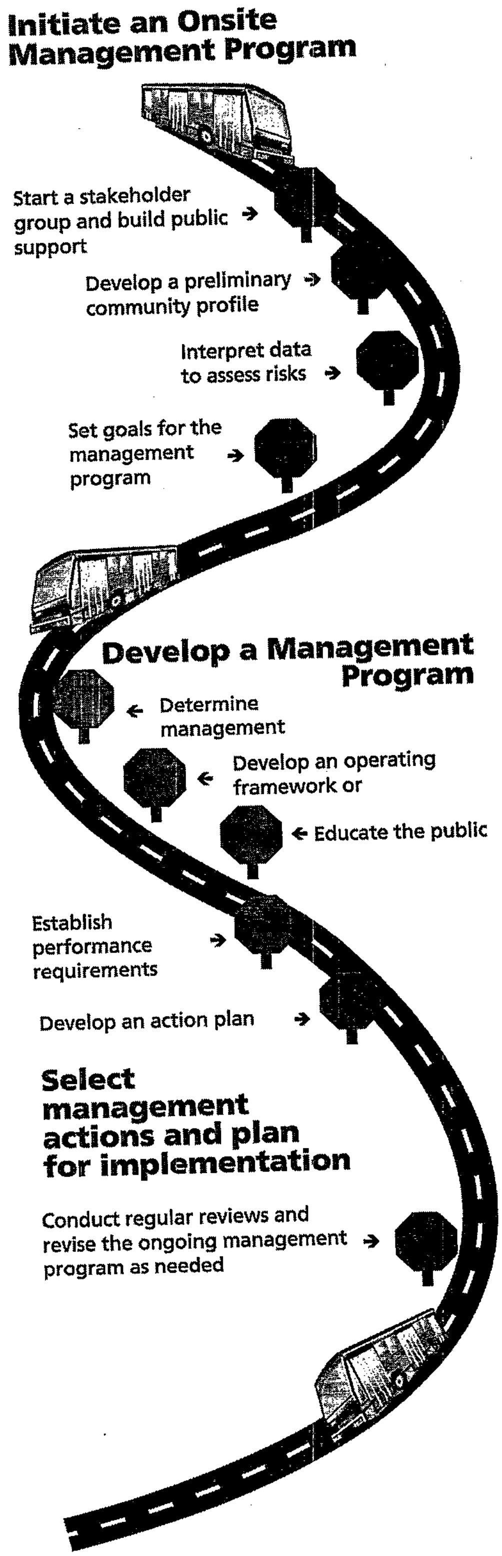
Table 4-1. General approach for developing and implementing a management program

Generalized steps	Examples of typical activities or processes
Convene interested parties and initiate education and outreach activities.	Identify key stakeholders (community and regulators) and other potential partners (e.g., planning departments, development companies, service providers, existing management entities). Develop a steering committee of key stakeholders to be responsible for defining the problems, assessing available information, involving the community, determining the feasibility of establishing a management program, and identifying its goals. Develop and implement education and outreach initiatives to publicize current issues and activities of the steering committee.
Identify and assess existing information to evaluate potential risks.	Inventory or otherwise collect information on existing systems and impacts i.e., explore development trends and relative uses and values of impacted receiving waters (i.e., drinking water source, recreational waters, shellfish habitat, aesthetic attributes). Analyze trends regarding new decentralized facilities and projected impacts. Consider applicable water quality standards, monitoring and assessment information, and relative vulnerability of water resources based on hydrogeologic, modeling, or other existing or new information. Based on trends analysis, estimate likely future impacts of onsite systems.
Identify, prioritize, and target key problem areas.	Conduct a community profiling and visioning process to identify the positive features about the community that should be preserved under any plan chosen. Ensure that the community is aware of the problems identified and the potential social and financial costs of traditional engineering solutions (central sewers) and the capabilities and costs of appropriately managed alternatives. Synthesize vulnerability, monitoring/assessment, and other information to identify and prioritize problem sites or areas. Conduct a reality check to determine the availability of technical, financial, and other resources.
Develop clear goals and explore options to address identified problems.	Investigate and identify resources needed to support remedial action or further study; establish performance requirements based on health and water resource assessment information. Evaluate powers necessary and approaches for incorporating them into a viable management program; review management program elements to ensure that all necessary functions are addressed.
Select management actions; develop and implement a workable plan to achieve goals and objectives.	Identify selected management actions (program elements) for implementation and methods for incorporation. Solicit support and resources for implementation among stakeholders, regulators, the public, and internal/external funding organizations. Develop easily understood indicators that can be monitored by the community to determine trends. Activate or implement management practices/actions, targeting highest priority sites or areas for immediate action. Monitor progress via selected indicators; evaluate progress and adapt as necessary.

4.2 Where do I start?

Any individual or entity can initiate the management program development process. After the effort begins to move forward, a local government agency (e.g., county planning agency, health department) or private entity (e.g., citizen group, community assistance organization, service provider group) may take the lead in coordinating and leading the process. It is not unusual for a development company, lake association, sanitation district, or other organization to convene stakeholders to develop an onsite wastewater management program. The primary duty of this lead agency is to create a steering committee to spearhead the planning process. The steering committee should reflect community demographics in terms of geographic subareas, economic classes, political views, etc., and should be made up of people willing to sustain their participation for the duration of the process. Other attributes that need to be sought out in creating this committee are technical understanding, community outreach experience, fiscal/financial experience, legal background, and community organization experience, in addition to political leadership. The regulatory authority (e.g., local health department) is almost always a key stakeholder in the process. The ability to supplement committee membership as specific expertise is requested should also be built into the program. Olson, et al. (2002) characterize successful committees as those that:

- Understand the problems clearly before seeking solutions
- Take responsibility for and ownership of the problems
- Have members with strong leadership qualities
- Have a clearly defined vision, mission, and goal
- Take the time to identify and examine all options before making decisions
- Gather information from as many sources as possible in their examinations
- Keep all affected parties informed and involved during the process
- Identify and use appropriate decision-making criteria



4.2.1 *Starting a stakeholder group and building public support*

The lead agency must create an atmosphere in which all questions and ideas are heard and all proposals and problem solutions are worthy of evaluation. Developing a management program has not proven to be a simple task. Olson, et al., (2002) estimate that the entire management program development process in a small community may take from 2.5 to 7 years to complete. Starting the process as early as possible allows time to overcome the inherent resistance of citizens, elected officials, regulators, and engineers to the relatively new concept of an onsite/cluster wastewater management program. The only reason for delaying the process is to ensure that the problem is real and quantifiable, and that this information is fully understood by stakeholders before investigating and recommending solutions.

Figure 4-3: Schematic of the management planning process

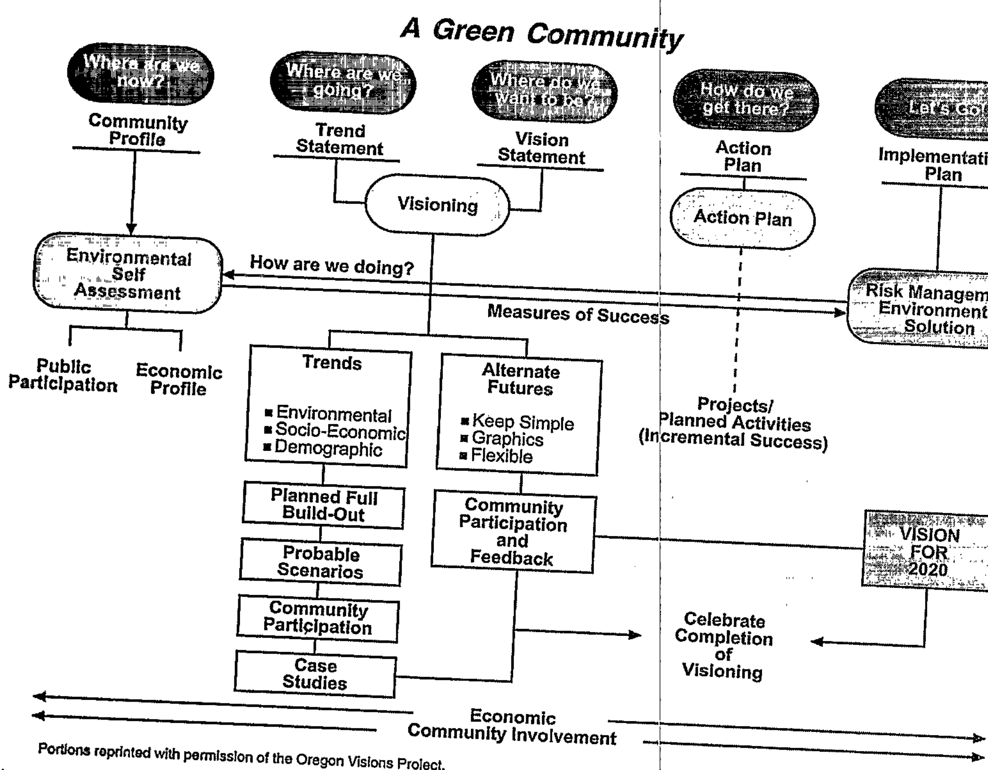


Figure 3-1. Green community flow chart (source: *http://www.epa.gov/region03/greenkit*).

4.2.2 *Responsibilities of the committee*

The steering committee's primary duties are to ensure that the community understands the problems, is willing to address them, and that resources are identified to support management program development. The committee's role is to develop the program and lead public outreach efforts to keep citizens and other important stakeholders informed. The community needs to be kept informed of committee progress and be assured that the committee receives citizen information gathered on a regular basis to assure the community of its role in the process. In conducting its outreach efforts to gain inputs from the entire community the committee needs to present the problems in a factual and straightforward manner, since hyperbole and exaggeration may undermine long-term credibility of the effort (Olson, et al., 2002).

> "It is helpful that homeowners are kept aware and involved in any decision making process that affects their future, and more importantly, potentially costs them money. Individual homeowners need to feel that their input is being considered when community officials are involved in determining the future wastewater needs for their neighborhood."
>
> Novickis, 2001

A popular and useful exercise during the early stages of the process is to develop a community vision that incorporates quality of life, natural resource, and socioeconomic considerations into a statement supported by local people. Vision statements typically express qualitative goals for a community in somewhat general and perhaps superlative terms, but their real value lies in the process that created them. The very act of forging a common consensus for what the future should be is a powerful tool for groups to explore their values, consider competing interests, and build workable relationships that will make future tasks less contentious. In addition, suspending the program development process periodically to reflect upon the previously established vision provides a valuable opportunity to pause and consider common goals when conflict begins to build during group deliberations.

4.3.3 Public education and participation

If a new management program is to be created, a considerable public education and involvement process is required. Public outreach and involvement programs are keys to sustainable management entities (Allee, et al., 1999; Olson, et al., 2002; and Mancl, 2001). The entire community will be interested and perhaps somewhat concerned regarding the development of an onsite wastewater management program. Stakeholders from various agencies and citizen groups, including local homeowner associations, civic groups, local health departments, and other public agencies should be identified and involved in the program through advisory committees, program review groups, and other volunteer programs. If citizens and homeowners are brought into the process, they are more likely to be cooperative and feel they have a stake in the outcome. Groups concerned with economic growth (e.g., Chamber of Commerce, regional development and planning entities) should also be represented because onsite management programs will likely have an impact on residential and commercial development. Local groups interested in conservation and environmental protection and neighborhood associations are also good candidates for involvement. As many stakeholders as possible should be involved in all stages of management program development and operation so they can provide meaningful input and serve as program representatives in their dealings with other citizens.

> In the initial phase, the committee should:
>
> - Ensure that the community understands the problems being addressed
> - Relay community concerns back to the committee
> - Keep the potential management entity informed of committee decisions
> - Develop a preliminary profile of the community
> - Interpret data to assess health and environmental risk
> - Set the overall goals of the decentralized management program

Public involvement can be encouraged through small focus groups that explore perceptions, attitudes, opinions, and general knowledge; formal or informal outreach/inputs through direct mail or telephone surveys; advisory committees composed of an appropriate mix of stakeholders; or public meetings focused on important issues like proposed changes in regulations or fees. At a minimum the public education program should include approaches such as news updates in monthly or quarterly bills, frequent appearances at churches, schools, and other civic organizations, participation in festivals, fairs and other events, and formal public meetings and open houses. The exact nature of the water quality and/or public health problems problem and the conventional solution implications and costs should be widely disseminated to the stakeholders (e.g., citizens, officials, regulators) at the earliest possible time, along with the need to investigate lower-cost solutions that can also meet the needs of the community. Accomplishing these objectives requires an outreach program that builds awareness, provides educational information, and motivates action (see *Getting In Step: A Guide to Effective Outreach in Your Watershed* at http://www.epa.gov/owow/watershed/outreach/documents/).

Gaining support for management in Idaho

Because of burgeoning development pressures in the Idaho panhandle and the alarming rise in the Rathdrum Prairie Aquifer's nitrate concentration, the Panhandle Health District (PHD), which covers the state's five northernmost counties, developed a plan to implement an interim moratorium on new developments dependent on conventional septic tank soil absorption systems. The high nitrate problem had been traced through groundwater monitoring to the recent densely developed subdivisions, and agricultural sources had been shown to exhibit no such phenomenon. To gain support for the plan the PHD made presentations that documented the problem and the proposed solutions before school, civic, and professional groups. They also used radio and television ads. In all cases, the PHD attempted to craft the presentation contents and supporting materials specifically to the audience being addressed. All public presentations were conducted in a cooperative, rather than confrontational, manner.

Subsequently, the PHD formed an ad hoc citizen's committee to develop and present suggested changes to the preliminary policy developed by the PHD. This committee included representatives from the homebuilders, USDA-NRCS and two other impacted federal agencies, farmers, planning boards, the state legislature, the League of Women Voters, and conservation/environmental organizations. The committee members not only reached out to their respective constituencies, but also solicited feedback to the deliberative process. The committee submitted its comments and suggestions to the PHD, which followed them closely. The state approved the policy thereafter. The policy has been credited with shaping growth in the region, curbing urban sprawl, and helping the cities to strengthen public services. The public education and involvement process resulted in improved relationships among the citizens, the cities, and the regional authorities.

(Source: Prins and Lustig, 1988).

It is also critical to consider the views of existing system owners when planning inspection, monitoring, enforcement, and maintenance programs. During focus group sessions on system management options convened by Cornell University, participants identified "giving homeowners discretion in choosing inspectors" and "inspections required by mortgage lenders" as key recommendations for improving public acceptance of mandated management actions (Allee, et al., 1999). This report also notes that the creation of a decentralized wastewater management program is mostly about building relationships among the community citizens, community leaders, and the oversight agencies.

The process itself has many benefits in building trust and enforcing common goals. As proof of this the authors cite the fact that there are several long-term management entities with which all these parties are satisfied, and those that failed were attributed to inadequate communications and public involvement in the formation process. Mancl (2001) cited the four essential elements of a successful management program during the formation stage as: 1) resource protection (including public health and property values), 2) effective leadership, 3) creativity in establishing legal authority, and 4) good communications with residents. Providing adequate and sustainable legal authority, funding, and staffing have presented challenges for some new management entities, but the primary reason for failure of these entities has always been related to inadequate public involvement in the process (Allee, et al., 1999; Mancl, 2001; Olson, et al., 2002). Therefore, the public should be involved in planning and periodic reviews of simple or comprehensive management programs.

4.3 Identifying and evaluating monitoring and assessment information

After the steering committee has formally or informally organized and launched initial public education and outreach initiatives, it should begin to systematically identify and collect potentially useful existing data sources to create a community profile. This profile should, as a minimum, incorporate both the locations and types of systems displayed on lot plans, keyed into the area-wide maps of potential management implementation areas.

Inventories and assessments: an important first step

System inventories and impact assessments are vital for determining whether or not problems exist and the extent of those problems, if any. Inventories and assessments can be general surveys initially, with further study targeted at areas where problems might be indicated. The basic approach is to review all relevant factors in the community that are pertinent to wastewater planning, and to then use this information to identify problems and needs.

The assessment involves a comprehensive data gathering process on system locations, types, and functional status, along with information on ground water and surface water quality, reports from service providers and regulatory agencies, and local/regional planning information. The purpose of the assessment is to inventory all relevant factors in the community that pertain to wastewater planning, and to use this information to identify problems and needs. The information and processes necessary to conduct a community self-assessment will vary from community to community depending on available human, financial and technological resources.

The purpose of conducting a community self-assessment is to identify and evaluate the status of the community's current wastewater treatment and needs. A self-assessment process will help to identify problem areas in the community and suggest solutions for those problems. It will also help to clarify goals for decentralized onsite wastewater management that will lead to a cleaner, healthier future for the community.

Source: NESC, 2002

The primary value of the preliminary community profile is to form the basis for creating the technical, administrative, and financial plans for the management program. have to be determined in the subsequent phases of the process. Since original data are usually generated by consultants and are relatively costly, use of verifiable existing data should be maximized.

The initial step in conducting a community profile is to review official records of the existing onsite wastewater agency, usually the county or city health department, and other governmental entities such as the planning agency, economic development office, and county/city housing and taxing agencies. Other information sources should include source water protection assessments and watershed study reports from local water and wastewater utilities, state water quality agencies, and regional monitoring organizations. In addition, the committee should request information from private-sector service providers such as pumpers, onsite system designers, installers, well drillers, and other water-related professional service providers who are known to work in the area.

System inventory information is often non-existent or maintained in a format that does not allow easy interpretation, mapping, or analysis. Some jurisdictions have conducted residential/commercial surveys for information on all centralized and decentralized wastewater systems in the targeted region. A door-to-door survey approach, however, can be costly in terms of time and resources. Clermont County, Ohio, developed a decentralized system database by cross-referencing waterline and sewer service customers. By subtracting the latter from the former, the county identified 70 percent of the onsite systems and was able to use water system records to build an owner contact information database (Caudill, 1998).

Typical sources of data on systems, site conditions, and potential impacts include:

- Aerial photographs from state transportation departments, Natural Resource Conservation Service offices, and local utilities (see http://terraserver.homeadvisor.msn.com/)
- Census data (see http://www.census.gov)
- Prior plans for wastewater, drinking water, and other facilities (contact local utilities)
- Soils data from NRCS, service providers, and construction projects (see http://soils.usda.gov/)
- Topographic data from USGS and state or tribal sources (see http://www.usgs.gov/)
- Existing facilities; e.g., septage/residuals management capacity (contact local utilities)
- Land-use data from local and regional planning agencies (contact local agencies)
- Water quality data from public agencies (see http://cfpub.epa.gov/surf/locate/map2.cfm)
- Watershed information (see http://www.epa.gov/wateratlas/)
- Onsite system inventories (contact local septic system permitting agency)

These sources can be used to create a preliminary community profile. When necessary supplemental data are identified and generated, the resulting community profile can then be used to:

- Identify the technical elements of the environmental/public health problem
- Identify reasons for inadequate performance of existing systems
- Identify technological limitations based on natural/physical features of the community
- Evaluate impacts of community-growth decisions
- Estimate potential environmental and public health impacts of alternative solutions

Preliminary review of a management program survey by NESC indicates that most small management programs use property records, service provider records, billing/fee collection records, and permit records to generate their systems inventory. Although these sources are a good starting point, there is a need to be more comprehensive in creating an inventory during latter stages of program development, when specific management activities are defined. GIS and global positioning system (GPS) databases, census information, and other statistical summaries for the area should also be used where they exist. If performance standards are to be met by the managed area, the inventory should be verified by sanitary surveys or other house-by-house techniques if possible.

An excellent example of how an inventory was developed for the small village of Warren, Vermont, is described by Clark, et al. (2001). Numerous reports of onsite system failures in the narrow Mad River Valley site were amplified by revelations of high pathogen counts in the river, drinking water well contamination and flooding in the porous ledgerock setting. The village evaluated a central sewer system but rejected it because of the high costs, the lack of an acceptable treatment plant site, and required hook-ups for all 97 properties. A USEPA grant provided funding to document and evaluate (i.e., inventory) all the water and wastewater systems in the community using a GPS to create a database in a GIS format.

Mancl (2001) reviewed five long-term management entities with more than 20 years of experience. All five either already had a computerized database of onsite systems or were in the process of creating one. These management programs are located in Lake Panorama, IA, Crystal Lakes/Red Feather Lakes, CO, Auburn Lake Trails and Stinson Beach, CA, and Will County, IL. Orange County, NC, is attempting to convert their databases to GIS format, but at present lacks the funding to do so (Holdway, 2001). Greuel (2001) reported on the successful development of an internet-based O/M program for Wood County, WI.

Inventorying systems through electronic databases

A variety of public and private entities have developed databases to track wastewater system inventory, maintenance, and other information. Minimum data elements for system inventories include owner contact information, GIS location, installation date, technology type, and design flow. Optional data elements include site characterization information, designer, installer, management entity (if applicable), date of last service (pumping, inspection, repair), service provider, and operational status. The following public/private database systems provide useful examples of existing inventory and management options, are presented for information purposes only:

SepTrack, developed by the Buzzards Bay National Estuary Program in Massachusetts (http://www.buzzardsbay.org/septrict.htm)

SepticPlanner, developed by Pamlico County, North Carolina (http://www.landplot.com/septic2.html)

SIMS (Septic Information Management System), developed by Stone Environmental, Inc. in Vermont (http://www.stone-env.com)

CASST (Computer Aided Septic System Tracking), developed by AppliTech, Inc. (http://www.casst.com)

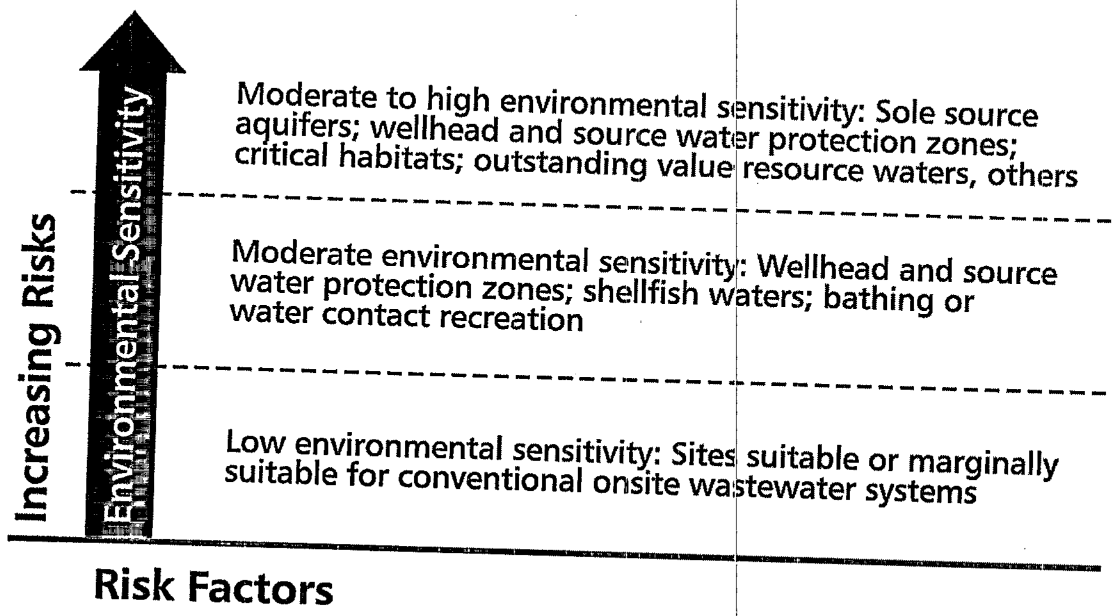
Carmody Waste Recording Services, developed by Carmody Data Systems Inc., (http://www.carmodydata.com)

Purdue University Onsite Wastewater Disposal Permit Database (http://danpatch.ecn.purdue.edu/~epados/onsiteOnline/database.htm)

4.4 Overview of risk factors related to system management

Treatment system management should be tailored to risks posed by those systems. Risks can be characterized and assessed by identifying key risk factors, such as environmental sensitivity, potential to threaten public health, wastewater characteristics, and treatment system complexity. Environmental sensitivity risk factors include water resource uses, such as drinking water sources, critical habitat, recreational waters, and other uses. The figure below illustrates risk potential relative to environmental sensitivity risk factors.

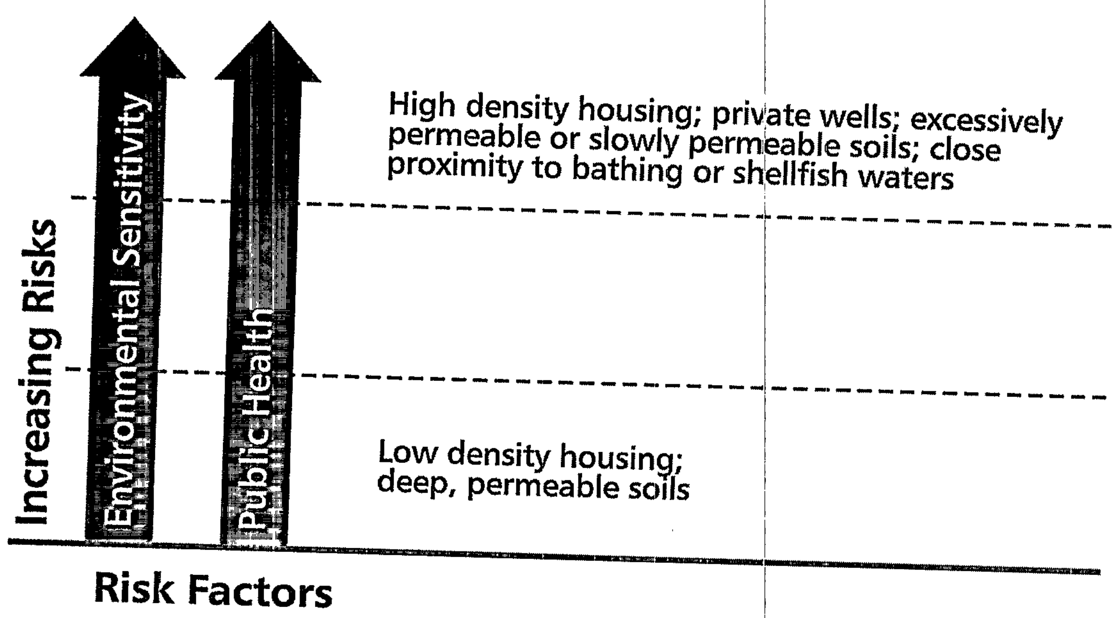
Figure 4-4. Environmental sensitivity risk factors



Source: Otis, 2002

Public health risk factors include system density, which increases wastewater loadings in concentrated residential areas; soil permeability, which affects treatment processes and effluent plume migration; and water resource uses (see figure below).

Figure 4-5. Public health risk factors



Source: Otis, 2002

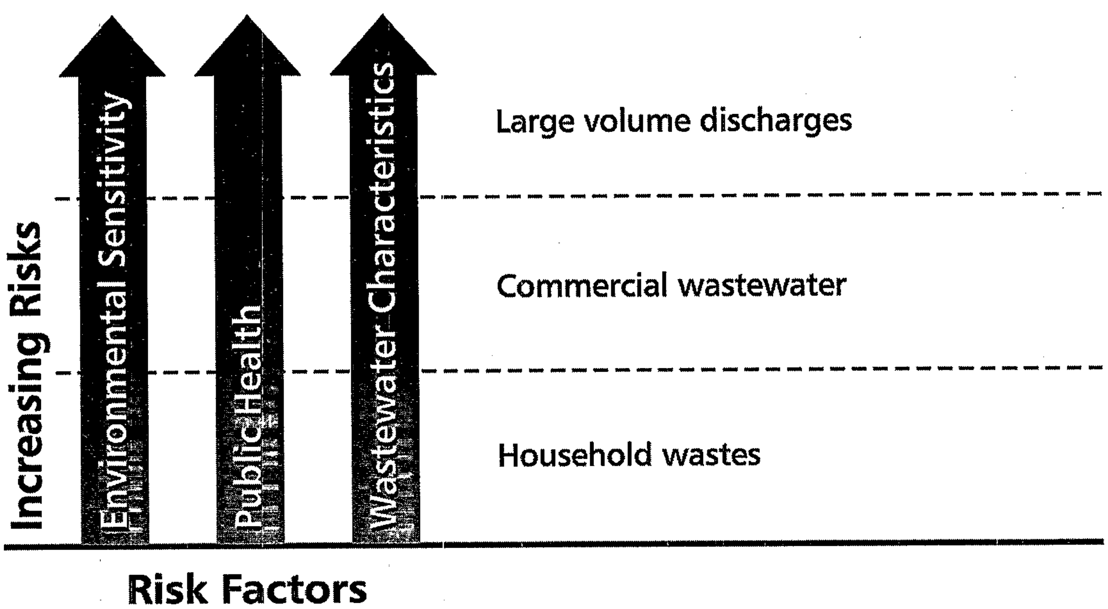
Nitrogen contributions from onsite systems

The San Lorenzo River basin in California is served primarily by OWTSs. Since 1985, the Santa Cruz County Environmental Health Service has been working with local stakeholders to develop a program for inspecting all onsite systems, assessing pollutant loads from those systems, and correcting identified problems. Studies conducted through this initiative included calculations of nutrient inputs to the river from onsite systems. According to the analyses performed by the county and its contractors, 55-60 percent of the nitrate load in the San Lorenzo River during the summer months came from onsite system effluent. Assumptions incorporated into the calculations included an average septic tank effluent total nitrogen concentration of 50 mg/L, per capita wastewater generation of 70 gallons per day, and an average house occupancy of 2.8 persons. Nitrogen removal was estimated at 15 percent for SWISs in sandy soils, and 25 percent for SWISs in other soils.

(Source: Ricker, 1994).

Wastewater characteristics also influence risk potential. For example, large volume discharges and commercial wastewaters can pose greater risk than lower volume domestic wastewater discharges due to greater effluent loadings to the soil or treatment system and higher concentrations of fats, oils, greases, sanitary waste, and other wastewater pollutants. The figure below summarizes risk potential relative to wastewater characteristics.

Figure 4-6. Wastewater characteristics risk factors



Source: Otis, 2002

Treatment system complexity risk indicators seek to differentiate between conventional, gravity-based soil infiltration systems – which require little maintenance beyond pumping every 3-5 years – and systems which incorporate electrical and mechanical components such as float switches, pumps, valves, pressure regulators, etc. The figure below illustrates risk factors related to treatment system complexity.

vulnerability category relative to each water resource are included by category of pretreatment requirement (see Table 4-2).

Figure 4-7. Treatment complexity risk factors

Otis (1999) has proposed a generally adaptable "probability of environmental impact" approach to determine onsite system impacts. This method was developed for use when resource characterization data are insufficient and GIS mapping data are unavailable for a more rigorous assessment. The approach is presented in the form of a decision tree that considers mass loadings to the receiving environment (ground water or surface water), population density, and the fate and transport of potential pollutants to a point of use (see case study box). The decision tree estimates the relative probability of water resource impacts from wastewater discharges generated by sources in the watershed. Depending on the state-defined designated use of the water resource, discharge standards for the treatment systems can be established. The community/management program can use these discharge standards to assemble appropriate treatment trains to meet those standards.

Establishing performance requirements by assessing the probability of impact

The "probability of impact" method estimates the probability that treated water discharged from an onsite system will reach an existing or future point of use in an identified water resource. By considering the relative probability of impact based on existing water quality standards (e.g., drinking water, shellfish water, recreational water), acceptable treatment performance standards can be established. The pollutants and their concentrations or mass limits to be stipulated in the performance requirements will vary with the relative probability of impact estimated, the potential use of the water resource, and the fate and transport characteristics of the pollutant (see Figure 1 and Table 4-6).

As an example, if the community/watershed assessment indicates that a ground water supply well that provides water for drinking without treatment might be adversely affected by an onsite system discharge and soils are assumed to be of acceptable texture and structure, with an unsaturated soil depth of 3 feet, nitrate-nitrogen and fecal coliform are two wastewater pollutants that should be addressed by the performance requirements for the treatment system (i.e., constructed components plus soil). With a relative probability of impact estimated to be "high," the regulatory agency considers it reasonable to require the treatment system to achieve drinking water standards for nitrate and fecal coliform before discharge to the saturated zone. The drinking water standards for nitrate and fecal coliform in drinking water are 10 mg/L for nitrate and zero for fecal coliform. Considering the fate of nitrogen in the soil, it can be conservatively expected that essentially all of the nitrogen discharged by the pretreatment system will be converted to nitrate in the unsaturated zone of the soil except for a few mg/L of refractory organic nitrogen. Because nitrate is very soluble and conditions for biological denitrification in the soil has not been determined, the performance standard for the onsite pretreatment system is set at 10 mg/L of total nitrogen prior to soil discharge. In the case of fecal coliform, the natural soil is very effective in removing fecal indicators where greater than 2 feet of unsaturated natural soil is present. Therefore, no fecal coliform standard is placed on the pretreatment (i.e., constructed) system discharge because the standard will be met after soil treatment and before final discharge to the saturated zone.

If the probability of impact were estimated to be "moderate" or "low," only the nitrogen treatment standard would change. If the probability of impact is "moderate" because travel time to the point of use is long, dispersion and dilution of the nitrate in the ground water may be expected to reduce the concentration in the discharge substantially. Therefore, the treatment standard for total nitrogen can be safely raised, perhaps to 20 to 30 mg/L of nitrogen. If the probability of impact is "low," no treatment standard for nitrogen is necessary. If the probability of impact is "high", but the point of ground water use at risk is an agricultural irrigation well, no specific pollutants in residential wastewater are of concern. Therefore, the pretreatment performance required need to be no more than that provided by a septic tank.

Adapted from Otis, 2000.

Such an approach is greatly enhanced by the availability of GIS mapping capabilities (see Colorado case study above). Baseline characterizations for larger groupings of homes (developments) should be done via GIS technology if possible because of its inherent ability for developing maps and other visual products that can help the community interpret data, assess risks, and make decisions to maximize the effectiveness of operating programs (USEPA, 2000). The potential benefits of GIS systems include the ability to project and analyze a variety of development, remediation, and other scenarios and to provide a real-time, dynamic and useable operating database for all of the management program's implementation and operation activities. These impact characterizations can also be approximated manually in the absence of GIS databases, and will likely be done that way for some time until GIS database coverage becomes more common. Many small communities contemplating managed decentralized systems will neither have this capability nor need it to move forward.

4.5 Using risk assessments to target management activities

A number of detailed risk assessment approaches for decentralized wastewater systems have been developed, and two are presented in this section to provide information on the basic processes that risk assessments follow. Hoover, et al., (1998) have proposed a vulnerability assessment method that deals with soil-based systems and emphasizes public input. This approach considers risk assessment methods and management control strategies for both ground waters and surface waters. It uses three components of risk assessment and management:

- Valuation of receiving ground and surface waters as a public water supply or resource
- Vulnerability assessment of the water supply or resource
- Identification of control measures for minimizing risk

The first part of this approach involves a listing of the potentially impacted ground water and surface water resources in the watershed. Through community meetings and regulatory agency inputs a consensus is developed on the relative perceived value of each identified resource and the potential and perceived consequences of contamination. For example, a coastal community and its technical advisory team might determine that shellfish waters that are open to public harvesting are less important than public drinking water supply areas, but more important than recreational waters that might be used for body contact sports.

The second part of this risk assessment process is development of a vulnerability assessment matrix. One key measure of vulnerability of specific subarea is the ease with which pollutants can move vertically from the point of release (infiltrative surface) to the ground water. The vulnerability assessment matrix identifies areas of low, moderate, high, or extreme vulnerability depending on soil and groundwater aquifer conditions. For example, vulnerability might be high for coarse or sandy soils with less than 2 feet of vertical separation between the ground surface and the unconfined water table. Vulnerability might be low for silty soils with a vertical separation of greater than 10 feet. Each resource specified in the first part of the risk assessment process can be associated with each vulnerability category. A more detailed discussion of ground water vulnerability assessment is provided in National Research Council (1993).

The third part of this risk assessment process is the development of a management matrix that specifies a pre-treatment performance standard based on the water quality requirements for the use of receiving water. A matrix is developed for each identifiable subarea that reflects the quality of pretreated effluent that must be released to soil systems' infiltrative surfaces in that zone. All the subareas defined by vulnerability category relative to each water resource are included by category of pretreatment requirement (see Table 4-2).

Almost all of the decentralized management programs that have been identified are for small developments, and most are for onsite systems only. Since clusters of significant size are often considered community-wide systems, their management is often categorized under conventional central sewers and is difficult to identify when performing searches to identify decentralized systems. Thus, the best documentation of existing information is still under development by the NESC. This preliminary information indicates that management programs that have been tentatively identified have small budgets and are modest in terms of coverage by the discussed program elements. Almost all total budgets were less than $1 million; the mode was only $5,000. The majority of the actual management programs are supported at least in part by user fees. Other key support mechanisms are operational fees and property taxes either as exclusive or as part of the overall funding package. User fees are primarily construction permit, operating permit, and inspection fees paid by system owners, but contractor (service provider) licensing fees are also significant.

The few studies of management programs provide a widely varying picture of management program costs versus services provided. Possibly the best single report is by Mancl (2001). The report, which attempted to compare five long-term management programs, failed to show any pattern of costs and services. Combining the report with some other case studies, however, does offer some insights. For example, throwing out some obvious outliers, a responsible management entity (Management Programs 4 and 5), which often include cluster systems, appears to cost homeowners somewhere between $180 and $450 per year. This cost may not include certain one-time costs to join or costs for special services. In contrast, minimal management programs (similar to Management Program 1) appear to cost less than $100 per year. Intermediate management programs vary widely between these extremes depending heavily on what is included in the fees charged, other sources of funding, and the technologies employed.

Lake Panorama, Iowa: developing a flexible management model

This management program began in 1980 through County ordinance changes and administrative rules approval and started with creating and implementing specific design requirements that exceeded those of the state code because of economic and water quality concerns. The boundaries are totally within the County, thus making the establishment of the management program. All new systems were sited, designed and constructed according to these more stringent requirements at the start. As-built drawings and descriptions of these systems were entered into the database. Existing systems were then located, inspected, upgraded, and entered into the database/inventory. A regular inspection program (originally, every 3 years for full-time and every-six for seasonal residents, but now reduced to 1 and 2 years, respectively) conducted by the County sanitarian was instituted. The County health agency provides oversight of the program by appointing the program's board of directors, but homeowner association input is obvious and welcomed in all aspects of the program operation.

The program could be characterized as a Model Program 3 without the specific use of operating permits. Inspections are required at specific intervals and enforcement of any deficiencies found through them is clear and locally encoded. Prescriptive site evaluation procedures and design requirements are more stringent than state code requirements. Hydraulic failures have been reduced to about 1 percent. The funding is to implement the program is raised through property taxes by the County, as the legal taxing authority. Participation is essentially mandatory for all homeowners. Presently, the cost is about $30/year per home with an onsite system for inspections and inventory updating. Operation and maintenance costs must be added to determine the total cost for each home. Some dwellings are on cluster systems, and they are assessed an additional $600/year or more.

Mancl and Patterson, 2001

Table 4-3. Proposed onsite system treatment performance standards in various control zones.

Standard	BOD (mg/L)	TSS (mg/L)	PO_4-P (mg/L)	NH_4-N (mg/L)	NO_3-N (mg/L)	Total N (% removed) [a]	Fecal coliform (CFU/1000 mL)
TS1 - primary treatment							
TS1u – unfiltered	300	300	15	80	NA	NA	10,000,000
TS1f – filtered	200	80	15	80	NA	NA	10,000,000
TS2 - secondary treatment	30	30	15	10	NA	NA	50,000
TS3 - tertiary treatment	10	10	15	10	NA	NA	10,000
TS4 - nutrient reduction							
TS4n - nitrogen reduction	10	10	15	5	NA	50%	10,000
TS4p - phosphorus reduction	10	10	2	10	NA	25%	10,000
TS4np - N & P reduction	10	10	2	5	NA	50%	10,000
TS5 - bodily contact disinfection	10	10	15	10	NA	25%	200
TS6 - wastewater reuse	5	5	15	5	NA	50%	14
TS7 - near drinking water	5	5	1	5	10	75%	<1[b]

NA = not available.
[a] Minimum percentage reduction of total nitrogen (as nitrate-nitrogen plus ammonium nitrogen) concentration in the raw, untreated wastewater.
[b] Total coliform colony densities < 50 per 100 mL of effluent.

Source: Hoover et al., 1998.

Table 4-4. Control zone designations vs. treatment standards.

Verticle Separation Distance (feet)	Control Zone (with management entity)					
	R1	R2a	R2b	R3	R4	R5
	Treatment Perforamance Standard					
>4	TS1	TS1	TS1 OR TS4	TS1	TS2	TS4
3 to 4	TS1	TS1	TS1 OR TS4	TS2	TS2	TS5
2 to 3	TS1	TS2	TS2 OR TS4	TS3	TS3	NA
1 to 3	TS2	TS3	TS3 OR TS4	TS4	TS4	NA
<1	TS3	TS4	TS4	TS5	TS5	NA

Increasing Resource Value →

Increasing Vulnerability ↓

Otis (1999) has proposed a generally adaptable "probability of environmental impact" approach to determine onsite system impacts. This method was developed for use when resource characterization data are insufficient and GIS mapping data are unavailable for a more rigorous assessment. The approach is presented in the form of a decision tree that considers mass loadings to the receiving environment (ground water or surface water), population density, and the fate and transport of potential pollutants to a point of use (see case study box). The decision tree estimates the relative probability of water resource impacts from wastewater discharges generated by sources in the watershed. Depending on the state-defined designated use of the water resource, discharge standards for the treatment systems can be established. The community/management program can use these discharge standards to assemble appropriate treatment trains to meet those standards.

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Adapted from Otis, 2000.

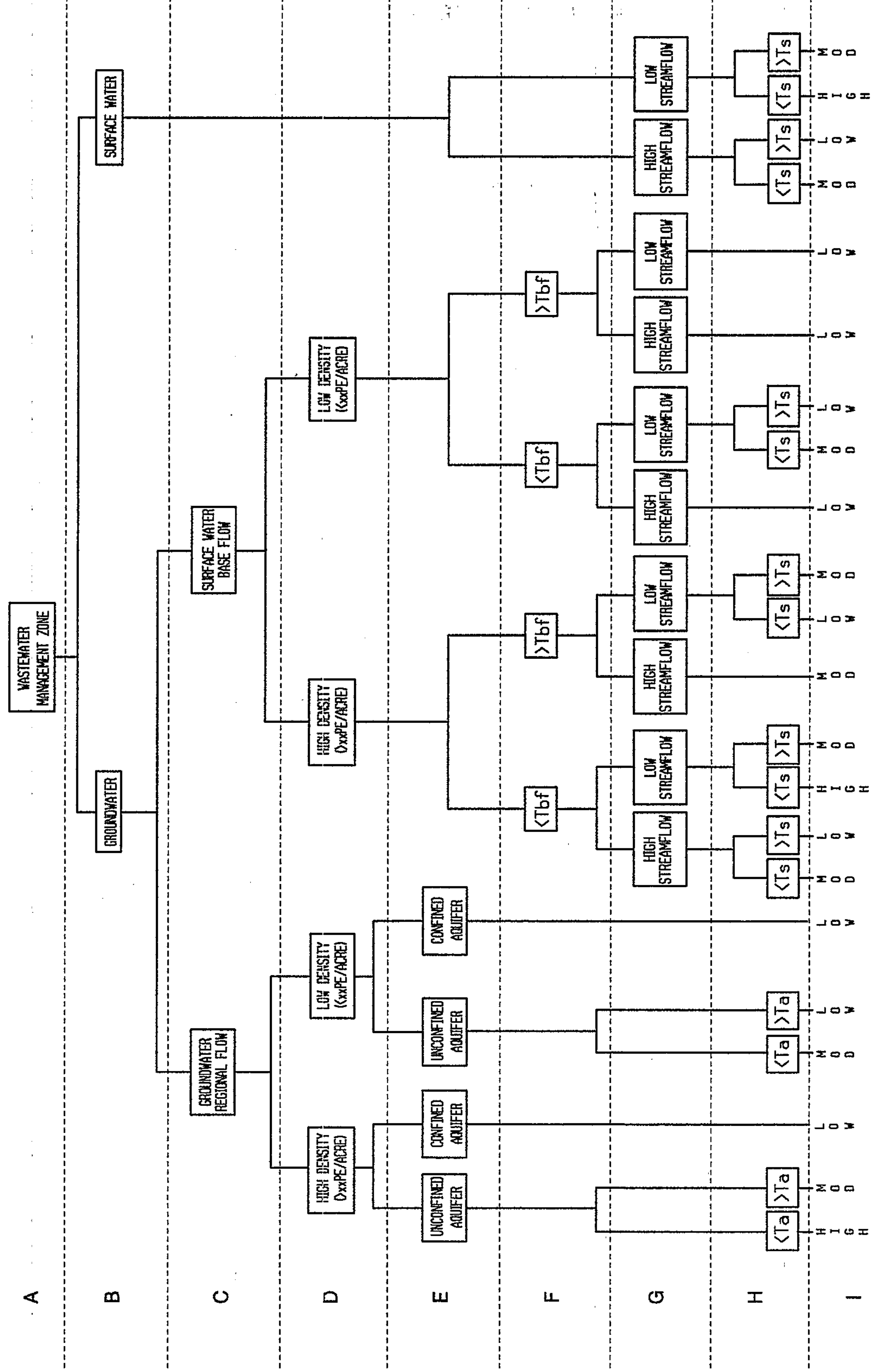


Figure 4-8. Probability of environmental impact decision tree (see key, next page).

Table 4-5. Environmental sensitivity assessment key for preceding figure.

A	**Wastewater management zone** Includes the entire service area of the district.
B	**Receiving environment** Receiving water to which the wastewater is discharged.
C	**Fate of ground water discharge** The treated discharge to ground water may enter the regional flow or become base flow to surface water. Ground water flow direction can be roughly estimated from ground surface topography if other sources of information are not available. In some instances both regional flow and base flow routes should be assessed to determine the controlling point of use.
D	**Planning area density (population equivalents per acre)** The risk of higher contaminate concentrations in the ground water from ground water-discharging treatment facilities will increase with increasing numbers of people served. Where building lots are served by individual infiltration systems, the population served divided by the total area composed by contiguous existing and planned lots would determine population equivalents per acre (p.e./acre). For a large cluster system, the p.e./acre would be determined by the population served divided by the area of the infiltration surface of the cluster system.
E	**Well construction** Wells developed in an unconfined aquifer with direct hydraulic connections to the wastewater discharge have a higher probability of impact from the wastewater discharge than wells developed in a confined aquifer. Wells that are considered within the zone of influence from the wastewater discharge should be identified and their construction determined from well logs.
F	**Travel time to base flow discharge, T_{bf}** Treated wastewater discharges in ground water can affect surface waters through base flow. The potential impacts of base flows are inversely proportional to the travel time in the ground water, T_{bf}, because of the dispersion and dilution (except in karst areas) that will occur. Where aquifer characteristics necessary to estimate travel times are unknown, distance can be substituted as a measure. If travel time, T_{bf}, is greater than time to a ground water point of use, T_a, the ground water should be assumed to be the receiving environment.
G	**Stream flow** Stream flow will provide dilution of the wastewater discharges. The mixing and dilution provided are directly proportional to the stream flow. Stream flow could be based on the 7-day, 10-year low-flow condition ($_7Q_{10}$) as a worst case. "High" and "low" stream flow values would be defined by the ratio of the $_7Q_{10}$ to the daily wastewater discharge. For example, ratios greater than 100:1 might be "high," whereas those less than 100:1 might be "low." Stream flow based on the watershed area might also be used (cfs/acre).
H	**Travel time to aquifer or surface water point of use, T_a or T_s** The potential impacts of wastewater discharges on points of use (wells, coastal embayments, recreational areas, etc.) are inversely proportional to the travel time. Except for karst areas, distance could be used as a substitute for travel time if aquifer or stream characteristics necessary to estimate travel times are unknown.
I	**Relative probability of impact** The relative probability of impact is a qualitative estimate of expected impact from a wastewater discharge on a point of use. The risk posed by the impact will vary with the intended use of the water resource and the nature of contaminants of concern.

Source: Otis, 1999.

4.6 Identifying goals for the management program

The inventory, assessment, and risk analysis activities described in the preceding sections provide information that can be used to develop goals for the management program. This information will likely identify areas where new development is occurring – and will occur in the future, groups of older systems believed to be failing, high-density system clusters, and critical areas near important ground water recharge zones or valued surface waters where greater management oversight might be needed.

Management programs generally support the twin goals of protecting human health and environmental resources. Developing management objectives and approaches for each group of systems – which may be organized as having high/moderate/low risk potential – will constitute much of the work in devising the overall management program. Many management programs have been developed to address direct threats to health or water resources, a trend that is likely to continue as state and local governments address water quality problems under the Clean Water Act TMDL program, the Source Water Protection provisions of the Safe Drinking Water Act (SDWA), and other state, tribal, and local rules. It is likely that water quality requirements will continue to drive calls for greater management of new and existing decentralized wastewater systems.

The questions that must be addressed during the goal-setting phase are the same as those addressed earlier in the community-visioning phase. Those questions are:

- Where are we now?
- Where are going?
- Where do we want to be?
- How will we get there?

The particular management mix selected for an area should be based primarily on the potential for onsite system discharges to affect public health or the quality of surface and/or ground waters. The level of oversight incorporated into the management program should increase as the potential for negative impacts on public health or for environmental degradation increases. Examples of parameters to consider in assessing public health and environmental sensitivity include soil permeability, depth to groundwater, aquifer type, receiving ground and surface water use, proximity to sensitive surface waters, topography, geology, and density of development. Another useful parameter to consider is the "susceptibility determinations" that states, tribes, and local water utilities make as part of their source water assessments. These assessments determine which potential sources of pollution, including onsite wastewater systems, pose the greatest threats to potable water systems.

Other issues to consider that might directly impact public health and the local economy include the need to protect shellfish harvesting and direct contact recreational waters. An area far from any surface water with moderately permeable soils and a deep ground water table might be designated as an area of low public health risk and environmental sensitivity, whereas an area close to a sensitive surface water with excessively permeable soils and a shallow, unconfined ground water aquifer used directly (untreated) for drinking water might be designated as an area of high sensitivity. For those watersheds where a determination has been made that onsite wastewater systems are substantially contributing to a violation of the ground and/or surface water quality standards, higher-level management will likely be needed. Also, systems that discharge to surface waters are subject to mandatory permitting and other requirements under state and federal National Pollutant Discharge Elimination Programs. Finally, decentralized systems that cause or contribute to violations of water quality standards (i.e., designated use attainment, water quality criteria) may be targeted for increased management through the Total Maximum Daily Load program of the Clean Water Act. More information on the pollutants of concern and their fate in soils and treatment systems is provided in the *Onsite Wastewater Treatment Systems Manual* (USEPA, 2001).

Table 4-6. Organizational, functional, and structural dimensions of management.

Issue	Questions to be addressed
Time frame	At what point will the planned management program structure be sustainable? If sequentially implemented, when will each sequence be completed? When will the management program be fully operational?
Service area	What areas will be served by the management program? Are these areas compatible with a local public jurisdiction that would have the necessary powers to make the program responsible and sustainable? Do specific sub areas require different management approaches (e.g., system designs, staffing, regulatory controls)?
Purpose	What public health and water resource problems will be addressed and satisfied by the management program? What measurements must be made (monitoring) to verify success?
Structure	Can existing entities be modified or partnered to provide management services or will a new entity be needed? Should the management program be limited to decentralized wastewater treatment, or should other (e.g., water/stormwater) infrastructure be included? How will the program elements of the management program be staffed and administered? Will formal agreements, ordinances, or other legal mechanisms (e.g., articles of incorporation, public charter) are required to create structural elements of the management program?
Authority/liability	Which systems will be under the jurisdiction of the management program? Will the onsite treatment systems be privately or publicly owned? How will future wastewater systems be planned, designed, installed, operated, maintained, inspected, and repaired or replaced? What is the relationship between the management program and the regulatory authority? What formal agreements, ordinances, or other legal mechanisms (e.g., with system or property owners) are required to implement each element of the program? How will the program be funded?

(Adapted from Ciotoli and Wiswall, 1982).

The answers to the questions in Table 4-4 must be integrated into the best type of management program appropriate for the community. The relationship is between those answers and the 5 program models is depicted in Figure Y

4.6.1 Performance requirements

The establishment of performance requirements can be viewed as one of the most important determinants of the type of management program required. Performance requirements—derived from health and water resource assessments and risk evaluations conducted during the earlier planning phases—may define minimum requirements for addressing site evaluation, system design, construction and O/M complexity, and monitoring requirements. All of these, in turn, will impact the other program elements.

Under a performance-based approach that is driven by the quality of the receiving waters, site conditions and wastewater characterization information define the selection (design) of treatment technologies at each site. For known technologies with extensive testing and field data, the management agency can satisfy performance requirements prescriptively by designating pretreatment system components, design flow (i.e., system size), construction practices, materials to be used, acceptable site conditions, and design requirements. For example, the Arizona Department of Environmental Quality has proposed a rule that establishes definitions, permit requirements, restrictions, and performance criteria for a range of conventional and alternative treatment systems (Swanson, 2000).

Some states have already incorporated stricter site suitability and performance requirements into their OWTS permit programs. Generally, the stricter requirements were established in response to concerns over nitrate contamination of ground water supplies or nutrient inputs to surface waters. For example, in Massachusetts, the Department of Environmental Protection has designated "nitrogen-sensitive areas" in which new nitrogen discharges must be limited (see box below). Designation of these areas is based on ecological sensitivity and relative risk of threats to drinking water wells.

Performance requirements and system design in Massachusetts

Massachusetts' onsite regulations identify certain wellhead protection areas, public water supply recharge zones, and coastal embayments as nitrogen-sensitive areas and require OWTSs in those areas to meet nitrogen-loading limitations. For example, recirculating sand filters or equivalent technologies must limit total nitrogen concentrations in effluent to no more than 25 mg/L and remove a minimum of 40 percent of the influent nitrogen load. All systems in nitrogen-sensitive areas must discharge no more than 440 gallons of design flow per acre per day unless system effluent meets a nitrate standard of 10 mg/L or other nitrogen removal technologies or attenuation strategies are used.

Source: Massachusetts Environmental Code, Title V

4.7 Developing a management action plan

The development of an action plan—including information on costs and how it will be supported and implemented—will be based on the nature of the management program chosen by the community. Programs created through cooperative arrangements with partner organizations to enhance existing management approaches will depend on the synergy, commitment, and resources applied by stakeholders through the steering committee process.

The action plan should define the extent of each program element and identify how it will be implemented. Such a plan should bring into focus some ideas of the possible political conflicts, narrow the options of potential sources of the necessary powers of the management program, and allow some focusing on the possible technology and programmatic options before proceeding with implementation. Key issues to be discussed in the plan with appropriate stakeholder involvement and public outreach and feedback include the following:

- Investigate legal, jurisdictional, and regulatory restrictions
- Assess public health and natural resource protection ramifications
- Identify potential program partners and inventory available resources
- Plan to build public support through targeted outreach activities
- Establish performance requirements for treatment systems
- Identify appropriate onsite technologies for particular site conditions
- Establish operation/maintenance requirements for specific system types
- Develop cost estimates for actions under consideration
- Compare costs of various management and technology options
- Develop proposed income source(s) for each approach

A comprehensive wastewater management plan will summarize the optimal mixture of wastewater management options for different areas of a community based on the following:

- Current and future growth, population density, and land use patterns
- Natural characteristics (soil suitability for on-site systems, etc.)
- Economic characteristics
- Environmental conditions
- Current infrastructure
- Community preferences

(Source: Lombardo, 2001).

In addition, the action plan should include achievable milestones such as:

- Enabling legislation, ordinances, and regulations required (if applicable)
- Community referenda or other actions needed for approval
- Preparation and implementation of operating agreements, protocols, and easements
- Execution of all agreements with oversight agencies
- Reorganization of existing agencies and staffing of management entity

In considering which approaches might be most successful, Deese and Hudson (1980) suggest that all the alternative management structures that provide the necessary services and have the necessary powers should be arrayed and ranked according to the following criteria:

- Overall cost-effectiveness
- Relative distribution of costs and benefits
- Dependability, reliability and related risks in performance
- Public acceptability (i.e., in terms of cost, intrusiveness, etc.)
- Operability (i.e., based on "real world" projections)
- Land-use and development implications
- Other socioeconomic impacts

4.7.1 Determining management program boundaries

One key issue that must be addressed by the committee is the potential boundaries of any management program. If the boundaries are within a single township or county, that governmental entity may already have the authorities and resources to serve as an effective management entity. If not, or if traditional government entities decline to lead the program, other management institutional approaches will be necessary. If state statutes exist that permit the establishment of a special purpose district that either has the necessary powers or can attain them through partnering with a governmental entity, a workable structure can be created. The best approach in areas electing to operate less comprehensive programs might be a cooperative partnership among the present regulatory authority, planning offices, water quality agencies, service providers, and other stakeholders. Shephard (1996) recommends use of the simplest possible partnering arrangements to facilitate the process. This is where the state oversight agencies can be most useful in advising the community of the limitations of existing state statutes.

4.7.2 Develop an operating framework or institutional structure

Many management programs have developed in response to specific public health or water pollution problems, but many of these problems can be anticipated before they come to the attention of regulators. Keuka Lake, NY, is an example of a decentralized management program that was created to avoid problems that would have seriously impaired tourism if the present trends continued (Shephard, 1996). In either (reactive or proactive) case the community must decide what wastewater services must be provided to meet its goals. It must then develop the institutional structure with which to carry out these essential services. The institutional structure (an arrangement of public and/or private organizations) will constitute the mechanism for setting and enforcing regulations, performing decentralized system oversight activities such as inspections and record keeping, monitoring program performance, reporting to regulatory oversight agencies, and performing all the other activities identified in prior chapters of this Handbook

Management of cluster systems in Missouri

In Missouri, both the Department of Health and the Department of Natural Resources regulate wastewater treatment systems. The Department of Health regulates all single-family residence wastewater systems and other sources of domestic sewage with a flow less than 3,000 gallons per day, which discharge to the soil or holding tanks. The Department of Natural Resources (DNR) regulates systems with a flow of more than 3,000 gallons per day, systems treating industrial facilities, and all systems that discharge to surface waters except single-family systems discharging to lagoons.

Clustered systems must be permitted by the DNR, which requires the designation of a "continuing authority" defined by state rules before an operating permit is issued. The continuing authority is a permanent organization responsible for the operation, maintenance, and upgrading of the facility. Missouri regulations regarding continuing authorities can be found at 10 CSR 20-6.010, Construction and Operating Permits, Continuing Authority (see http://www.sos.state.mo.us/adrules/csr/current/10csr/10c20-6a.pdf).

There is a hierarchy of acceptable continuing authorities, which are listed in preferential order in the regulation. If a system is built within the jurisdiction of a higher-order authority, a permit will not be issued to an organization lower in the preferred order unless the higher authority submits a letter that it does not want to own and operate the system. Homeowner's associations are on the bottom of the preferential list. In recent years the legislature created the option of forming a nonprofit sewer company (see Missouri Revised Statutes, Chapter 398.825, at http://www.moga.state.mo.us/STATUTES/C393.HTM)).

Source: Smith, 2002

Development of onsite management functions within existing sanitation districts provides support for planning, installation, operation, maintenance, inspection, enforcement, and financing. Traditional onsite management entities (e.g., health departments) can partner with sanitation or other special districts to build programs with all the necessary powers. For example, a health department could retain its authority to approve system designs, issue permits, and oversee construction while the sanitation district could assist with regional planning and conduct inspections, maintenance (e.g., tank pumping and residuals reuse/disposal), and remediation. In some areas, special districts or private or public utilities have been created to manage the full range of onsite system management activities, from regional planning and system permitting to inspection and enforcement (Shephard, 1996; see Missouri case study).

For many jurisdictions, however, the concept of centralized management of decentralized systems is new and few resources are currently available to develop such a program. For those areas, a management partnership may provide the best program development and implementation option. In cases where significant problems are causing serious health or water quality threats or where new development provides an opportunity to initiate improved management, creation of a single management entity is likely to be justified.

The authority to perform all management functions might not be granted by existing state legislation to a single entity. Involving stakeholders who represent public health, environmental, economic development, political entities and the public in this process can ensure that the lines and scope of authority for an onsite systems management program are well understood and supported locally. The different governmental entities involved in the overall management program, especially for lower level programs, should have the combined authority to perform all necessary functions and should coordinate their activities through a relatively seamless approach. Thus, the management entity should have the following abilities (adapted from Venhuizen, 2001):

- Provide policy and management continuity
- Charge fees for services (e.g., book-keeping, inspections, etc)
- Compel users of the management services to comply with requirements (e.g., fines and incentives)
- Ensure sustainable financial and legal support and responsibility
- Hire and retain qualified employees
- Enter into contracts and undertake debt obligation
- Own, purchase, or lease real and personal property
- Have access to the systems managed

The management program is likely to be a *mix of approaches* under the *various program elements* and a *mix of approaches* in terms of *grouping and targeting systems for attention*. Consolidating as many management functions and activities as possible under a single program or entity is the most effective and efficient approach. In many basic management models (e.g., Program models 1 through 3) local health departments may become the management entity or may serve to coordinate the service provider and agency framework that comprises the management program. A Level 1 program may merely provide a means for better record keeping and public education, but it, like all effective management programs, must start with the development and maintenance of an inventory of existing systems on a central database.

4.8 Implementing and adapting the management program

Developing a sound, comprehensive wastewater management program involves consideration of applicable wastewater collection, treatment and dispersal technologies, and effective institutional arrangements. The mix of institutions, procedures, and arrangements involved in the management program development process will vary depending on local circumstances, environmental conditions, resources, and so on. Because of this diversity, the outcomes of management development efforts are likely to be different in different locations across the country.

In some towns or rural areas a decision might be made to develop an enhanced management strategy only for those systems presenting a clear and significant risk to valued water resources. For example, a coastal community might designate various management or treatment zones that have different performance requirements and management mandates, including regular inspections for near-shore properties that have a high potential for economic impacts on the community, (e.g., loss of recreation or tourism, commercial shellfish harvesting), while inland systems that pose less risk have less intensive management. Similarly, a rapidly urbanizing area might decide to require comprehensive, perpetual management of all systems serving new adjacent residential areas to prevent future demands that would result in far more expensive expansion of the existing wastewater infrastructure.

Successful creation of a management program involves devising a management partnership or entity capable of implementing selected actions and meeting established goals (see Table 4-6). Executing the action plan can be a challenge. Some tasks will proceed well, while others might require some adaptation. The adaptive management process—continuous improvement of strategies as new information, resources, or situational advantages become available—is both art and science, and involves a few key considerations in order to be useful:

- A set of baseline indicators of public health and environmental quality that can be easily monitored to verify the impact of the management program.
- Awareness of community perceptions and concerns through advisory boards and other feedback mechanisms that monitor the community.
- A process for collecting, analyzing, and acting on new information in reviewing the program and for reporting to state oversight agencies.
- Careful documentation and justification for actions, through widespread use of publicly-disseminated technical, administrative, and enforcement procedures and protocols

Adaptations are not necessary if potential pitfalls are identified and addressed early in the management program development process. NSFC (2001) cited the primary onsite management pitfalls to be: 1) inadequate funding, 2) sub optimal management program design, 3) lack of adequate inspection, monitoring and program evaluation capabilities, and 4) lack of public involvement and education. Mancl (2001) reported that the successful long-term management entities she evaluated all exhibited creative day-to-day problem solving, empathetic staff, dependable financing, and good record keeping.

In the implementation phase, the committee should

- Monitor tasks to ensure that activities proceed according to schedule
- Track the effectiveness of cooperative arrangements and the management framework
- Adapt to new information and changing conditions as necessary

Preparing and implementing operating agreements, protocols, and easements should be a natural outcome of thorough public and oversight agency involvement in developing the action plan. The citizens and regulators have by this time seen all the alternatives and have agreed to the content of these necessary operating items. The difficulty in obtaining these approvals in official form should be directly related to the planning effort, (i.e., good planning should yield quick agreements).

If the plan creates a new management entity, the task of hiring capable and affable staff might be only the first step in a prolonged period of transferring responsibilities from existing agencies. If it was merely a consolidation or partnership of entities that have been involved in such programs, the lag time might be minimal. If, for example, a local regulatory agency (such as a health department) is enhanced to perform a wider array of duties (e.g., record keeping and public education), the staffing and organizational changes might be accomplished with a minimum of delay. Again, the thoroughness of the planning process has a major impact. If inventory development, protocol and enforcement program development, and enabling steps have been comprehensive, the problems with management program implementation and startup should be minimized. In cases where the implementation plan involves a significant amount of construction for immediate rehabilitation of problem systems or replacement of onsite systems in a densely populated area with cluster systems, the transitional stage could be extended because of innate time delays in contracting such projects. If the management program is implemented by a responsible management entity that performs many tasks through contracts to service providers, those contracts should be advertised and let at the earliest possible time, since these procedures have their own built-in timelines.

The Rhode Island Septic System Maintenance Policy Forum

For years, Rhode Island communities have worked to adopt septic system management programs. Despite many attempts, however, few programs materialized. Opposition typically included three arguments: 1) the state should stay out of its citizens' backyards, 2) upgrading septic systems is cost prohibitive, and 3) no agreed-upon maintenance or inspection standards exist.

To address these concerns comprehensively, the Rhode Island Department of Environmental Management (DEM) convened the Septic System Maintenance Policy Forum. The policy forum is a roundtable group that comprises approximately 100 representatives from federal, state, and local government, as well as private associations and citizens. It has met seventeen times since its inception in 1995, and routinely attracts 30 or more attendees per meeting. The policy forum operates on a consensus-based approach. Meeting coordinators characterize issues and suggest options, engendering debate and discussion until an agreement is reached.

Funding programs supported in part by the State Revolving Fund have been developed to provide low interest loans for system repairs and grants for community-wide management programs. Technical assistance is provided by DEM as requested. As of 2002, 83 percent of the communities in the state that rely extensively on decentralized wastewater systems are developing management programs. The forum also provided input for the new guide entitled *Septic System Check-Up: The Rhode Island Handbook for Inspection*. DEM developed the handbook, which describes two types of inspection: 1) a maintenance inspection to determine the need for pumping and minor repairs, and 2) a functional inspection for use during property transfer. The guide includes detailed instructions for locating septic system components, diagnosing in-home plumbing problems, and flow testing and dye tracing.

Source: Riordan, 2002

Possibly the most difficult issue to face during the planning phase is where to find financing for selected management approaches or actions. Community resource providers and consultants who specialize in small community projects for assistance generally have knowledge of various possible sources of financing and how to effectively apply for them. National resource providers like the Rural Community Assistance Project, the National Rural Water Council, and state extension services are generally equipped to provide this type of assistance, but many regional resources exist throughout the country that provide similar services. See Chapter 5 for a listing of financial, technical, and other resources to support decentralized wastewater programs.

Table 4-7. Institutional considerations in selecting a management entity

	State Agency	County	Municipality	Special district	Improvement district	Public authority	Public nonprofit corporation	Private nonprofit corporation	Private for-profit corporation
Responsibilities	Enforcement of state laws and regulations	Enforcement of state codes, county ordinances	Enforcement of municipal ordinances; may enforce state/county codes	Powers defined; may include code enforcement (e.g., sanitation district)	State statutes define extent of authority	Fulfilling duties specified in enabling instrument	Role specified in articles of incorporation (e.g., homeowner association)	Role specified in articles of incorporation (e.g., homeowner association)	Role specified in articles of incorporation
Financing capabilities	Usually funded through appropriations and grants.	Able to charge fees, assess property, levy taxes, issue bonds, appropriate general funds	Able to charge fees, assess property, levy taxes, issue bonds, appropriate general funds	Able to charge fees, assess property, levy taxes, issue bonds	Can apply special property assessments, user charges, and other fees. Can sell bonds.	Can issue revenue bonds, charge user and other fees	Can charge fees, sell stock, issue bonds, accept grants/loans	Can charge user fees, accept grants/loans	Can charge fees, sell stock, accept some grants/loans
Advantages	Authority level and code enforceability are high; programs can be standardized; scale efficiencies	Authority level and code enforceability are high; programs can be tailored to local conditions	Authority level and code enforceability are high; programs can be tailored to local conditions	Flexible, renders equitable service (only those receiving services pay); simple and independent approach	Can extend public services without major expenditures; service recipients usually supportive	Can provide service when government unable to do so; autonomous, flexible	Can provide service when government unable to do so; autonomous, flexible	Can provide service when government unable to do so; autonomous, flexible	Can provide service when government unable to do so; autonomous, flexible
Disadvantages	Sometimes too remote; not sensitive to local needs and issues; often leaves enforcement up to local entities	Sometimes unwilling to provide service, conduct enforcement; debt limits could be restrictive	Might lack administrative, financial, other resources; enforcement might be lax	Can promote proliferation of local govern-ment, duplication/frag mentation of public services	Contributes to fragmentation of government services; can result in administrative delays.	Financing ability limited to revenue bonds; local government must cover debt	Local governments might be reluctant to apply this concept	Services could be of poor quality or could be terminated.	No enforcement powers, company might not be fiscally viable; not eligible for major grant/loan programs

(Source: Ciotoli and Wiswall, 1982).

Almost all of the decentralized management programs that have been identified are for small developments, and most are for onsite systems only. Since clusters of significant size are often considered community-wide systems, their management is often categorized under conventional central sewers and is difficult to identify when performing searches to identify decentralized systems. Thus, the best documentation of existing information is still under development by the NESC. This preliminary information indicates that management programs that have been tentatively identified have small budgets and are modest in terms of coverage by the discussed program elements. Almost all total budgets were less than $1 million; the mode was only $5,000. The majority of the actual management programs are supported at least in part by user fees. Other key support mechanisms are operational fees and property taxes either as exclusive or as part of the overall funding package. User fees are primarily construction permit, operating permit, and inspection fees paid by system owners, but contractor (service provider) licensing fees are also significant.

The few studies of management programs provide a widely varying picture of management program costs versus services provided. Possibly the best single report is by Mancl (2001). The report, which attempted to compare five long-term management programs, failed to show any pattern of costs and services. Combining the report with some other case studies, however, does offer some insights. For example, throwing out some obvious outliers, a responsible management entity (Management Programs 4 and 5), which often include cluster systems, appears to cost homeowners somewhere between $180 and $450 per year. This cost may not include certain one-time costs to join or costs for special services. In contrast, minimal management programs (similar to Management Program 1) appear to cost less than $100 per year. Intermediate management programs vary widely between these extremes depending heavily on what is included in the fees charged, other sources of funding, and the technologies employed.

Lake Panorama, Iowa: developing a flexible management model

This management program began in 1980 through County ordinance changes and administrative rules approval and started with creating and implementing specific design requirements that exceeded those of the state code because of economic and water quality concerns. The boundaries are totally within the County, thus making the establishment of the management program. All new systems were sited, designed and constructed according to these more stringent requirements at the start. As-built drawings and descriptions of these systems were entered into the database. Existing systems were then located, inspected, upgraded, and entered into the database/inventory. A regular inspection program (originally, every 3 years for full-time and every-six for seasonal residents, but now reduced to 1 and 2 years, respectively) conducted by the County sanitarian was instituted. The County health agency provides oversight of the program by appointing the program's board of directors, but homeowner association input is obvious and welcomed in all aspects of the program operation.

The program could be characterized as a Model Program 3 without the specific use of operating permits. Inspections are required at specific intervals and enforcement of any deficiencies found through them is clear and locally encoded. Prescriptive site evaluation procedures and design requirements are more stringent than state code requirements. Hydraulic failures have been reduced to about 1 percent. The funding is to implement the program is raised through property taxes by the County, as the legal taxing authority. Participation is essentially mandatory for all homeowners. Presently, the cost is about $30/year per home with an onsite system for inspections and inventory updating. Operation and maintenance costs must be added to determine the total cost for each home. Some dwellings are on cluster systems, and they are assessed an additional $600/year or more.

Mancl and Patterson, 2001

Regarding the fundamental financial, managerial, and technical analyses that are required for consideration in becoming a decentralized wastewater "responsible management entity" (e.g., electricity providers, water/sewer providers, or public sector entities), some excellent guidance on basic business decisions exists (Drake, 2001; Yeager, 2001; and English and Yeager, 2001). Since these management programs are often considered to be business-oriented, business plans must be approved that show financial viability in perpetuity for these entities. Drinking water suppliers have also become aware of the need for this viability in recent years after experiencing some of the legal, financial, and public health consequences of failing to do so.

The community may also seek information on the concept of centralized management of decentralized systems through information centers like the NESC, which is developing a series of non-technical tools designed to assist the community at each of the steps in this process. Handbook readers should visit http://www.nesc.wvu.edu/nsfc/nsfc_index.htm on the Web for further information on the availability of these products. Publicly financed support for centralized wastewater treatment services has been available for decades from federal, state, and local sources. Since 1990, support for public funding of onsite treatment systems has been growing. (See Appendix A for a summary of the most prominent sources of grant, loan, and loan guarantee funding.)

4.9 Regular review and revision of an ongoing management program

Management entities or cooperative program steering committee members should regularly review inspection and monitoring data, state or tribal water quality monitoring data, customer complaints, fee structures, and data to track progress of the management program in achieving goals and objectives. Although an annual review is most likely, the management program should have the capability to make interim adjustments in response to unanticipated problems that arise during the course of normal operations.

Evaluating the effectiveness of onsite management program components (e.g., planning, fiscal, regulatory, service provider certification) can provide valuable information for adapting program provisions and execution approaches. A regular and structured evaluation of any program can provide critical information for program managers, the public, and decision makers. Periodic program evaluations should be performed to analyze program methods and procedures, identify problems, evaluate the potential for improvement through new technologies or program enhancements, and adjust program goals. The program evaluation process should include:

- A tracking system for measuring success and evaluating/adapting program components
- Processes for comparing program achievements to goals and objectives
- Approaches for adapting goals and objectives if internal or external conditions change
- Processes for initiating administrative or legal actions to improve program functioning
- An annual report on the status, trends, and achievements of the management program
- Venues for ongoing information exchange among program stakeholders

A variety of techniques and processes exist to perform program evaluations to assess administrative and management elements. The method chosen for each program will depend on local circumstances, the type and number of stakeholders involved, and the level of support generated by management agencies to conduct a careful, unbiased, detailed review of the program's success in protecting health and water resources. Regardless of the method selected, the program evaluation should be performed at regular intervals by experienced staff with involvement by program stakeholders.

Suggested approach for conducting a formal program evaluation

Form a program evaluation team composed of management, program staff, service providers, public health agency representatives, environmental protection organizations, elected officials, and interested citizens.

Define the goals, objectives, and operational components of the various onsite management program elements. This can be done simply by using a checklist to identify which program elements currently exist and whether or not they are meeting their objectives.

Review the program elements checklist and feedback collected from staff and stakeholders to determine progress toward goals and objectives, current status, trends, administrative processes used, and cooperative arrangements with other entities.

Identify program elements in need of improvement, define actions or amount and type of resources required to address deficient program areas, identify sources of support or assistance, and implement recommended improvement actions.

Communicate suggested improvements to program managers, to ensure that the findings of the evaluation are considered in program structure and function.

A number of state, local, and private organizations have implemented performance-based management programs for a wide range of activities, from state budgeting processes to industrial production operations. The purpose of these programs is twofold: linking required resources with management objectives and continuous improvement. Onsite management programs should use the expertise present among partnering entities to develop and implement in-house evaluation processes (see case study).

Performance-based budgeting in Texas

Since 1993 state agencies in Texas have been required to develop a long-term strategic plan that includes a mission statement, goals for the agency, performance measures, an identification of persons served by the agency, an analysis of the resources needed for the agency to meet its goals, and an analysis of expected changes in services due to changes in the law. Agency budget line items are tied to performance measures and are available for review through the Internet. Information on the budgeting process in Texas is available from the Texas Legislative Budget Board at http://www.lbb.state.tx.us.

Source: Texas Senate Research Center, 2000.

4.10 Using the management models as a basis for management

The five management models described in Chapter 3 provide a workable template for building a management program (see Figure 4-9 and Appendix D). Management Model 1 – Homeowner Awareness – is suggested as the starting point for any management program, since it stresses system inventories, public education, and homeowner awareness/responsibility for system operation and maintenance. Management Model 2 provides further enhancement through the addition of operation and maintenance contracts between the system owners and service providers. The relationship to the regulatory authority is still the same, but the management program has better control of the management of more complex onsite systems to review in its oversight activities.

Management Model 3 systems (i.e., with operating permits) may consist of enhanced partnerships among public/private entities and the local regulatory authority. However, the management structure and its capabilities must be more sophisticated because it oversees inspections and operating permits for onsite systems within its boundaries. Also, the public education and involvement aspects should be enhanced, since more enforcement is likely when operating permits, inspections, system performance monitoring, and more sophisticated record keeping are involved.

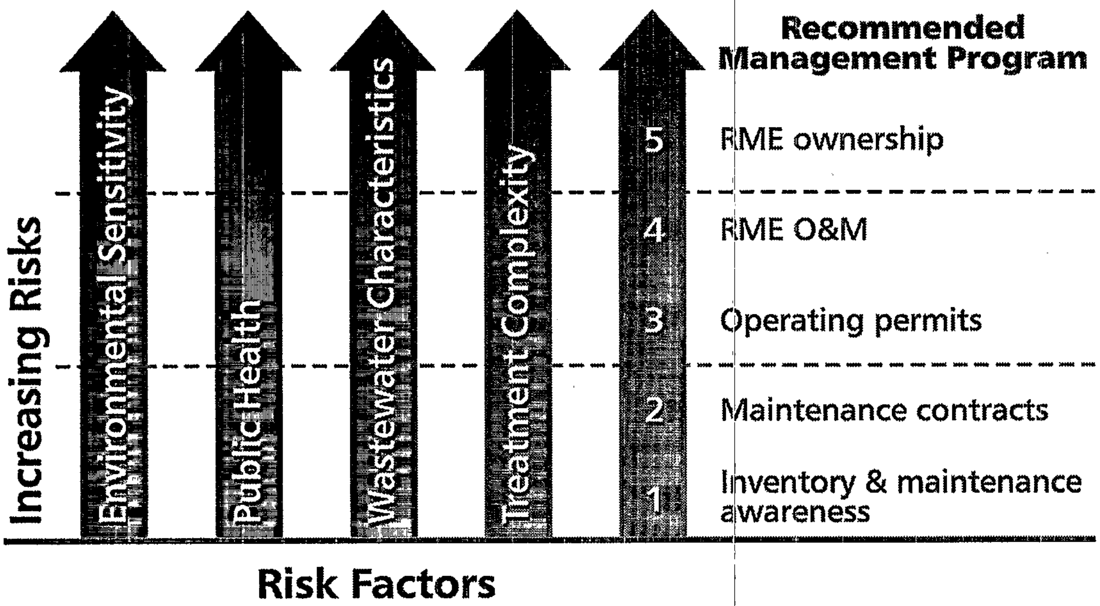
With clearly defined "responsible management entities" (i.e., under Management Models 4 and 5), there may be major changes in interagency relationships. Enabling legislation for creation of third party onsite wastewater management entities will vary, and cause some variation in the role of the traditional regulatory authority (e.g., local health department). The management of cluster systems will bring more oversight from the state environmental agency as well the state health department. In most cases, at least some of the inherent regulatory program responsibilities, (e.g., permitting, training and certification/licensing of service providers), may either be delegated to or shared with the responsible management entity (RME). An RME must be quite sophisticated in its technical capability and records management. It will normally, as negotiated with the oversight agencies, bear some responsibility for developing and administering service-provider protocols, conducting monitoring and inspection programs, and arranging supplemental training for service providers.

Performance must be ensured more proactively through oversight of design and installation, performance of inspections, and monitoring of operating systems and the receiving environment, and in oversight of the residuals management program. The RME must also be responsible for meeting any permits issued to it by the oversight agencies. It has all the necessary capability (legal, financial, and administrative) to devise internal plans to incorporate and operate cluster wastewater systems and play an active role in regional land use planning. Both types of RMEs can enter into contracts with licensed/certified service providers to implement any part of its overall service needs, which is a typical approach to lower costs. The RME must , however, also have the technical resources to oversee the performance of its contractors since it is ultimately responsible to the oversight agencies in accordance with its permits.

It is important for the committee to note that implementing higher overall levels of management can be accompanied by significantly increased public opposition, especially if the community and important stakeholders (e.g., system owners) are not sufficiently involved in developing the set of enforcement actions and fee structures. Herring (2001) noted that in the absence of clearly perceived benefits, such as resolving severe water quality problems associated with a valued resource, little public support can be expected for increased management. Development of a RME appears to be an attractive alternative only under the following conditions (Herring, 2001):

- There is a serious threat to property values, and a management district is projected to be able to reduce the impact at a lower cost than central sewers.
- There is a widespread perception of a threat to public health or the environment and a perception that central sewers would be more expensive.
- The area is undergoing significant new development, and the formation of a management entity is part of an overall development package.

Figure 4-9. Using risk inputs to select a management program model.



Source: Otis, 2002.

The robustness of the decentralized wastewater system technology has a major influence on the type of management program selected. Proper application of the normally prescriptive elements of the regulatory code under Management Model 1 should be sufficient to minimize the hydraulic backup problems resulting from unmanaged application of that code in areas where environmental concerns are minimal and improved public health protection from direct human contact is the goal of the program. A more complex treatment system, such as a surface discharging aerobic system with filtration and disinfection, will require frequent monitoring and attention from a professional technician to maintain its performance, and therefore requires a higher level of management.

Integrating public and private entities in watershed management

In 1991 the Keuka Lake Association established a watershed project to address nutrient, pathogen, and other pollutant loadings into the upstate New York lake, which provides drinking water for more than 20,000 people and borders 8 municipalities and two counties. The project sought to assess watershed conditions, educate the public on the need for action, and foster inter-jurisdictional cooperation to address problems. The Keuka Watershed Improvement Cooperative was conceived by the project team as an oversight committee composed of elected officials from the municipalities and counties. The group developed an 8-page inter-municipal agreement under the state home rule provisions, which allow municipalities to collectively do anything they can do individually, to formalize the cooperative and recommend new laws and policies for onsite systems and other pollutant sources.

Voters in each municipality approved the agreement by landslide margins after an extensive public outreach program. The cooperative developed regulations governing onsite system permitting, design standards, inspection, and enforcement. The regulations carry the force of law in each town or village court and stipulate that failures be cited and upgrades required. Inspections are required every 5 years for systems within 200 feet of the lake and alternative or aerobic systems must be inspected annually. The cooperative coordinates its activities with state and county health agencies and maintains a GIS database to track environmental variables and the performance of new technologies. The program is financed by onsite system permit fees, some grant funds, and appropriations from each city's budget.

(Source: Shephard, 1996).

Chapter 5 Where can I find more information to support our management program?

5.1 Potential Funding Sources

U.S. Environmental Protection Agency

Clean Water State Revolving Fund

The Clean Water State Revolving Fund (CWSRF) is a low- or no-interest loan program that has traditionally financed centralized sewage treatment plants across the Nation. Program guidance issued in 1997 by EPA emphasized that the fund could be used as a source of support for the installation, repair, or upgrading of onsite systems in small towns, rural, and suburban areas. CWSRF programs are administered by the states and the territory of Puerto Rico and operate like banks. Federal and state contributions are used to capitalize the fund programs, which make loans for water quality projects. Funds are then repaid to the CWSRF over terms as long as 20 years. Repaid funds are recycled to fund other water quality projects. Projects that may be eligible for CWSRF funding include new system installations, replacement or modification of existing systems, and costs associated with establishing a management entity to oversee onsite systems in a region, including capital outlays (e.g., trucks, storage buildings). Approved management entities include city and county governments, special districts, public or private utilities, and private for-profit or nonprofit corporations. For more information, visit www.epa.gov/owm/cwfinance/cwsrf or call 202-564-0752.

Environmental Finance Program

The U.S. Environmental Protection Agency developed the Environmental Finance Program to assist communities in their search for creative approaches to funding their environmental projects. The Environmental Finance Program provides financial technical assistance to the regulated community and advice and recommendations on environmental finance issues, trends, and options. The university-based Environmental Finance Centers help communities lower costs, increase investment, and build capacity by creating partnerships with state and local governments and the private sector to fund environmental needs. For more information, visit www.epa.gov/efinpage/ or call 202-564-4994.

Non point Source Pollution Program

The Clean Water Act (CWA) section 319 (nonpoint source pollution) funds can support a wide range of polluted runoff abatement, including onsite wastewater projects. Authorized under section 319 of the federal CWA and financed by federal, state, and local contributions, these projects provide cost-share funding for individual and community systems and support broader watershed assessment, planning, and management activities. Projects funded in the past have included direct cost-share for onsite system repairs and upgrades, assessment of watershed-scale onsite system contributions to polluted runoff, regional remediation strategy development, and a wide range of other programs dealing with onsite wastewater issues. For example, a project conducted by the Gateway District Health Department in east-central Kentucky enlisted environmental science students from Morehead State University to collect and analyze stream samples for fecal coliform "hot spots." Information collected by the students was used to target areas with failing systems for cost-share assistance or other remediation approaches (EPA, 1997). The Rhode Island Department of Environmental Management developed a user-friendly system inspection handbook with CWA section 319 funds to improve system monitoring practices and then developed cost-share and loan programs to help system owners pay for needed repairs (EPA, 1997). For more information, visit www.epa.gov/owow/nps/319hfunds.html or call 202-566-1163.

U.S. Department of Agriculture (USDA)

Rural Development programs provide loans and grants to low/moderate income individuals. State Rural Development offices administer the programs. For state office locations, see http://www.rurdev.usda.gov/recd_map.html. A brief summary of USDA Rural Development programs is provided below.

Rural Housing Service

The Rural Housing Service (RHS) Single-Family Housing Program (http://www.rurdev.usda.gov/rhs/Individual/ind_splash.htm) provides homeownership opportunities to low- and moderate-income rural Americans through several loan, grant, and loan guarantee programs. The program also makes funding available to individuals to finance vital improvements necessary to make their homes decent, safe, and sanitary. The Direct Loan Program (section 502) provides individuals or families direct financial assistance in the form of a home loan at an affordable interest rate. Most loans are to families with income below 80 percent of the median income level in the communities where they live. Applicants may obtain 100 percent financing to build, repair, renovate or relocate a home, or to purchase and prepare sites, including providing water and sewage facilities. Families must be without adequate housing, but be able to afford the mortgage payments, including taxes and insurance. These payments are typically within 22 to 26 percent of an applicant's income. In addition, applicants must be unable to obtain credit elsewhere, yet have reasonable credit histories. Elderly and disabled persons applying for the program may have incomes up to 80 percent of area median income (AMI).

Home Repair Loan and Grant Program

For very low-income families who own homes in need of repair, the Home Repair Loan and Grant Program offers loans and grants for renovation. Money may be provided, for example, to repair a leaking roof, to replace a wood stove with central heating, or to replace an outhouse and pump with running water, a bathroom, and a waste disposal system. Homeowners 62 years and older are eligible for home improvement grants. Other low-income families and individuals receive loans at a 1 percent interest rate directly from RHS. Loans of up to $20,000 and grants of up to $7,500 are available. Loans are for up to 20 years at 1 percent interest.

Rural Utilities Service

The Rural Utilities Service (www.usda.gov/rus/water/programs.htm) provides assistance for public or nonprofit entities, including wastewater management districts. Water and waste disposal loans provide assistance to develop water and waste disposal systems in rural areas and towns with a population not in excess of 10,000. The funds are available to public entities such as municipalities, counties, special-purpose districts, Native American tribes, and corporations not operated for profit. The program also guarantees water and waste disposal loans made by banks and other eligible lenders. Water and Waste Disposal Grants can be accessed to reduce water and waste disposal costs to a reasonable level for rural users. Grants can be made for up to 75 percent of eligible project costs in some cases.

The Rural Business-Cooperative Service (http://www.rurdev.usda.gov/rbs/busp/b&i_gar.htm) provides assistance for businesses that provide services for system operation and management. Business and Industry Guaranteed Loans can be made to help create jobs and stimulate rural economies by providing financial backing for rural businesses. This program provides guarantees for up to 90 percent of a loan made by a commercial lender. Loan proceeds may be used for working capital, machinery and equipment, buildings and real estate, and certain types of debt refinancing. Assistance under the Guaranteed Loan Program is available to virtually any legally organized entity, including a cooperative, corporation, partnership, trust or other profit or nonprofit entity, Native American tribe or federally recognized tribal group, municipality, county, or other political subdivision of a state.

U.S. Department of Housing and Urban Development

Community Development Block Grants

The U.S. Department of Housing and Urban Development (HUD) operates the Community Development Block Grant (CDBG) program, which provides annual grants to 48 states and Puerto Rico. The states and Puerto Rico use the funds to award grants for community development to smaller cities and counties. CDBG grants can be used for numerous activities, including rehabilitation of residential and nonresidential structures, construction of public facilities, and improvements to water and sewer facilities, including onsite systems. EPA is working with HUD to improve access to CDBG funds for treatment system owners by raising program awareness, reducing paperwork burdens, and increasing promotional activities in eligible areas. More information can be found at www.hud.gov/cpd/cdbg.html or by calling 202-708-1112.

Appalachian Regional Commission

The Appalachian Regional Commission's (ARC) mission is to be an advocate for and partner with the people of Appalachia to create opportunities for self-sustaining economic development and improved quality of life. The ARC will help communities in Appalachia fund the development of onsite management programs. For more information, visit www.arc.gov or call 202-884-7799.

The National Decentralized Water Resources Capacity Development Project

The National Decentralized Water Resources Capacity Development Project (NDWRCDP) funds new projects, enhancement or expansion of existing work, and cooperative ventures with other organizations in the onsite/decentralized wastewater treatment field. For more information, visit www.ndwrcdp.org/funding.cfm or call 510-651-4210.

Tribal Sources

U.S. EPA Clean Water Indian Set-Aside Program

Section 518(c) of the 1987 Amendments to the Clean Water Act established the program and authorized EPA to administer grants in cooperation with the Indian Health Service (IHS). This partnership maximizes the technical resources available through both agencies to address tribal sanitation needs. The ISA Program uses IHS's Sanitation Deficiency System (SDS) to identify high priority wastewater projects for funding. For more information, visit www.epa.gov/owm/mab/indian/cwisa.htm or call 202-564-0621.

Indian Health Service-Sanitation Facilities Construction Program

The IHS's Division of Sanitation Facilities Construction administers a nationwide Sanitation Facilities Construction (SFC) Program that is responsible for the delivery of environmental engineering services and sanitation facilities to American Indians and Alaska Natives. The SFC Program allocates available resources to the twelve IHS area offices. For more information, visit www.dsfc.ihs.gov or call 301-443-1046.

State-Specific Sources (check with your state to learn more about their financial assistance programs)

Kentucky PRIDE Program

PRIDE is a local, state, and federal cooperative effort designed to address the challenge of cleaning up the Kentucky's rivers and streams of sewage and garbage, ending illegal trash dumps, and promoting environmental awareness and education while renewing pride in southern and eastern Kentucky. Visit www.kypride.org for more information.

Pennsylvania PENNVEST Community Septic Management Program
The Pennsylvania Infrastructure Investment Authority (PENNVEST) provides low cost financing for wastewater systems across the Commonwealth. These systems typically serve an entire community with many users who are unable to tie into the central system. For more information, visit www.phfa.org/programs/singlefamily/pennvest or call (717) 780-3837.

Texas Supplemental Environmental Project
A Supplemental Environmental Project (SEP) is a project that prevents pollution, reduces the amount of pollution reaching the environment, enhances the quality of the environment, or contributes to public awareness of environmental matters. For more information, visit http://www.tnrcc.state.tx.us/legal/sep/index.html or call 512/239-3400.

Washington Centennial Clean Water Fund

The Centennial Clean Water Fund provides low-interest loans and grants for wastewater treatment facilities and fund related activities to reduce nonpoint sources of water pollution. The fund provides low-interest loans and grants for projects that protect and improve water quality in Washington State. For more information, visit www.ecy.wa.gov/programs/wq/funding/index.html or call 360-407-6566.

Other funding sources

Other sources of funding include state finance programs, capital reserve or savings funds, bonds, certificates of participation, notes, and property assessments. Nearly 20 states offer some form of financial assistance for installation of onsite treatment systems, either through direct grants, loans, or special project cost-share funding. Capital reserve or savings funds are often used to pay for expenses that might not be eligible for grants or loans, such as excess capacity for future growth. Capital reserve funds can also be used to assist low and moderate-income households with property assessment or connection fees. Bonds usually finance long-term capital projects such as the construction of onsite wastewater systems. Bonds are issued by states, municipalities, towns, townships, counties, and special districts. The two most common types of bonds are general obligation bonds, which are backed by the faith and credit of the issuing government, and revenue bonds, which are supported by the revenues raised from the beneficiaries of a service or facility. General obligation bonds are rarely issued for wastewater treatment facilities because communities are often limited in the amount of debt that they may incur. These bonds are generally issued only for construction of schools, libraries, municipal buildings, and police/fire stations.

Revenue bonds are usually not subject to debt limits and are secured by repayment through user fees. Issuing revenue bonds for onsite projects allows a community to preserve the general obligation borrowing capacity for projects that do not generate significant revenues. This mechanism works well for ongoing management programs, but does not work for new management programs. A third and less commonly used bond is the special assessment bond, which is payable only from the collection of special property assessments. Some states administer state bond banks, which act as intermediaries between municipalities and the national bond market to help small towns that otherwise would have to pay high interest rates to attract investors or would be unable to issue bonds. State bond banks, backed by the fiscal security of the state, can issue one large, low-interest bond that funds projects in a number of small communities.

Certificates of Participation (COPs) are issued by communities to lenders to spread out costs and risks of loans to specific projects. If authorized under state law, COPs can be issued when bonds would exceed debt limitations. Notes, which are written promises to repay a debt at an established interest rate, are similar to COPs and other loan programs. Notes are used mostly as a short-term mechanism to finance construction costs while grant or loan applications are processed. Grant anticipation notes are secured by a community's expectation that it will receive a grant. Bond anticipation notes are secured by the community's ability to sell bonds.

Finally, property assessments may be used to recover capital costs for wastewater facilities that benefit property owners within a defined area. For example, property owners in a specific neighborhood could be assessed for the cost of installing sewers or a cluster treatment system. Depending on the amount of the assessment, property owners might pay it all at once or pay in installments at a set interest rate. Similar assessments are often charged to developers of new residential or commercial facilities if developers are not required to install wastewater treatment systems approved by the local regulatory authority. Funding for ongoing management of onsite systems in newly developed areas should be considered when these assessments are calculated.

5.2 Technical resources

Technical Information on Onsite Wastewater Systems

Barnstable County, Massachusetts Department of Health and the Environment Alternative Septic System Information Center
This web site contains information on alternative onsite technologies.
www.barnstablecountyhealth.org/AlternativeWebpage/index1.htm

City of Austin, Texas Onsite Wastewater Treatment and Disposal Fact Sheets
The set of fact sheets covers many onsite topics from conventional systems to alternative systems. The fact sheets can be downloaded from www.ci.austin.tx.us/wri/fact.htm.

Constructed Wetlands for Wastewater Treatment
This document describes constructed wetlands for wastewater treatment and has numerous case studies. This document can be downloaded from www.epa.gov/owow/wetlands/construc/content.html.

Delaware Department of Natural Resources and Environmental Control fact sheets
These fact sheets describe different wastewater disposal systems. They can downloaded from www.dnrec.state.de.us/dnrec2000/P2/Septic.htm.

The Easy Septic Guide
This guide describes everything a homeowner needs to know about their septic system. It has chapters on checking your septic system, understanding your septic system, how to maintain a health system, and the septic shopping guide. The guide can be downloaded www.cessnock.nsw.gov.au/scripts/CESSremdm.pl?Do=page&Page=PNum326.

Everything You Wanted to Know About Your Septic System: But Didn't Know Whom to Ask
The Volusia County, Florida Department of Health developed this interactive CD-ROM to educate homeowners on septic systems. To order a copy of the CD, call 904-736-5579.

Homeowner's Guide to On-Site Wastewater Disposal Zone
The Sea Ranch Association, an onsite management entity, developed this guide for new homeowners. The guide explains a septic system and explains a typical inspection. This guide can be downloaded from www.tsra.org/Zone.htm.

Massachusetts Department of Environmental Protection Publications
This web page contains links to many publications concerning septic systems and alternative technologies. For more information, visit www.state.ma.us/dep/brp/wwm/t5pubs.htm.

National Environnemental Services Center
National Environmental Services Center provides technical assistance and information about drinking water, wastewater, environmental training, and solid waste management to communities serving fewer than 10,000 individuals. Visit www.nesc.wvu.edu/ for more information.

National Small Flows Clearinghouse
Funded by grants from EPA, NSFC helps small communities and individuals solve their wastewater problems. Its services include a web site, online discussion groups, a toll-free

assistance line (800-624-8301), and informative publications. Visit www.nesc.wvu.edu/nsfc/nsfc_index.htm for more information.

Ohio State University Extension Fact Sheets

This series of fact sheets cover topics from Septic System Maintenance, to Septic Tank - Mound System, to Onsite Wastewater Management: Cost and Financing. They can be downloaded from //ohioline.osu.edu/aex-fact/.

Onsite Wastewater Training Centers

Alabama, Alabama Onsite Wastewater Training Center
aowtc.uwa.edu/
Arizona, Institute for Tribal Environmental Professionals and Northern Arizona University
www4.nau.edu/itep/twwtc.html
Arizona, Onsite Wastewater Demonstration Project
www.cet.nau.edu/Projects/WDP/
California, California Wastewater Training and Research Center
www.csuchico.edu/cwtrc/Pages/home.htm
Florida, Florida Department of Health Onsite Sewage Training Courses
www.doh.state.fl.us/environment/ostds/training/maintrai.htm
Kentucky, Kentucky Onsite Wastewater Training Center
www.kentuckyonsite.org/
New England, NEIWPCC Environmental Training Center
www.neiwpcc.org/
New York, SUNY Morrisville Environmental Training Center
www.nyruralwater.org/aquafacts/winter2000/9.shtml
North Carolina, National Training Center for Land-Based Technology and Watershed Protection
www2.ncsu.edu/ncsu/CIL/WRRI/news/jf99trainingcenter.html
North Carolina, NC State University Soils and On-Site Wastewater Training Academy
www.soil.ncsu.edu/swetc/onsite2/onsite.htm
Minnesota, The Onsite Sewage Treatment Program
septic.coafes.umn.edu//Events/index.html
Missouri, Missouri Small Wastewater Flows Education and Research Center
aes.missouri.edu/bradford/news/mso-ftc.stm
Montana Environmental Training Center
msun.edu/grants/metc/
Rhode Island, URI On-Site Wastewater Training Center
http://www.uri.edu/ce/wq/owtc/html/owtc.html
Utah, Utah On-Site Wastewater Treatment Training Center
http://www.engineering.usu.edu/uwrl/training/
Wisconsin, Small Scale Waste Management Project
http://www.wisc.edu/sswmp/

Onsite Wastewater Treatment Systems Manual

This comprehensive reference manual is designed to provide state and local governments with guidance on the planning, design and oversight of onsite systems. This manual is useful for onsite wastewater professionals, developers, land planners, and academics. This manual can be downloaded from www.epa.gov/ORD/NRMRL/Pubs/625R00008/625R00008.htm.

Oregon Department of Environmental Quality On-Site Fact Sheets

These fact sheets include information on septic system installation and maintenance. The fact sheets can be downloaded from www.deq.state.or.us/wq/onsite/onsite.htm.

Protecting Water Quality: Understanding Your Septic System and Water Quality
This fact sheet explains the relationship between septic systems and water quality and recommendations for septic system maintenance.
This document can be downloaded from
http://www.aces.edu/department/extcomm/publications/anr/anr-790/WQ1.2.5.pdf

The Septic Education Kit
The Department of Commerce's National Technical Information Service is distributing The Septic Education Kit, a toolbox that contains everything needed to organize an education program on the care and maintenance of septic systems. This kit can be ordered from www.ocrm.nos.noaa.gov/nerr/septickit/moreinformation.html.

Septic Systems: What You Don't Know Can Hurt You!
This brochure describes the potential problems caused by septic system if they are not maintained. It also offers maintenance recommendations. This brochure can be ordered from the Madera County, California Environmental Health Department 559-675-7823.

Septic Yellow Pages
This web site provides useful information concerning septic systems for homeowners. Visit www.septicyellowpages.com/homeowner.html for more information.

Subsurface Flow Constructed Wetlands for Wastewater Treatment: A Technology Assessment
This report verifies that subsurface flow constructed wetland can be a viable and cost-effect wastewater treatment option.
This document can be downloaded from www.epa.gov/owow/wetlands/pdf/sub.pdf.

U.S. EPA Municipal Technologies Branch Fact Sheets
These fact sheet cover difference treatment technologies. These fact sheets can be downloaded from www.epa.gov/owm/mtb/mtbfact.htm.

University of Minnesota Fact Sheets
This set of fact sheets covers topics from homeowner education to alternative technologies and can be downloaded from www.extension.umn.edu/topics.html?topic=2&subtopic=110.

University of Rhode Island Fact Sheets
This set of fact sheets covers topics from what you should know about inspectors, to how to hire a contractor, to how to order and boy a distribution box and can be downloaded from www.uri.edu/ce/wq/has/html/has_septicfacts.html.

US EPA's Decentralized Onsite Management for Treatment of Domestic Wastes
This program provides operation and maintenance information for on-site wastewater treatment systems and can be downloaded from www.epa.gov/glnpo/seahome/decent.html.

Washington Sea Grant Septic Manuals
Five homeowner manuals are available from this web site, including Pressure Distribution, Gravity, Mound, Sand Filter, Proprietary Device. Visit
www.wsg.washington.edu/outreach/mas/water_quality/septicsense/relatedinfo.html for more information.

5.3 Management program development resources

The following is a list of websites and publications available related to wastewater systems and initiating and planning a decentralized wastewater management program.

Information on the initiating and planning a management program

Building Our Future: A Guide to Community Visioning
This manual provides community residents with a process for planning for their mutual future. This manual can be downloaded from www.drs.wisc.edu/vision/abtguide/index.htm.

Choices for Communities: Wastewater Management Options for Rural Areas
This 17-page document helps guide communities through exploring their wastewater treatment options. This document can be downloaded from http://www.easternnc-ced.org/pdf-files/NCSU.WMOR.pdf.

City of Vancouver Citizen Handbook on Building Community
The Citizens Handbook is meant to encourage more active citizens - people motivated by an interest in public issues, and a desire to make a difference. This document can be downloaded from www.vcn.bc.ca/citizens-handbook/Welcome.html.

Community Visioning: Planning for the Future in Oregon's Local Communities
This report describes how new approaches to anticipate and plan for change are needed - approaches that actively engage citizens in thinking about the future at the local level. This report can be downloaded from www.asu.edu/caed/proceedings97/ames.html.

Decentralized Wastewater Management
This brochure is for homeowners in the City of Austin, Texas. It explains their management program. The brochure can be ordered by calling 512-322-0101.

Funding Decentralized Wastewater Systems Using the Clean Water State Revolving Fund
This fact sheet explains the Clean Water State Revolving Fund and the types of activities that can be funded. This fact sheet can be downloaded from http://www.epa.gov/owm/cwfinance/cwsrf/factsheets.htm#Decentralized.

A Guide to Public Management of Private Septic Systems
This guide can be used by communities to examine their wastewater treatment options and design a unique program that meets their needs. This document can be downloaded from www.cardi.cornell.edu/clgp/septics_index.cfm.

The Neighborhood Charrette Handbook: Visioning and Visualizing Your Neighborhood's Future
The charrette workshop is designed to stimulate ideas and involve the public in the community planning/design process. This handbook can be downloaded from www.louisville.edu/org/sun/planning/char.html.

Pennsylvania Department of Environmental Protection Wastewater Management Fact Sheets
These fact sheets cover topics from sewage planning, to sewage disposal systems. The fact sheets can be downloaded from www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqp_wm/Pubs-c.htm.

A Quick Guide to Small Community Wastewater Treatment Decisions
When deciding on the right treatment system, the community must have clear goals and specific criteria to use in making the decision. This document guides communities through choosing an effective and reasonably priced wastewater treatment system. The guide can be purchased from http://www.extension.umn.edu/distribution/naturalresources/DD7735.html.

Response to Congress on Use of Decentralized Wastewater Treatment Systems
This document describes the benefits and barriers to implementing an onsite wastewater management program. This document can be downloaded from http://www.epa.gov/owm/mtb/decent/response/.

Rural Empowerment Zone and Economic Community Program
The road to economic opportunity and community development starts with broad participation by all segments of the community. This web site provides information on how to involve the community and develop a strategic plan. Visit www.ezec.gov/index.html for more information.

A Simpler, Cheaper Alternative to Sewer Systems
The guide describes a wastewater project in Willard, a small village in New Mexico where the sole supply of drinking water is threatened by contamination from wastewater.
Copies of this guide can be downloaded for free from www.sewerless-wastewater-solutions.org/guide.htm.

Wastewater Management Fact Sheets
Pennsylvania Department of Environmental Protection developed these fact sheets to assist wastewater managers and includes Process For Resolving Complaints About Malfunctioning Onlot Systems, Sales Contract Requirements Under Act 537, Understanding The Importance Of Soils In Siting An Onlot System. Some of the fact sheets explain Pennsylvania regulations. The fact sheets can be downloaded from www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqp_wm/Pubs-c.htm.

U.S Environmental Protection Agency Community-Based Environmental Protection
Community-Based Environmental Protection (CBEP) integrates environmental management with human needs, considers long-term ecosystem health, and highlights the positive correlations between economic prosperity and environmental well-being.
Visit www.epa.gov/ecocommunity/ for more information.

U.S. Environmental Protection Agency for Onsite and Clustered (Decentralized) Wastewater Treatment Systems
EPA developed this web site to provide tools for communities investigating and implementing decentralized management programs. The Web site contains fact sheets, program summaries, case studies, links to design and other manuals, and a list of state health department contacts. Visit www.epa.gov/owm/onsite for more information.

Appendix A: References

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Chapter 5

See Chapter 5 for listing.

Appendix B: Glossary of Terms

Aerobic Treatment Unit (ATU): A mechanical wastewater treatment unit that provides secondary wastewater treatment for single home, cluster of homes, or commercial establishments by mixing air (oxygen) and aerobic and facultative microbes with the wastewater. ATUs typically use either a suspended growth process (such as activated sludge _ extended aeration and batch reactors), fixed film process (similar to a trickling filter), or a combination of the two treatment processes.

Alternative Onsite Treatment System: A wastewater treatment system that includes different components than typically used in a conventional septic tank and subsurface wastewater infiltration system (SWIS). An alternative system is used to achieve acceptable treatment and dispersal of wastewater where conventional systems either may not be capable of protecting public health and water quality, or are inappropriate for properties with shallow soils over groundwater or bedrock or soils with low permeability. Examples of components that may be used in alternative systems include sand filters, aerobic treatment units, disinfection devices, and alternative subsurface infiltration designs such as mounds, gravelless trenches, and pressure and drip distribution.

Centralized Wastewater System: A managed system consisting of collection sewers and a single treatment plant used to collect and treat wastewater from an entire service area. Traditionally, such a system has been called a Publicly Owned Treatment Works (POTW) as defined in 40 CFR 122.2.

Cesspool: A drywell that receives untreated sanitary waste containing human excreta, which sometimes has an open bottom and/or perforated sides (40 CFR 144.3). Cesspools with the capacity to serve 20 or more persons per day were banned in federal regulations promulgated on December 7, 1999. The construction of new cesspools was immediately banned and existing large-capacity cesspools must be replaced with sewer connections or onsite wastewater treatment systems by 2005.

Cluster System: A wastewater collection and treatment system under some form of common ownership which collects wastewater from two or more dwellings or buildings and conveys it to a treatment and dispersal system located on a suitable site near the dwellings or buildings.

Construction Permit: A permit issued by the designated local regulatory authority that allows the installation of a wastewater treatment system in accordance with approved plans and applicable codes.

Conventional Onsite Treatment System: A wastewater treatment system consisting of a septic tank and a typical trench or bed subsurface wastewater infiltration system.

Decentralized System: Managed onsite and/or cluster system(s) used to collect, treat, and disperse or reclaim wastewater from a small community or service area.

Dispersal System: A system which receives pretreated wastewater and releases it into the air, surface or ground water, or onto or under the land surface. A subsurface wastewater infiltration system is an example of a dispersal system.

Engineered Design: An onsite or cluster wastewater system that is designed and certified by a licensed/certified designer to meet specific performance requirements for a particular wastewater on a particular site.

Environmental Sensitivity: The relative susceptibility to adverse impacts of a water resource or other receiving environment from dispersal of wastewater and/or its constituents. The impacts may be low, acute (i.e. immediate and significantly disruptive), or chronic (i.e. long-term, with gradual but serious disruptions).

Large Capacity Septic System: An onsite method of partially treating and disposing of sanitary wastewater having the capacity to serve 20 or more persons-per-day subject to EPA's Underground Injection Control regulations.

Management Model: A program consisting of thirteen elements that is designed to protect and sustain public health and water quality through the use of appropriate policies and administrative procedures that define and integrate the roles and responsibilities of the regulatory authority, system owner, service providers and management entity, when present, to ensure that onsite and cluster wastewater treatment systems are appropriately managed throughout their life cycle. The program elements include public education and participation, planning, performance requirements, training and certification/licensing, site evaluation, design, construction, operation and maintenance, residuals management, compliance inspections/monitoring, corrective actions and enforcement, record keeping, inventory, and reporting, and financial assistance and funding. Management services should be provided by properly trained and certified personnel and tracked via a comprehensive management information system.

National Pollutant Discharge Elimination System (NPDES) Permit: A national program under Section 402 of the Clean Water Act for regulation of discharges of pollutants from point sources to waters of the United States. Discharges are illegal, unless authorized by an NPDES permit.

Onsite Service Provider: A person who provides onsite system services. They include but are not limited to designers, engineers, soil scientists, site evaluators, installers, contractors, operators, managers, maintenance service providers, pumpers, and others who provide services to system owners or other service providers.

Onsite Wastewater Treatment System (OWTS): A system relying on natural processes and/or mechanical components to collect, treat, and disperse or reclaim wastewater from a single dwelling or building.

Operating Permit: A renewable and revocable permit to operate and maintain an onsite or cluster treatment system in compliance with specific operational or performance requirements stipulated by the regulatory authority.

Performance-Based Management Program: A program designed to preserve and protect public health and water quality by seeking to ensure sustained achievement of specific, measurable performance requirements based on site and risk assessments.

Performance Requirement: Any requirement established by the regulatory authority to assure future compliance with the public health and water quality goals of the community, the state or tribe, and the federal government. Performance requirements can be expressed as numeric limits (e.g., pollutant concentrations, mass loads, wet weather flow, structural strength) or narrative descriptions of desired conditions or requirements (e.g., no visible scum, sludge, sheen, odors, cracks, or leaks).

Permitting Authority: The state, tribal, or local unit of government with the statutory or delegated authority to issue permits to build and operate onsite wastewater systems.

Prescription-Based Management Program: A program designed to preserve and protect public health and water quality through specification of pre-engineered system designs for specific sets of site conditions, which if sited, designed, and constructed properly, are deemed to meet public health and water quality standards.

Prescriptive Requirements: Specifications for design, installation and other procedures and practices for onsite or cluster wastewater systems on sites that meet stipulated criteria. Proposed deviations from the stipulated criteria, specifications, procedures, and/or practices require formal approval from the regulatory authority.

Regulatory Authority (RA): The unit of government that establishes and enforces codes related to the permitting, design, placement, installation, operation, maintenance, monitoring, and performance of onsite and cluster wastewater systems.

Residuals: The solids generated and/or retained during the treatment of wastewater. They include trash, rags, grit, sediment, sludge, biosolids, septage, scum, grease, as well as those portions of treatment systems that have served their useful life and require disposal such as the sand or peat from a filter. Because of their different characteristics, management requirements can differ as stipulated by the appropriate Federal Regulations.

Responsible Management Entity (RME): A legal entity responsible for providing various management services with the requisite managerial, financial, and technical capacity to ensure the long-term, cost-effective management of decentralized onsite and/or cluster wastewater treatment facilities in accordance with applicable regulations and performance requirements.

Septage: The liquid and solid materials pumped from a septic tank during cleaning operations.

Septic Tank: A buried, watertight tank designed and constructed to receive and partially treat raw wastewater. The tank separates and retains settleable and floatable solids suspended in the wastewater and discharges the settled wastewater for further treatment and dispersal to the environment.

Source Water Assessment: A study and report required by the Source Water Assessment Program (SWAP) of the Safe Drinking Water Act addressing the capability of a given public water system to protect water quality that includes delineation of the source water area, identification of potential sources of contamination in the delineated area, determination of susceptibility to those sources, and public notice of the completed assessment.

Underground Injection Well: A constructed system designed to place waste fluids above, into, or below aquifers classified as underground sources of drinking water. As regulated under the Underground Injection Control (UIC) Program of the Safe Drinking Water Act (40 CFR Parts 144 & 146), injection wells are grouped into five classes. Class 5 includes shallow systems such as cesspools and subsurface wastewater infiltration systems. Subsurface wastewater infiltration systems with the capacity to serve 20 or more people per day, or similar systems receiving non-sanitary wastes, are subject to federal regulation. Class V motor vehicle waste injection wells and large-capacity cesspools are specifically prohibited under the UIC regulations.

Appendix C: Relationship to other USEPA water programs

The USEPA *Voluntary Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems* will help support the activities and approaches being applied in several other USEPA programs and contribute toward achieving mutual water quality objectives and public health protection goals. Related programs include watershed management, water quality management, biosolids and residuals management, nonpoint source control, source water assessment and protection, underground injection control, water permitting and coastal zone management. The relationship of the Guidelines to these companion programs is summarized in the following discussion.

Watershed Management.

The Guidelines can be integrated into a comprehensive watershed approach at the state, tribal, or local government level. There are clear benefits to managing onsite/centralized systems at basin, watershed or subwatershed levels. Ideally, the use of a watershed approach will facilitate the identification of both existing and anticipated sources of pollutants of concern, e.g., nutrient and pathogens, and allow the appropriate jurisdictions to take coordinated actions to protect or restore an identified resource. In such an approach, short and long-term wastewater management plans and actions for both centralized and decentralized systems can be integrated into a comprehensive plan that may include analyses and actions that address the impacts of other contributing sources of pollutants such as animal waste, wildlife or agriculture. The use of a watershed approach also encourages the coordination of management entities and actions across jurisdictions. Inter-jurisdictional planning and coordination can result in more efficient resource utilization, including data sharing, and also help to avoid inconsistent management policies or requirements that can cause unanticipated consequences such as accelerated growth in adjacent communities due to less burdensome requirements or lower costs.

National Pollutant Discharge Elimination System (NPDES)

In 1972, Congress established the NPDES program under the Clean Water Act (CWA). Under the CWA, discharge of a pollutant from a point source to waters of the United States is prohibited unless that discharge is authorized by a NPDES (CWA Section 402) or wetlands (CWA Section 404) permit. The NPDES program includes discharges to groundwater with a direct hydrologic connection to surface water. NPDES permits are issued by a State or Tribe authorized to implement the NPDES program, or by USEPA if there is no authorized State or Tribe. The NPDES permit establishes necessary technology-based and water quality-based terms, limitations and conditions on the discharge to protect public health and the environment. EPA's NPDES regulations (40 CFR 122.28) provide for issuance of a "general permit" to authorize discharges from similarly situated facilities such as onsite and cluster systems. Several States issue general permits, including Arkansas, Kentucky and North Carolina. An example of the key aspects of a general permit is in the Management Handbook.

Biosolids and Residuals Management

The 1987 Amendments to the CWA required the development of comprehensive requirements for the use and disposal of sewage sludge (biosolids). As defined in the resulting "Use and Disposal of Sewage Sludge" rule at 40 CFR Part 503, sewage sludge includes the residuals produced by the treatment of domestic sewage (other than grit and screenings) and includes septage from onsite and cluster wastewater treatment systems. The Part 503 rule (along with non-hazardous solid waste disposal requirements under 40 CFR Part 257 and 258 which apply when domestic septage is mixed with other waste sources by pumpers) establish minimum Federal requirements for the proper management of septage from onsite and cluster wastewater treatment systems. USEPA has developed supplemental guidance on the management of septage in *Domestic Septage Regulatory Guidance: A Guide to the USEPA 503 Rule*[13] and *Guide to Septage Treatment and Disposal*[14]. The use and disposal of sewage sludge is usually regulated as part of the NPDES program.

Storm Water Management

Historically, polluted storm water runoff was often transported by municipal separate storm sewer systems (MS4s) or discharged from industrial or construction activities and ultimately discharged into local rivers and streams without treatment. Common pollutants include oil and grease from roadways, pesticides from lawns, sediment from construction sites, and carelessly discarded trash, such as cigarette butts, paper wrappers, and plastic bottles. When deposited into nearby waterways through MS4 discharges, these pollutants can impair the waterways, thereby discouraging recreational use of the resource, contaminating drinking water supplies, and interfering with the habitat for fish, other aquatic organisms, and wildlife.

In 1990, USEPA promulgated rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) storm water program. The Phase I program requires communities with MS4s serving populations of 100,000 or greater or sites with industrial or construction activity to implement a storm water management program as a means to control polluted discharges. The Storm Water Phase II Rule, promulgated on December 8, 1999, extends coverage of the NPDES storm water program to certain "small" MS4s and small construction sites. Operators of regulated small MS4s are required to design their programs to reduce the discharge of pollutants to the "maximum extent practicable"; protect water quality; and satisfy the appropriate water quality requirements of the Clean Water Act.

The Phase II program for MS4s is designed to accommodate a general permit approach using a Notice of Intent (NOI) as the permit application. The operator of a regulated small MS4 must include in the permit application, or NOI, its chosen best management practices (BMPs) and measurable goals for each of six minimum control measures. To help permittees identify the most appropriate BMPs for their programs, USEPA will issue a "menu," of BMPs to serve as guidance.

One measure in a Phase II storm water program is the detection and elimination of illicit discharges. USEPA has determined that many onsite and cluster systems (typically those that discharge to surface waters) illicitly discharge effluent to storm ditches which drain to storm sewers. In these cases, there must be a permit approach to protect the MS4 from pollutants associated with the onsite and cluster system. The Guidelines can be used to assist NPDES permit applicants in determining appropriate BMPs.

Water Quality Management (including Total Maximum Daily Loads)

Nationally, States have reported in their Clean Water Act Section 303(d) reports that designated uses are not being met for approximately 5,400 water bodies due to pathogens and that approximately 4,700 water bodies are impaired by nutrients[12]. Onsite wastewater treatment systems are often significant contributors of pathogens and nutrients. Under EPA's current requirements a total maximum daily load (TMDL) determination is required when the total loading of pollutants to a water body results in a violation of water quality standards. The Agency promotes the control and management of both point and non-point source discharges on a watershed basis. If onsite and cluster systems are determined to be a significant source of the pollutants, increased management is needed.

The most common approach to resolving problems with onsite wastewater treatment systems has been to replace onsite wastewater treatment systems with a centralized wastewater treatment and collection system. However, a decentralized approach, with a high level of management, is capable of meeting water quality objectives while offering communities a wider range of options. In these situations, these

Guidelines can be a valuable tool to use as the basis of TMDL/watershed implementation plans which promote improved management to address identified problems. An appropriate level of management, as described in this document could reduce pollutant loads to achieve water quality standards. USEPA also recognizes, as discussed more fully below, there are situations where a system is subject to the NPDES program. In such cases, permit requirements should be consistent with any applicable TMDL and water quality standards.

Water Quality Standards

State and tribal water quality standards do not consistently address pathogen and nutrient loadings. This lack of consistency has been due to a scarcity of information on how to measure, monitor and evaluate the impacts of pathogens and nutrients on water quality. New methods and information are being developed to assist tribes, states and local governments in assessing and developing appropriate management strategies to control these pollutants. USEPA is currently developing recommendations for improved methods to measure and document human health risks due to exposure to the most common pathogens and differing concentrations of these pathogens. A thorough discussion is available in the draft *Implementation Guidance for Ambient Water Quality Criteria for Bacteria-1986.*[15] USEPA is also developing a series of *Nutrient Criteria Technical Guidance Manuals* [what is reference?] for various water body types, e.g., rivers and streams. The intent of these documents is to provide States/tribes with methods to assess waterbody nutrient impairment, select criteria, design monitoring programs, and implement management practices. These factors should be considered during the siting, design, and operation of onsite and decentralized wastewater treatment systems.

Source Water Assessment and Protection

The 1996 Amendments to the Safe Drinking Water Act require States and tribes to implement Source Water Assessment and Protection (SWAP) programs which assess areas serving as sources of drinking water, identify potential threats, and implement protection efforts. The SWAP requires States to conduct source water assessments for all their public water systems. Assessments consist of delineating protection areas for the source waters of public drinking water supplies, identifying potential sources of contaminants within these areas, determining the susceptibility of the water supplies to contamination from these potential sources, and making the results of the assessments available to the public.

Assessments for many water systems, such as those in rural areas, are likely to inventory onsite and cluster systems located in delineated source water protection areas and identify some of these as priority pollution threats. Communities are encouraged to consider this emerging information from the assessments as a factor in deciding what level of management of onsite and cluster systems is necessary. Several programs specifically address the protection of ground water, since it serves as the source of drinking water for 95 percent of the nation's population in rural areas, and for half of the total U.S. population. USEPA also recommends the onsite and cluster management Guidelines as a tool in the protection of drinking water sources.

Underground Injection Control (UIC) Program

Certain onsite systems are regulated under the Underground Injection Control (UIC) Program. The UIC program was established by the Safe Drinking Water Act (SDWA) to protect current and future underground sources of drinking water (USDWs) from contamination caused by subsurface disposal of wastes. USEPA groups underground injection into five classes (Classes I-V), from deep to shallow. Class V wells include typically shallow, percolating systems, such as dry wells, leach fields, and similar types of drainage wells that overlie USDWs.

Under the existing federal regulations, Class V injection wells are authorized by rule provided they meet certain reporting requirements (e.g. submit inventory information) and do not endanger underground sources of drinking water. USEPA recognizes that State, Tribal and local governments commonly regulate onsite systems of varying sizes. Regardless, the UIC program is responsible for ensuring that these entities meet UIC program requirements when regulating large-capacity septic systems (those that accept solely sanitary waste and have the capacity to serve 20 or more people). Onsite wastewater treatment systems may also be regulated under the UIC program by an authorized State, Tribe, or USEPA if they accept industrial, chemical, or other non-sanitary wastes, also called "industrial drainage wells" or "agricultural drainage wells."

In 1999, the UIC program undertook two efforts relevant to large-capacity septic systems. First, the program promulgated regulations prohibiting the construction of new large capacity cesspools, and ordered all existing large capacity cesspools to be closed by April 5, 2005. Second, the program completed a comprehensive study of shallow injection wells, including septic systems, that are regulated under the Underground Injection Control Program.(16) USEPA found that, while the prevalence of contamination cases appears low relative to the prevalence of these systems, there are documented examples which implicate these large systems as sources of ground water contamination, and that they are being addressed locally.

On June 7, 2002 (67 FR 39583), USEPA announced a final determination for all sub-classes of Class V wells (such as large capacity septic systems), not included in the December 7, 1999 final UIC rule. The agency determined that additional federal requirements are not needed, at this time, and existing federal underground injection control regulations are adequate to prevent Class V wells from endangering USDWs. This is based on the actions USEPA is taking to improve the performance of onsite and cluster systems through the development of these Management Guidelines.

Coastal Zone Management Act

USEPA and National Oceanographic and Atmospheric Administration (NOAA) jointly administer Section 6217 of the Coastal Zone Management Act Reauthorization Amendments of 1992. This provision requires the 29 States with approved Coastal Zone Management Programs to establish and implement Coastal Nonpoint Pollution Control Programs. These programs must include management measures for both new and operating onsite sewage dispersal systems (OSDS). The measures are described in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*(17). The measure for new OSDS specifies that they be designed, installed, and operated properly and be situated at safe distances from sensitive resources including wetlands and flood plains. Protective separation between the bottom of the infiltration system and ground water tables is to be established, and OSDS are to be designed to reduce nitrogen loadings in areas where surface waters may be adversely affected. The measure for operating OSDS requires operation and maintenance to prevent surface water discharge and reduce loadings to groundwater, as well as inspection at regular time intervals and repair/replacement of faulty systems. The OSDS measures described above are consistent with many of the concepts described in these Guidelines.

Nonpoint Source Program

Congress established the national nonpoint source (NPS) program in 1987 when it amended the Clean Water Act with Section 319. States were required to conduct nonpoint source assessments and develop USEPA approved "Nonpoint Source Management Programs." All States and Territories and, as of September 2001, over 70 Tribes (representing over 70% of Indian lands) now have EPA-approved nonpoint source assessments and management programs. Typical categories of nonpoint sources identified and addressed in the state, territorial and tribal assessments and management plans include:

agriculture, urban, onsite disposal systems, forestry and hydromodification. In some states, the primary responsibility for managing onsite and cluster systems falls within the purview of the NPS program.

Congress provides funding to assist the states, territories and tribes in developing and implementing their NPS management programs. These funds can be used by states, territories and tribes to address sources identified within in their management programs submissions. States, territories and tribes can use these funds to promote, demonstrate and fund activities relating to onsite and cluster management programs including monitoring, program assessments and development, demonstration projects, research, public education and outreach and system replacement/rehabilitation. The voluntary Guidelines are intended to support the achievement of the goals of the state, territorial and tribal programs as they relate to onsite and cluster program management.

Technology Transfer

USEPA has recently published the *Onsite Wastewater Treatment Systems Manual*[18] (Onsite Manual) to provide new information on alternative treatment technologies and to promote a performance-based approach to onsite and cluster wastewater system management. This document is an update of EPA's 1980 *Design Manual - Onsite Wastewater Treatment and Disposal Systems*[19]. The Onsite Manual serves as the technical complement to the Management Guidelines and as a reference to identify the environmental, technological, administrative and public health factors to consider when developing an improved management program. The Onsite Manual contains information that can be used by program managers in assessing the environmental impacts of specific onsite and cluster wastewater treatment technologies on both the watershed and individual site levels and in the selection of appropriate technologies.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
DESIGN	Regulatory Authority	Codify prescriptive, pre-engineered designs, which are suitable for treatment sites that meet the appropriate prescriptive site criteria.
	Designer	Obtain certification/license to practice. Design treatment system that is compatible with the site and soil characteristics described by the site evaluator. Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	Hire a certified/licensed designer to prepare system design.
CONSTRUCTION	Regulatory Authority	Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. Perform final construction inspection for compliance assurance and inventory data collection. Require record drawings of constructed system be submitted to the Regulatory Authority by Owner.
	Contractor/ Installer	Obtain certification/license to practice. Construct system in accordance with the approved plans and specifications. Prepare record drawings of completed system and submit to Owner. Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	Approve proposed field changes and submit to Owner. Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Owner	Hire a certified/licensed contractor/installer to construct system. Submit final record drawings of constructed system to Regulatory Authority
OPERATION & MAINTENANCE	Regulatory Authority	Provide Owner/User with educational materials regarding system use and care. Send timely reminder to Owner of when scheduled preventive maintenance is due.
	Pumper/Hauler	Obtain certification/license to practice. Inspect and service system as necessary. Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Owner	Perform recommended routine maintenance or hire certified/licensed pumper/hauler to perform maintenance. Hire certified/licensed pumper/hauler periodically to inspect, service, and remove septage for proper treatment and disposal.
	User	Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure undesirable or prohibited materials are not discharged to system.
RESIDUALS MANAGEMENT	Regulatory Authority	Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257, and applicable state/tribal/local requirements. Inventory available residuals handling/treatment capacities and develop contingency plans to ensure sufficient capacities are always available.
	Pumper/Hauler	Obtain certification/license to practice. Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.
COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	Conduct final construction inspections to assure compliance with approved plans and permit requirements. Perform compliance inspections at point-of-sale, change-in-use of properties, "targeted areas" and/or systems reported to be in violation. Conduct compliance inspections of residuals hauling, treatment, and disposal.
	Pumper/Hauler	Inform Owner of any non-compliant items observed during routine servicing of system.
	Owner	Periodically perform a "walk-over" inspection of the system and correct any deficiencies.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
CORRECTIVE ACTIONS AND ENFORCEMENT	Regulatory Authority	Negotiate compliance schedule with Owner for correcting documented non-compliance items. Administer enforcement program including fines and/or penalties for failure to comply with compliance requirements. Obtain necessary authority to enter property to correct imminent treats to public health if the Owner/User fails to comply.
	Designer	Provide Owner with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective action.
	Contractor/ Installer	Perform required repairs/modifications/upgrades as necessary.
	Owner	Comply with terms and conditions of the negotiated compliance schedule. Submit required documents for corrective actions to Regulatory Authority. Hire appropriate certified/licensed Service Providers to perform required corrective actions.
RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, inspection reports) of all systems. Maintain residuals treatment and disposal tracking system. Maintain a current certified/licensed Service Provider listing that is available to the public.
	Pumper/Hauler	Prepare and submit records of residuals handling as required.
	Owner	Maintain approved record drawings of system. Maintain maintenance records of system. Provide drawings, specifications and maintenance records to new property owner at time of property transfer.
FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	Provide the legal and financial support to sustain the management program. Provide listing of financial assistance programs available to Owner and the qualifying criteria for each program. Consider implementing a state or local financing program to assist Owners in upgrading their systems.

MAGEMENT MODEL 2: MAINTENANCE CONTRACTS

***Objective:** To allow use of more complex mechanical treatment options or small clusters through the requirement that maintenance contracts be maintained between the Owner and maintenance provider to ensure appropriate and timely system component maintenance by qualified technicians over the service life of the system.*

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	Educate Owner/User on purpose, use, and care of treatment system. Provide public review and comment periods of any proposed program and/or rule changes.
	Service Provider	Be informed of existing rules and review and comment on any proposed program and/or rule changes. Participate in advisory committees established by the Regulatory Authority
	Owner/User	Be informed of purpose, use, and care of treatment system. Be informed of existing rules and review and comment on any proposed program and/or rule changes. Participate in advisory committees established by the Regulatory Authority.
PLANNING	Regulatory Authority	Coordinate program rules and regulations with state/tribal/ local planning and zoning and other water related programs. Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. Inform local planning authority of rule changes and recommend their evaluation of potential impacts on land use.
	Developer	Hire planners, certified site evaluators and designers to assure all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
PERFORMANCE REQUIREMENTS	Regulatory Authority	Establish system failure criteria to protect public health, e.g. wastewater backups in building, wastewater ponding on ground surface, insufficient separation from groundwater, wells, etc. Establish minimum performance requirements for manufactured component approvals. Establish minimum maintenance requirements for approved systems.
	Owner/User	Regularly maintain system in proper working order.
TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, operators, and haulers/pumpers. Maintain a current certified/licensed Service Provider listing.
	Service Provider	Obtain appropriate certification(s)/license(s) and continuing education as required. Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements and operation and maintenance procedures of any proprietary equipment to be installed. Comply with applicable federal, state, tribal, and local requirements
	Owner/User	When using third party services, contract only with the appropriate certified/licensed Service Providers.
SITE EVALUATION	Regulatory Authority	Codify prescriptive requirements for site evaluation procedures. Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground surface water resources. Establish alternative site acceptance criteria for approved systems providing enhanced pretreatment.
	Site Evaluator	Obtain certification/license to practice. Describe site and soil characteristics, determine suitability of site with respect to code requirements and estimate site's hydraulic and treatment capacity. Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	Hire a certified/licensed site evaluator to perform site evaluation.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
DESIGN	Regulatory Authority	Codify prescriptive, pre-engineered designs, which are suitable for treatment sites that meet the appropriate prescriptive site criteria. Administer an evaluation program for approving manufactured components for use with pre-engineered designs.
	Designer	Obtain certification/license to practice. Design treatment system that is compatible with the site and soil characteristics described by the site evaluator. Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	Hire a certified/licensed designer to prepare system design.
CONSTRUCTION	Regulatory Authority	Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. Perform final construction inspection for compliance assurance and inventory data collection. Require record drawings of constructed system be submitted to the Regulatory Authority by Owner. Require Owner to submit a copy of system O&M manual to the Regulatory Authority.
	Contractor/ Installer	Obtain certification/license to practice. Construct system in accordance with the approved plans and specifications. Prepare record drawings of completed system and submit to Owner. Provide Owner with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations. Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	Approve proposed field changes and submit to Owner. Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Owner	Hire a certified/licensed contractor/installer to construct system. Submit final record drawings of constructed system to Regulatory Authority Submit copy of system O&M manual to Regulatory Authority to record required maintenance.
OPERATION & MAINTENANCE	Regulatory Authority	Provide Owner/User with educational materials regarding system use and care. Send timely reminder to Owner when scheduled preventive maintenance is due. Administer a program that requires the Owner to attest periodically that he/she holds a valid contract with a certified/licensed operator to perform scheduled and any necessary maintenance according to the maintenance requirements described in submitted O&M manual. Require Owner to submit a maintenance report signed/sealed by certified/licensed operator immediately following scheduled maintenance.
	Operator	Obtain certification/license to practice. Inspect and service system as necessary in accordance with the submitted O&M manual. Certify to Owner that the required maintenance was performed in timely manner describing any system deficiencies observed. Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Pumper/ Hauler	Obtain certification/license to practice. Inspect and service system as necessary. Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Owner	Hire certified/licensed pumper/hauler periodically to inspect, service, and remove septage or other residuals for proper treatment and disposal. Maintain contractual agreement with a certified/licensed operator to perform scheduled maintenance as required. Inform Regulatory Authority of any change in maintenance contract status.
	User	Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure undesirable or prohibited materials are not discharged to system.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
RESIDUALS MANAGEMENT	Regulatory Authority	Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257, and applicable state/tribal/local requirements. Inventory available residuals handling/treatment capacities and develop contingency plans to ensure sufficient capacities are always available.
	Pumper/Hauler	Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.
COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	Conduct final construction inspections to assure compliance with approved plans and permit requirements. Perform compliance inspections at point-of-sale, change-in-use of properties, "targeted areas" and/or systems reported to be in violation. Conduct compliance inspections of residuals hauling, treatment, and disposal. Administer program for confirming Owners hold valid maintenance contracts with certified/licensed operators and for monitoring timely submittals of certified maintenance reports.
	Operator or Pumper/Hauler	Inform Owner of any non-compliant items observed during routine servicing of system.
	Owner	Periodically perform a "walk-over" inspection of the system and correct any deficiencies. Attest to the Regulatory Authority that a valid contract exists with a certified/licensed operator to perform necessary system maintenance. Submit a maintenance report signed/sealed by a certified/licensed Service Provider immediately following scheduled maintenance.
CORRECTIVE ACTIONS AND ENFORCEMENT	Regulatory Authority	Negotiate compliance schedule with Owner for correcting documented non-compliant items. Administer enforcement program including fines and/or penalties for failure to comply with compliance requirements. Obtain necessary authority to enter property to correct imminent treats to public health if the Owner/User fails to comply.
	Designer	Provide Owner with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective action.
	Contractor/ Installer	Perform required repairs/modifications/upgrades as necessary
	Owner	Comply with terms and conditions of the negotiated compliance schedule. Submit required documents for corrective actions to Regulatory Authority. Hire appropriate certified/licensed Service Providers to perform required corrective actions.
RECORD KEEPING, INVENTORY, & REPORTING	Regularity Authority	Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, inspection reports) of all systems. Maintain residuals treatment and disposal tracking system. Maintain a current certified/licensed Service Provider listing that is available to the public. Administer an Owner/Service Provider maintenance contract compliance and certified maintenance report tracking system. Record maintenance contract requirement on property deed. Administer a certified maintenance report tracking system.
	Operator	Provide certified report of all maintenance and observed system deficiencies to Owner.
	Pumper/Hauler	Prepare and submit records of residuals handling as required.
	Owner	Maintain approved record drawings and O&M manual of system. Maintain maintenance records of system. Provide drawings, specifications, O&M manual, and maintenance records to new property owner at time of property transfer.
FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	Provide the legal and financial support to sustain the management program. Provide listing of financial assistance programs available to Owner/User and the qualifying criteria for each program. Consider implementing a state or local financing program to assist Owners in upgrading their systems.

MANAGEMENT MODEL 3: OPERATING PERMITS

Objective: To issue renewable/revocable operating permits to system Owner that stipulate specific and measurable performance requirements for the treatment system and periodic submittals of compliance monitoring reports. The performance requirements are based on risks to public health and water resources posed by wastewater dispersal in the receiving environment. Operating permits allow the use of cluster or onsite systems on sites with a greater range of site characteristics.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	Educate Owner/User on purpose, use, and care of treatment system. Provide public review and comment periods of any proposed program and/or rule changes.
	Service Provider	Be informed of existing rules and review and comment on any proposed program and/or rule changes. Participate in advisory committees established by the Regulatory Authority
	Owner/User	Be informed of purpose, use, and care of treatment system. Be informed of existing rules and review and comment on any proposed program and/or rule changes. Participate in advisory committees established by the Regulatory Authority.
PLANNING	Regulatory Authority	Coordinate program rules and regulations with state/tribal/ local planning and zoning and other water related programs. Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. Inform local planning authority of rule changes and recommend their evaluation of potential impacts on land use.
	Developer	Hire planners, certified site evaluators and designers to assure all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
PERFORMANCE REQUIREMENTS	Regulatory Authority	Establish system failure criteria to protect public health, e.g. wastewater backups in building, wastewater ponding on ground surface, insufficient separation from groundwater, wells, etc. Establish minimum maintenance requirements for approved systems. Establish performance requirements necessary to protect public health and water resources for each defined receiving environment in the Regulatory Authority's jurisdiction.
	Owner/User	Operate and regularly maintain system in proper working order. Operate system to comply with performance requirements stipulated in the operating permit.
TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, operators, haulers/pumpers, and inspectors. Maintain a current certified/licensed Service Provider listing.
	Service Provider	Obtain appropriate certification(s)/license(s) and continuing education as required. Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements and operation and maintenance procedures of any proprietary equipment to be installed. Comply with applicable federal, state, tribal, and local requirements.
	Owner/User	When using third party services, contract only with the appropriate certified/licensed Service Providers.
SITE EVALUATION	Regulatory Authority	Codify prescriptive requirements for site evaluation procedures. Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources. Establish defining characteristics for each receiving environment in the Regulatory Authority's jurisdiction.
	Site Evaluator	Obtain certification/license to practice. Describe site and soil characteristics, determine suitability of site with respect to code requirements and estimate site's hydraulic and treatment capacity Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	Hire a certified/licensed site evaluator to perform site evaluation.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
DESIGN	Regulatory Authority	Codify prescriptive, pre-engineered designs, which are suitable for treatment sites that meet the appropriate prescriptive site criteria. Administer plan review program for engineered designs to meet stipulated performance requirements. Require routine operation and emergency contingency plans be submitted that will sustain system performance and avoid unpermitted discharges.
	Designer	Obtain certification/license to practice. Certified/licensed designer to design treatment system that is compatible with the site and soil characteristics described by the site evaluator. Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	Hire a certified/licensed designer to prepare system design.
CONSTRUCTION	Regulatory Authority	Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. Require designer of record to certify that completed system construction is in substantial compliance with approved plans and specifications. Require record drawings of constructed system be submitted to the Regulatory Authority by Owner. Require Owner to submit a copy of system O&M manual to the Regulatory Authority.
	Contractor/ Installer	Obtain certification/license to practice. Construct system in accordance with the approved plans and specifications. Prepare record drawings of completed system and submit to Owner. Provide Owner with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations. Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	Approve proposed field changes and submit to Owner. Designer of record to certify that construction of the system is substantially in conformance with the approved plans and specifications.
	Owner	Hire a certified/licensed contractor/installer to construct system. Submit final record drawings of constructed system to Regulatory Authority Submit copy of system O&M manual to Regulatory Authority to record required maintenance.
OPERATION & MAINTENANCE	Regulatory Authority	Provide Owner/User with educational materials regarding system use and care. Administer a program of renewable/revocable operating permits that are issued to Owner stipulating system performance requirements, compliance monitoring reporting schedule, term of permit, and renewal option upon documented compliance with permit. Track and review compliance monitoring reports for to ensure systems are operating in accordance with operating permits.
	Operator	Obtain certification/license to practice. Inspect and service system as necessary in accordance with the submitted O&M manual and/or operating permit stipulations. Certify to Owner that the required maintenance was performed in timely manner describing any system deficiencies observed. Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Pumper/Hauler	Obtain certification/license to practice. Inspect and service system as necessary. Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Owner	Hire a certified/licensed pumper/hauler or operator to maintain system. Maintain system in proper working order. Operate and maintain the system in accordance with O&M manual and/or operating permit stipulations. Submit compliance monitoring reports to the Regulatory Authority according to the schedule stipulated in the operating permit.
	User	Follow recommendations provided by Regulatory Authority, and/or Service Providers to ensure undesirable or prohibited materials are not discharged to system.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
RESIDUALS MANAGEMENT	Regulatory Authority	Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with *40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257,* and applicable state/tribal/local requirements. Inventory available residuals handling/treatment capacities and develop contingency plans to ensure sufficient capacities are always available.
	Pumper/Hauler	Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.
COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	Perform inspection programs at point-of-sale, change-in-use of properties, "targeted areas" and/or systems reported to be in violation. Conduct compliance inspections of residuals hauling, treatment, and disposal. Administer a program to monitor timely submittals of acceptable compliance maintenance reports. Notify Owner of impending scheduled submittals of compliance monitoring reports. Perform system inspections randomly and/or at time of operating permit renewal.
	Operator or Pumper/Haler	Inform Owner of any non-compliant items observed during routine servicing of system.
	Owner	Submit compliance monitoring reports to Regulatory Authority as stipulated in operating permit. Submit compliance inspection report signed/sealed by a certified/licensed inspector prior to applying for renewal of operating permit.
CORRECTIVE ACTIONS AND ENFORCEMENT	Regulatory Authority	Negotiate compliance schedule with Owner for correcting documented non-compliant items. Administer enforcement program including fines and/or penalties for failure to comply with compliance requirements Obtain necessary authority to enter property to correct imminent threats to public health if the Owner/User fails to comply. Require system inspection by certified inspector at time of operating permit renewal.
	Designer	Provide Owner with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective action.
	Contractor/ Installer	Perform required repairs/modifications/upgrades as necessary.
	Inspector	Obtain certification/license to practice. Inspect treatment system for compliance with operating permit prior to permit renewal.
	Owner	Comply with terms and conditions of the negotiated compliance schedule. Submit required documents for corrective actions to Regulatory Authority. Hire appropriate certified/licensed Service Providers to perform required corrective actions.
RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, and inspection reports) of all systems. Maintain residuals treatment and disposal tracking system. Maintain a current certified/licensed Service Provider listing that is available to the public. Administer a tracking system for operating permits. Administer a tracking database for compliance reports.
	Operator or Inspector	Provide certified report of all maintenance and observed system deficiencies to Owner. Perform system monitoring as stipulated in Owner's operating permit.
	Pumper/Hauler	Prepare and submit records of residuals handling as required.
	Owner	Maintain approved record drawings and O&M manual of system. Maintain maintenance records of system. Submit compliance monitoring reports to Regulatory Authority. Provide drawings, specifications, O&M manual, and maintenance records to new property owner at time of property transfer.
FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	Provide the legal and financial support to sustain the management program. Provide listing of financial assistance programs available to Owner/User and the qualifying criteria for each program. Consider implementing a state or local financing program to assist Owners in upgrading their systems.

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

***Objective:** To ensure that onsite/decentralized systems consistently meet their stipulated performance requirements through Responsible Management Entities that are responsible for operation and performance of systems within their service areas.*

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	Educate Owner/User on purpose, use, and care of treatment system. Hold public meetings to inform the public of any proposed program and/or rule changes.
	Service Provider	Be informed of existing rules and review and comment on any proposed program and/or rule changes. Participate in advisory committees established by the Regulatory Authority.
	Owner/User	Be informed of purpose, use, and care of treatment system. Be informed of existing rules and review and comment on any proposed program and/or rule changes. Participate in advisory committees established by the Regulatory Authority.
	RME	Inform Owner/User of care and use of system. Inform Owner/User of RME requirements and prohibited uses of system.
PLANNING	Regulatory Authority	Coordinate program rules and regulations with state/tribal/ local planning and zoning and other water related programs. Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. Inform local planning authority of rule changes and recommend their evaluation of potential impacts on land use.
	Developer	Hire planners, certified site evaluators and designers to assure all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
	RME	Develop criteria (e.g. site evaluation, design, construction) to be required of systems for acceptance into O&M program and inform Owners. Continuously evaluate existing wastewater treatment needs and forecast future needs.
PERFORMANCE REQUIREMENTS	Regulatory Authority	Establish system failure criteria to protect public health, e.g. wastewater backups in building, wastewater ponding on ground surface, insufficient separation from groundwater, wells, etc. Establish minimum maintenance requirements for approved systems. Establish performance requirements necessary to protect public health and water resources for each defined receiving environment in the Regulatory Authority's jurisdiction.
	Owner	Regularly maintain system components in proper working order. Comply with any RME requirements regarding care and use of system.
	RME	Operate systems to comply with performance requirements stipulated in the operating permits.
TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, operators, haulers/pumpers, and inspectors. Maintain a current certified/licensed Service Provider listing.
	Service Provider	Obtain appropriate certification(s)/license(s) and continuing education as required. Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements and operation and maintenance procedures of any proprietary equipment to be installed. Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	When using third party services, contract only with the appropriate certified/licensed Service Providers.
	RME	When using third party services, contract only with the appropriate certified/licensed Service Providers RME staff who operate, and/or maintain systems must obtain appropriate certification(s)/license(s) to practice. Arrange for supplemental training as needed for Service Providers and/or staff to manage, operate, and/or maintain systems.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
SITE EVALUATION	Regulatory Authority	Codify prescriptive requirements for site evaluation procedures. Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources. Establish the defining characteristics of each receiving environment in the Regulatory Authority's jurisdiction. Approve and oversee site evaluation procedures required by RME for system acceptance in the O&M program to ensure system designs are appropriate for the sites and their stipulated performance requirements.
	Site Evaluator	Obtain certification/license to practice. Describe site and soil characteristics, determine suitability of site with respect to code requirements and estimate site's hydraulic and treatment capacity. Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	Hire a certified/licensed site evaluator to perform site evaluation. Comply with any additional siting requirements established by RME for system acceptance in the O&M program.
DESIGN	Regulatory Authority	Codify prescriptive, pre-engineered designs, which are suitable for treatment sites that meet the appropriate prescriptive site criteria. Administer plan review program for engineered designs to meet stipulated performance requirements. Require routine operation and emergency contingency plans that will sustain system performance and avoid unpermitted discharges be submitted.
	Designer	Obtain certification/license to practice. Design treatment system that is compatible with the site and soil characteristics described by the site evaluator. Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	Hire a certified/licensed designer to prepare system design. Comply with any additional design requirements established by the RME for system acceptance in the O&M program.
CONSTRUCTION	Regulatory Authority	Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. Require designer of record to certify that completed system construction is in substantial compliance with approved plans and specifications. Require record drawings of constructed system be submitted to the Regulatory Authority by Owner. Require Owner to submit a copy of system O&M manual to the Regulatory Authority and RME.
	Contractor/ Installer	Obtain certification/license to practice. Construct system in accordance with the approved plans and specifications. Prepare record drawings of completed system and submit to Owner. Provide Owner with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations. Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	Approve proposed field changes and submit to Owner. Certify that construction of the system is substantially in conformance with the approved plans and specifications.
	Owner	Comply with any additional construction requirements established by the RME for system acceptance in the O&M program. Hire a certified/licensed designer to prepare system design. Submit final record drawings of constructed system to Regulatory Authority Submit copy of system O&M manual to Regulatory Authority and RME to record required maintenance.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
OPERATION & MAINTENANCE	Regulatory Authority	Provide Owner/User with educational materials regarding system use and care. Administer a program of renewable/revocable operating permits that are issued to RME, stipulating system performance requirements, compliance monitoring reporting schedule, term of permit, and renewal option upon documented compliance with operating permit stipulations. Track and review compliance monitoring reports for to ensure systems are operating in accordance with operating permits. Consider replacing individual system operating permits with general permits issued to the RME for classes of systems.
	Operator	Inspect and service system as necessary in accordance with the submitted O&M manual and/or operating permit stipulations. Perform system monitoring as stipulated in RME's operating permit. Certify to RME that the required maintenance and monitoring was performed timely and noting any system deficiencies. Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Pumper/Hauler	Obtain certification/license to practice. Inspect and service system as necessary. Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Owner/User	Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure undesirable or prohibited materials are not discharged to system. Maintain system components in proper working order. Comply with any RME requirements regarding care and use of system.
	RME	Operate and maintain systems in accordance with the stipulated operating permit requirements. Submit compliance monitoring reports to the Regulatory Authority according to the schedule stipulated in the operating permit. Hire a certified/licensed pumper/hauler or operator to maintain system.
RESIDUALS MANAGEMENT	Regulatory Authority	Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with *40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257*, and applicable state/tribal/local requirements. Inventory available residuals handling/treatment capacities and develop contingency plans to ensure sufficient capacities are always available.
	Pumper/Hauler	Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of wastewater treatment system residuals.
	RME	Hire a certified/licensed pumper/hauler to remove, treat, and dispose of residuals. Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals. Inventory available residuals handling/treatment capacities and develop contingency plans when insufficient capacities are available.
COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	Perform inspection programs at point-of-sale, change-in-use of properties, "targeted areas" and/or systems reported to be in violation. Conduct compliance inspections of residuals hauling, treatment, and disposal. Administer a program to monitoring timely submittals of acceptable compliance maintenance reports. Perform system inspections randomly and/or at time of operating permit renewal.
	Inspector	Obtain certification/license to practice. Perform system compliance inspections for RME in accordance with prevailing Regulatory Authority requirements.
	RME	Submit compliance monitoring reports to Regulatory Authority as stipulated in operating permit. Submit compliance inspection report signed/sealed by a certified/licensed inspector prior to applying for renewal of operating permit. Conduct regular reviews of management program with Owner/User and Regulatory Authority to optimize system operation program. Hire a certified/licensed inspector to inspect system compliance status.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
CORRECTIVE ACTIONS AND ENFORCEMENT	Regulatory Authority	Negotiate compliance schedules with RME for correcting documented non-compliance items. Administer enforcement program including fines and/or penalties for failure to comply with compliance requirements. Obtain necessary authority to enter property to correct imminent threats to public health if the Owner/User fails to comply. Require system inspection by certified inspector at time of operating permit renewal. Negotiate compliance schedules with RME, Owner/User, or both for correcting documented non-compliance items.
	Designer	Provide Owner/RME with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective actions.
	Contractor/ Installer	Perform required repairs/modifications/upgrades as necessary.
	Inspector	Inspect treatment system for compliance with operating permit prior to permit renewal.
	Owner	Comply with terms and conditions of the negotiated compliance schedule for component replacement/repairs. Submit required documents for corrective actions to Regulatory Authority. Hire appropriate certified/licensed Service Providers to perform required corrective actions.
	RME	Comply with terms and conditions of the negotiated compliance schedule for system performance.
RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, and inspection reports) of all systems. Maintain residuals treatment and disposal tracking system. Maintain a current certified/licensed Service Provider listing that is available to the public. Administer a tracking system for operating permits. Administer a tracking database for compliance reports. Administer periodic financial, management, and technical audits of RME.
	Operator or Inspector	Provide certified report of all maintenance and observed system deficiencies to RME. Provide certified report of all observed system deficiencies to Owner Perform system monitoring as stipulated in RME's operating permit.
	Pumper/Hauler	Prepare and submit records of residuals handling as required.
	Owner	Maintain approved record drawings and O&M manual of system. Maintain maintenance records of system. Provide drawings, specifications, O&M manual, and maintenance records to new property owner at time of property transfer.
	RME	Maintain system monitoring and service records. Inventory, collect, and provide permit information to Regulatory Authority.
FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	Provide the legal and financial support to sustain the management program. Provide listing of financial assistance programs available to Owner/User and the qualifying criteria for each program. Consider implementing a state or local financing program to assist Owners in upgrading their systems.
	RME	Conduct regular reviews of management program with Owner/User and Regulatory Authority to optimize operations.

MANAGEMENT MODEL 5: RME OWNERSHIP

Objective: To provide professional management of the planning, siting, design, construction, operation, and maintenance of onsite/decentralized systems through Responsible Management Entities that own and manage individual and cluster systems within its service area.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	Educate Owner/User on purpose, use, and care of treatment system. Provide public review and comment periods of any proposed program and/or rule changes.
	Service Provider	Be informed of existing rules and review and comment on any proposed program and/or rule changes. Participate in advisory committees established by the Regulatory Authority.
	RME	Inform User of care and use of system. Inform User of RME requirements and prohibited uses of system.
	User	Be informed of purpose, use, and care of treatment system.
PLANNING	Regulatory Authority	Coordinate program rules and regulations with state/tribal/ local planning and zoning and other water related programs. Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. Inform local planning authority of rule changes and recommend their evaluation of potential impacts on land use.
	Developer	Hire planners, certified site evaluators and designers to assure all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
	RME	Continuously evaluate existing wastewater treatment needs and forecast future needs. Require developers to submit proposed subdivision plats to RME for review and comment to ensure compatibility with RME requirements. Plan most cost-effective approach to meeting treatment needs through appropriate mix of central sewerage, clusters, and individual onsite systems.
PERFORMANCE REQUIREMENTS	Regulatory Authority	Establish system failure criteria to protect public health, e.g. wastewater backups in building, wastewater ponding on ground surface, insufficient separation from groundwater, wells, etc. Establish minimum maintenance requirements for approved systems. Establish performance requirements necessary to protect public health and water resources for each defined receiving environment in the Regulatory Authority's jurisdiction.
	RME	Operate, maintain, and repair systems to comply with performance requirements stipulated in the operating permits.
	User	Comply with any RME requirements regarding care and use of system.
TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, haulers/pumpers, inspectors, and operators. Maintain a current certified/licensed Service Provider listing.
	Service Provider	Obtain appropriate certification(s)/license(s) and continuing education as required. Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements and operation and maintenance procedures of any proprietary equipment to be installed. Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	RME	When using third party services, contract only with certified/licensed Service Providers RME staff who site, design, construct, operate, and/or maintain systems must obtain appropriate certification(s)/license(s) to practice. Arrange for supplemental training as needed for Service Providers and/or staff to manage, operate, and/or maintain systems.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
SITE EVALUATION	Regulatory Authority	Codify prescriptive requirements for site evaluation procedures. Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground surface water resources. Establish the defining characteristics of each receiving environment in the Regulatory Authority's jurisdiction. Approve and oversee site evaluation procedures used by RME to ensure system designs are appropriate for the sites and their stipulated performance requirements.
	Site Evaluator	Obtain certification/license to practice. Describe site and soil characteristics, determine suitability of site with respect to code requirements and estimate site's hydraulic and treatment capacity Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	RME	Hire a certified/licensed site evaluator to perform site evaluation.
DESIGN	Regulatory Authority	Codify prescriptive, pre-engineered designs, which are suitable for treatment sites that meet the appropriate prescriptive site criteria. Administer plan review program for engineered designs to meet stipulated performance requirements. Require routine operation and emergency contingency plans that will sustain system performance and avoid unpermitted discharges be submitted.
	Design	Obtain certification/license to practice. Certified/licensed designer to design treatment system that is compatible with the site and soil characteristics described by the site evaluator. Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	RME	Hire a certified/licensed designer to prepare system design.
CONSTRUCTION	Regulatory Design	Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. Require designer of record to certify that completed system construction is in substantial compliance with approved plans and specifications. Require record drawings of constructed system be submitted to the Regulatory Authority by RME.
	Contractor/ Installer	Obtain certification/license to practice. Construct system in accordance with the approved plans and specifications. Prepare record drawings of completed system and submit to RME. Provide RME with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations. Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	Approve proposed field changes and submit to RME. Certify that construction of the system is substantially in conformance with the approved plans and specifications.
	RME	Hire a certified/licensed designer to prepare system design. Submit final record drawings of constructed system to Regulatory Authority Submit copy of system O&M manual to Regulatory Authority to record required maintenance.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
OPERATION & MAINTENANCE	Regulatory Authority	Provide User with educational materials regarding system use and care. Administer a program of renewable/revocable operating permits that are issued to RME which stipulate system performance requirements, compliance monitoring reporting schedule, term of permit and renewal option upon documented compliance with operating permit stipulations. Track and review compliance monitoring reports for to ensure systems are operating in accordance with operating permits. Consider replacing individual system operating permits with general permits issued to the RME for classes of systems.
	Operator	Inspect and service system as necessary in accordance with the submitted O&M manual and/or operating permit stipulations. Perform system monitoring as stipulated in RME's operating permit. Certify to RME that the required maintenance and monitoring was performed timely and noting any system deficiencies. Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Pumper/Hauler	Obtain certification/license to practice. Inspect and service system as necessary. Comply with applicable federal, state tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	User	Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure undesirable or prohibited materials are not discharged to system. Comply with any RME requirements regarding care and use of system.
	RME	Operate and maintain systems in accordance with the stipulated operating permit requirements. Submit compliance monitoring reports to the Regulatory Authority according to the schedule stipulated in the operating permit. Hire certified/licensed pumper/hauler or operator to maintain system.
RESIDUALS MANAGEMENT	Regulatory Authority	Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257, and applicable state/tribal/local requirements. Inventory available residuals handling/treatment capacities and develop contingency plans when insufficient capacities are available.
	Pumper/ Hauler	Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of wastewater treatment system residuals.
	RME	Hire a certified/licensed pumper/hauler to remove, treat, and dispose of residuals. Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals. Inventory available residuals handling/treatment capacities and develop contingency plans when insufficient capacities are available.
COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	Perform inspection programs at point-of-sale, change-in-use of properties, "targeted areas" and/or systems reported to be in violation. Conduct compliance inspections of residuals hauling, treatment, and disposal. Administer a program to monitoring timely submittals of acceptable compliance maintenance reports. Perform system inspections randomly and/or at time of operating permit renewal.
	Inspector	Obtain certification/license to practice. Perform system compliance inspections for RME in accordance with prevailing Regulatory Authority requirements.
	RME	Submit compliance monitoring reports to Regulatory Authority as stipulated in operating permit. Submit compliance inspection report signed/sealed by a certified/licensed inspector prior to applying for renewal of operating permit. Conduct regular reviews of management program with Regulatory Authority to optimize system operation program. Hire a certified/licensed inspector to inspect system compliance status.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
CORRECTIVE ACTIONS AND ENFORCEMENT	Regulatory Authority	Negotiate compliance schedules with RME for correcting documented non-compliance items. Administer enforcement program including fines and/or penalties for failure to comply with compliance requirements. Require system inspection by certified inspector at time of operating permit renewal. Negotiate compliance schedules with RME for correcting documented non-compliance items.
	Designer	Provide RME with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective action.
	Contractor/ Installer	Perform required repairs/modifications/upgrades as necessary.
	Inspector	Inspect treatment system for compliance with operating permit prior to permit renewal.
	RME	Comply with terms and conditions of the negotiated compliance schedule. Submit required documents for corrective actions to Regulatory Authority. Hire appropriate certified/licensed Service Providers to perform required corrective actions.
RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	Administer a database inventory (locations, site evaluations, record drawings, permits, and inspection reports) of all systems within the Regulatory Authority's jurisdiction. Maintain residuals treatment and disposal tracking system. Maintain a current certified/licensed Service Provider listing that is available to the RMEs. Administer a tracking system for operating permits. Administer a tracking database for compliance reports. Administer financial, management, and technical audits of RME.
	Operator or Inspector	Provide certified report of all maintenance and observed system deficiencies to RME. Provide certified report of all observed system deficiencies to Owner Perform system monitoring as stipulated in RME's operating permit.
	Pumper/Hauler	Prepare and submit records of residuals handling as required.
	RME	Maintain system monitoring and service records. Inventory, collect, and provide permit information to Regulatory Authority.
FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	Provide the legal and financial support to sustain the regulatory program. Provide listing of financial assistance programs available to RME and the qualifying criteria for each program. Consider implementing a state or local financing program to assist RME in upgrading systems.
	RME	Conduct regular reviews of management program with Regulatory Authority to optimize operations.

Hennepin County, MN

ORDINANCE NUMBER 19

INDIVIDUAL SEWAGE TREATMENT SYSTEMS STANDARDS

FOR HENNEPIN COUNTY

Adopted by the Hennepin County Board of Commissioners
of Hennepin County, Minnesota
on September 28, 1999

IN ACCORDANCE WITH MINNESOTA STATUTES ss115.55 and

MINNESOTA RULES CHAPTER 7080 ORDINANCE No. 19

INDIVIDUAL SEWAGE TREATMENT SYSTEMS STANDARDS

The Hennepin County Board of Commissioners does hereby adopt this Ordinance establishing county-wide standards for the regulation of Individual Sewage Treatment Systems (ISTS) pursuant to Minn. Stat. § 115.55 and Minn. Rules Chapter 7080.

SUBDIVISION 1: GENERAL PROVISIONS.

1.1 Purpose. This ordinance is enacted to provide minimum standards for the regulation of individual sewage treatment systems (ISTS) including: their proper location, design and construction; their necessary modification and reconstruction; their operation, maintenance and repair for the purpose of protecting surface water and groundwater from contamination by human sewage and waterborne household and commercial wastes; the protection of the public's health and safety; and the elimination and prevention of the development of public nuisances, pursuant to the authority granted under Minn. Stat. Chapters 115 and 145A and Minnesota Rules Chapter 7080 and as amended that may pertain to sewage and wastewater treatment.

1.2 Objectives. The principal objectives of this Ordinance are as follows:

1.21 The protection of Hennepin County's lakes, rivers and streams, wetlands, and groundwater essential to the promotion of public health, safety, welfare, socioeconomic growth and development of the County in perpetuity.

1.22 The regulation of proper ISTS construction, reconstruction, repair and maintenance to prevent the entry and migration of contaminants, thereby ensuring the non-degradation of surface water and groundwater.

1.23 The establishment of minimum standards for ISTS placement, design, construction, reconstruction, repair and maintenance to prevent contamination and, if contamination is discovered, the identification and control of its consequences and the abatement of its source and migration.

1.25 The appropriate utilization of privy vaults and other non-water carried ISTS.

1.26 The prevention and control of water-borne disease, lake degradation, groundwater related hazards, and public nuisance conditions through technical assistance and education, plan reviews, inspections, ISTS surveys and complaint investigation.

SUBDIVISION 2: DEFINITIONS.

2.1 Health Authority. The Hennepin County Community Health Department and its designated agent who shall be a qualified employee or licensee.

2.2 Owner. The fee owner(s) and, if applicable, the contract-for-deed purchaser. Ownership interests shall be determined by reference to the records of Hennepin County. The owner of each lot upon served by an ISTS is responsible for the lawful operation and maintenance of each ISTS.

SUBDIVISION 3: STANDARDS ADOPTED BY REFERENCE

3.1 This Ordinance hereby adopts by reference Minnesota Rules Chapter 7080, sections 7080.0020, 7080.0060, 7080.0065, 7080.0110, 7080.0120, 7080.0125, 7080.0130, 7080.0150, 7080.0160, 7080.0170, 7080.0175, 7080.0176, and 7080.0190 being the sections containing the technical standards and criteria contained in the "Individual Sewage Treatment Systems Program".

SUBDIVISION 4: JURISDICTION.

4.1 Municipalities. Municipalities in Hennepin County that elect to regulate Individual Sewage Treatment Systems pursuant to Minn. Rules Chapter 7080.0300 – 0305 shall:

A. Provide verification to the Health Authority of its intention to assume or retain jurisdiction of Individual Sewage Treatment Systems by submitting a resolution of the City Council or authorized governmental official to that effect prior to January 1, 1999 or within 90 days of County adoption, whichever comes later.

B. Provide timely notification to the Health Authority of its intent to assume or abandon its jurisdiction but in no case provide less than one years' notice of such action or at a time mutually acceptable to both parties.

C. In the event of abandonment of jurisdiction, agree to cooperate with the Health Authority in the transfer of responsibility including timely transfer of all records maintained by the municipality.

SUBDIVISION 5: ADMINISTRATION BY THE HEALTH AUTHORITY.

5.1 The Health Authority shall have the following duties and responsibilities:

A. To review all applications for ISTS.

B. To issue all required permits.

C. To conduct construction inspections and to perform all necessary tests to determine its conformance with this Ordinance.

D. To investigate complaints regarding ISTS.

E. To perform compliance inspections and to issue Certificates of Compliance or Notices of Noncompliance where appropriate.

F. To issue Stop Work Orders and Notices of Violation pursuant to this Ordinance.

G. To take complaints to the Municipal or County Attorney for violations of this Ordinance.

H. To maintain proper records for ISTS including site evaluation records, design records including calculations and summaries for all system component sizings and as-builts, complaints on noncompliance, compliance inspections, site evaluations, applications and exhibits, variance requests, issued permits, Certificates of Compliance, and enforcement proceedings.

I. To submit annual reports to the MPCA to demonstrate enforcement of this Ordinance per Chapter 7080.0310.

5.2 Neither the issuance of permits, Certificates of Compliance nor Notices of Noncompliance as requested or issued shall be construed to represent a guarantee or warranty of the system's operation or effectiveness. Such certificates signify that the system in question is or has been designed and installed in compliance or non-compliance with the provision of these standards and regulations.

SUBDIVISION 6: PERMITTING.

6.1 Required Permits. A permit from the Health Authority is required before any ISTS in Hennepin County's jurisdiction is installed, replaced, altered, repaired or extended. Installation, replacement, alteration, repair, or extension of an ISTS shall not begin prior to the receipt of a permit from the Health Authority for each specific installation, replacement, alteration, repair or extension pursuant to this Ordinance. Such permits are not transferable as to person or place. Such permits shall expire 12 months after date of issuance. Upon request of an inspector, permits shall be provided by the permitee at the time of inspection.

6.2 Permits Not Required. Permits shall not be required for the following activities:

A. Repair or replacement of pumps, floats or other electrical devices of the pump.

B. Repair or replacement of baffles in the septic tank.

C. Installation or repair of inspection pipes and manhole covers.

D. Repair or replacement of the line from the building to the septic tank.

6.4 Permit Application. All applications for an ISTS permit shall include the following information:

A. Name and address of property owner.

B. Property identification number.

C. Legal description of the property.

D. ISTS Designer Name, address, phone number and State ISTS License number; (or Health Authority qualified employee name and number).

E. ISTS Installer name, address, phone number and ISTS License Number.

F. Site evaluation report on forms approved by the Health Authority.

G. System design with full information including applicable construction information on forms approved by the Health Authority.

H. The location of at least one designated additional soil treatment area that can support a standard soil treatment system on lots created after January 23, 1996.

I. Any other information requested pertinent to the process.

J. A certified statement from the person who conducted the work.

6.5 Individuals Constructing Their Own ISTS. A license is not required for an individual who is constructing a system on land that is owned or leased by the individual and functions solely as a dwelling or seasonal dwelling for that individual. The ISTS shall be designed by a Minnesota Pollution Control Agency licensed Designer I or II.

6.6 Application Review and Determination. If after consideration of the application for a permit, the Health Authority determines that the work proposed conforms to and complies with provision of this Ordinance, the Health Authority shall issue a written permit granting preliminary approval authorizing initiation of the work as proposed. If the Health Authority determines that the work proposed will not conform to or comply with the provisions of this Ordinance, the Health Authority shall deny the permit application. The permit application may be revised or corrected and resubmitted to the Health Authority for reconsideration.

6.7 Variances. Variances to decrease the three feet of vertical separation required beneath the distribution medium and the saturated soil or bedrock must be approved by the MPCA as per the procedures contained in Minnesota Rules Chapter 7080.0305 Subp. 3. Variances to wells and water supply lines require approval from the Minnesota Department of Health. Any other requests for a variance from this ordinance shall be requested in writing to the Health Authority on forms approved by the Health Authority.

SUBDIVISION 7: CONSTRUCTION INSPECTIONS.

7.1 Requirements. Compliance inspections shall be conducted by the Health Authority anytime an ISTS is installed, replaced, altered, repaired or extended. The installation and construction of the ISTS shall be in accordance with the permit requirements and application design. If any ISTS component is covered before being inspected by the Health Authority, it shall be uncovered if so ordered by the Health Authority. Proposals to alter the permitted construction shall be reviewed and the proposed change accepted by the Health Authority prior to construction. Inspections shall be conducted at least once during the construction of the ISTS to assure that the system has been constructed per the submitted and approved design.

7.2 Inspector. Compliance inspections for construction, replacement, alteration or repair work on ISTS shall be conducted by the Health Authority.

7.3 Request for Inspection. It shall be the duty of the permitee to notify the Health Authority of the date and time the inspection is requested at least 24 hours (excluding weekend days and holidays) preceding the requested inspection. If the permitee provides proper notice as described above and the Health Authority does not appear for an inspection within two hours after the time scheduled, the permitee may complete the installation and submit an As-built for the system.

7.4 Access to Premises and Records. Upon the request of the Health Authority, the applicant, owner, permitee or any other person shall allow access at any reasonable time to the affected premises as well as any related records, for the purposes of regulating and enforcing this Ordinance. If entry is refused, the Health Authority shall have the recourse to the remedies provided by law to secure entry. No person shall hinder or otherwise interfere with the Health Authority in the performance of their duties and responsibilities pursuant to the enforcement of this Ordinance. Refusal to allow reasonable access to the Health Authority shall be deemed a separate and distinct offense, whether or not any other specific violations are cited.

7.5 Stop Work Orders. Whenever any ISTS work is being done contrary to the provisions of this Ordinance, the Health Authority may order the work stopped by verbal or written notice personally served upon the installer or the owner of the land. All installation and construction shall cease and desist until subsequent authorization to proceed is received from the Health Authority.

7.6 As-builts. As-builts shall be submitted to the Health Authority within five (5) working days of completion of the work on the ISTS on forms provided or approved by the Health Authority. The As-built shall include photographs of the system prior to covering and a certified statement that the work was installed in accordance with submitted design and permit conditions and that it was free from defects. If an As-built is not submitted, the Health Authority may require the uncovering of the system for inspection.

7.7 Inspection Reports. A Certificate of Compliance or Notice of Noncompliance shall be prepared by the Health Authority following an inspection or review of As-builts submitted in accordance with Section 7.6. A Certificate of Compliance or Notice of Noncompliance shall include a signed statement by the inspector identifying the type of ISTS inspected and whether the system is in compliance with Minnesota Rules Chapter 7080.0060. A copy of the Certificate of Compliance or Notice of Noncompliance shall be provided to the property owner within 30 days of the compliance inspection and a copy kept on file with the Health Authority.

7.71 Certificates of Compliance issued by the Health Authority for new construction and replacement shall be valid for five (5) years from the date of the compliance inspection or As-built certification unless the Health Authority or licensed inspector identifies the system as an Imminent Public Health Threat.

7.72 Notices of Violation may be issued with Notices of Noncompliance when the Health Authority determines that new construction, replacement or repairs are not in compliance with this Ordinance.

SUBDIVISION 8: EXISTING SYSTEMS.

8.1 Requirements. The Health Authority shall require a compliance inspection of an existing system whenever:

A. In designated Shore land Management Areas, an application for any type of building or land use permits is made.

B. If the Health Authority deems a compliance inspection may be necessary, including, but not limited to, the receipt of information of a potential ISTS failure.

C. An additional bedroom on the property is requested. If a request for an additional bedroom is received between November 1 and April 30, the governing municipality may issue a building permit immediately with the contingent requirement that a compliance inspection of the existing ISTS shall be completed by the following June 1.

8.2 Inspector. Only the Health Authority or licensed Designer I or Inspector, shall conduct an inspection when a compliance inspection is required for an existing ISTS.

8.3 Existing Systems in Compliance with the Two-foot Rule. An existing system shall be considered in compliance with the technical standards of MN Rules 7080 and need not be upgraded if the following conditions exist:

A. The system is not an Imminent Public Health Threat.

B. The system has at least two feet of vertical separation between the bottom of the distribution medium and seasonally saturated soil as indicated by mottling or other indicators.

C. The system is not in a Shore land Designated Area.

D. The system is not in a wellhead protection area.

E. The system is not serving a food/beverage/lodging facility.

8.4 Inspection Reports. A copy of the Certificate of Compliance or Notice of Noncompliance resulting from a compliance inspection shall be provided to the property owner and the Health Authority within 30 days of inspection.

8.41 Certificates of Compliance issued by a licensed ISTS Inspector for an existing system shall be valid for three (3) years from the date of the compliance inspection unless the Health Authority or licensed inspector identifies the system as an Imminent Public Health Threat.

8.42 A Notice of Noncompliance shall be issued in the following circumstances and the conditions noted in violation of this Ordinance shall be remedied as follows:

A. An ISTS determined to be failing shall be upgraded, replaced, or repaired in accord with Minnesota Rules Chapter 7080.0060, within three (3) years, or its use is discontinued. The Health Authority, at its discretion, may grant an extension of an additional two (2) years.

B. An ISTS posing an imminent threat to public health or safety shall be upgraded, replaced or repaired within 10 months. The Health Authority will give consideration to weather conditions in determining compliance dates. If an ISTS is determined to be a public health nuisance by the Health Authority, the Health Authority may order the owner of the ISTS to cease use immediately and not allow use of the ISTS until it is corrected in accordance with the recommendations of the Health Authority.

SUBDIVISION 9: VIOLATIONS.

9.1 Cause to Issue a Notice of Violation. Noncompliance with this Ordinance by an applicant, permitee, installer or other person, as determined by the Health Authority, shall constitute a violation.

9.2 Serving a Notice of Violation. The Health Authority shall serve in person or by mail a Notice of Violation upon any person determined to be not in compliance with this Ordinance.

9.3 Contents of a Notice of Violation. A Notice of Violation shall contain the following:

A. A statement documenting the findings of fact determined through inspections, reinspection or investigation.

B. A list of specific violation or violations of this Ordinance.

C. The specific requirements for correction or removal of the specified violation(s).

D. A mandatory time schedule for correction, removal and compliance with this Ordinance.

9.4 Notification of MPCA. The Health Authority shall in accordance with state law notify the MPCA of any inspection, installation, design, construction, alteration or repair of an ISTS by a licensed person or any pumping by a licensed pumper done in violation of the provisions of this Ordinance.

SUBDIVISION 10: ADDITIONAL STANDARDS FOR HEALTH AND ENVIRONMENTAL PROTECTION.

10.1 Siting of an ISTS. Notwithstanding any state or federal requirements, the separation distance from an ISTS to a Type 3, 4, 5 or 6 wetland shall be no less than fifty (50) feet.

10.2 Alternative and Experimental Systems.

10.21 Alternative and experimental systems are allowed only in areas where the Health Authority has determined that a standard system cannot be installed or is not the most suitable treatment.

10.22 Any required monitoring plan for an alternative ISTS is the responsibility of the ISTS Designer. The monitoring plan shall provide information as to:

A. The specific modification to a standard system.

B. The type and parameters for monitoring which shall be conducted to assure that the change will protect public health and the environment, including the monitoring time period and the person responsible for conducting the monitoring and reporting.

C. A mitigation plan detailing what will be done if the system fails to meet the expectations established by the monitoring plan requirements.

10.23 The results of the monitoring of an alternative ISTS shall be submitted in accordance with the approved monitoring plan to the Health Authority.

10.3 Warranted Systems. Warranted systems, as discussed in Minn. Stat., Chapter 115.55, subd. 8, are prohibited.

10.4 Maintenance Report. The owner of an ISTS or an owner's agent who measures or removes accumulations in accord with Minn. Rules 7080.0175B shall submit records to the Health Authority of all pumping activities and recording fees.

SUBDIVISION 11: ENFORCEMENT.

11.1 Any person, firm, corporation or other entity who violates any of the provisions of this Ordinance or who makes any false statement on a Certificate of Compliance, shall be guilty of a misdemeanor, punishable by imprisonment or a fine or both, as defined by law. Each day in violation may constitute a separate violation.

11.2 In the event of a violation of this Ordinance, in addition to other remedies, the County or Municipal Attorney may institute appropriate actions or proceedings to prevent, restrain, correct or abate such violations.

SUBDIVISION 12: FEES. The Hennepin County Board shall from time to time establish fees for activities undertaken by the Health Authority pursuant to this Ordinance. Fees shall be due and payable at a time and in a manner to be determined by the Health Authority.

SUBDIVISION 13: SEVERABILITY. If a provision or application of this Ordinance is held invalid, that invalidity shall not affect other provisions or applications of this Ordinance.

SUBDIVISION 14: EFFECTIVE DATE. This ordinance shall take effect January 1, 2000.

This ordinance was current as of the date stated below. To be certain that it has not been amended since published here, please contact the Hennepin County Community Health Department, 525 Portland Av., Minneapolis, Minnesota 55415; phone (612)348-3925; fax (612)348-3830; e-mail Community.Health@co.hennepin.mn.us

Appendix E: Sample ordinances

WASHTENAW COUNTY

Department of Environment & Infrastructure Services
Environmental Health Division

Regulation For the Inspection of Residential Onsite Water and Sewage Disposal Systems At Time of Property Transfer

ARTICLE I

Purpose

Sec. 1:1 The Washtenaw County Board of Commissioners adopts this Regulation that states the procedures, standards and enforcement that shall be used by the Washtenaw County Environmental Health Division ("Division"), under the authority of the Washtenaw County Health Officer, to manage any residential premises containing an Onsite Water and Sewage Disposal System, ("OWSDS") in order to promote the safety, health and general welfare of the community as follows:

- Ensure a safe and adequate supply of drinking water for those homes served by an Onsite Water Supply System ("OWSS"); and
- Ensure the adequate disposal of sewage from homes served by an Onsite Sewage Disposal System ("OSDS"); and
- It is not the intention of this regulation to cause existing systems that are currently functioning, but do not meet existing construction standards, to be brought into compliance with such standards.

Rules Adopted

Sec. 1:2 This Regulation contains minimum standards and supplements the Rules and Regulations enacted by the Michigan Department of Public Health and Washtenaw County. In addition, this Regulation supplements Michigan law as it relates to public health and environmental quality and shall supercede all local minimum standards previously enacted that are inconsistent with this Regulation.

Authority

Sec. 1:3 This Regulation is enacted pursuant to MCLA 333. 1101 et seq. as amended, MCLA 324.1701 et. seq., and MCLA 46.11, to protect the public health, safety and welfare of the citizens of Washtenaw County.

Jurisdiction

Sec. 1:4 The Public Health Officer shall have jurisdiction to administer and enforce the provisions of this Regulation. Nothing in this Regulation, however, shall be construed to restrict or abrogate the authority of any municipality, or incorporated city, village or township in Washtenaw County to adopt standards that are more restrictive. However, whenever an inspection relating to health or sanitation is required, no municipality shall issue a license without first having obtained written approval from the Health Officer indicating that the applicant has complied with the minimum requirements of this Regulation.

Effective Date

Sec. 1:5 This Regulation shall become effective in Washtenaw County when notice of its adoption by the Washtenaw County Board of Commissioners is published in a newspaper of general circulation within Washtenaw County, provided, however, that actual inspections shall not begin before January 3, 2000, to insure that a sufficient number of inspectors are certified and available.

ARTICLE II

Definitions

Sec. 2:1 The following rules of language shall apply to the text of this Regulation: The word "shall" is mandatory. The word "may" is permissive. When not inconsistent with the context, words in the present tense shall include the future and words designating singular numbers shall include the plural.

Words and Terms

Sec. 2:2 The following words and terms used in this Regulation, unless otherwise expressly stated, shall have the following meaning:

Authorized Agent: The term "Authorized Agent" shall mean any individual or corporation authorized, in writing, to act as the legal representative in all matters authorized by the seller or purchaser.

Environmental Health Division: The term "Environmental Health Division" shall mean the Washtenaw County Environmental Health Division.

Failure: The term "failure" is defined as follows: 1) the backup of sewage into a structure; 2) discharge of effluent onto the ground surface; 3) the connection of an OSDS to a storm drain; 4) liquid level in the septic tank above the outlet invert; 5) structural failure of a septic tank; 6) discharge of sewage into any stream or other body of water; 7) the liquid level in a disposal field above the outlet holes in the pipe of such field; 8) unsafe water sample; 9) substantial nonconformance with water well construction requirements; 10) substantial nonconformance with water well isolation from contamination source requirements.

Health Officer: The term "Health Officer" shall mean the Public Health Officer, the acting Public Health Officer or her/his duly authorized representative.

Municipality: The term "municipality" shall mean any incorporated city, village, or township within Washtenaw County.

OSDS: The term "OSDS" shall mean an onsite sewage disposal system.

Owner: The term "Owner" shall mean any person who has legal title to any premises.

OWSS: The term "OWSS" shall mean an onsite water supply system.

OWSDS: The term "OWSDS" shall mean an onsite water and sewage disposal system.

Person : The term "person" shall mean any individual, firm, partnership, party, corporation, company, society, association, or other legal entity.

Premises: "Premises" shall mean any tract of land, or portion thereof, or combination of tracts of land under single or common ownership, operation or control, that contains any type of structure that is, was or will be inhabited either permanently or transiently, water well or septic tank, drains, drain field, underground tank or pipes or similar appurtenances containing sewage or other contaminants or combination thereof.

Health Code Board Of Appeals/Public Health Advisory Committee: The term "Health Code Board Of Appeals/Public Health Advisory Committee" (HCBA/PHAC) shall mean the Health Committee of the Washtenaw County Board of Commissioners.

Substantial Conformance: The term "Substantial Conformance" shall mean there is a minimal likelihood of degradation of groundwater and surface water, or risk to public health caused by improper construction or location of an OWSDS, or a malfunctioning OWSDS.

ARTICLE III

Limitations on Sale or Transfer Of Property

Sec. 3:1 There shall be no sale, transfer or conveyance of a parcel containing an OWSDS until the following conditions are met: The seller files an evaluation report by a Washtenaw County certified inspector to the Division; and, the Division determines, based upon such report, that the OWSDS is acceptable, or any necessary remediation is completed, or assured and accepted; and the Division authorizes the sale, transfer or conveyance of the parcel.

Evaluations

Sec. 3:2 Each OWSDS in Washtenaw County shall be inspected and evaluated prior to the sale, transfer or conveyance of property upon which an OWSDS is located if certification has not been done within twelve months preceding the date of property transfer. Transfers exempt from inspections include:

- Transfer from a spouse.
- Change in ownership solely to exclude a spouse.
- Transfer subject to life lease or life estate, (until the life lease or life estate expires).
- Transfer to effect foreclosure or forfeiture of real property.
- Transfer by redemption from a tax sale.
- Transfer creating or ending joint ownership if at least one person is an original owner of the property or his or her spouse.
- Transfer to establish or release a security interest.
- Premises built within the previous twenty-four months prior to date of property transfer.
- Premises that shall be demolished and shall not be occupied after the property transfer.
- New homes that have not been occupied.

The owner of a premises containing an OWSDS shall have the system evaluated by a Division certified inspector. Persons certified to perform evaluations of an OWSDS shall meet the minimum standards in Sec: 3.6 of this Article. After the evaluation is complete, the Division shall send a letter to the owner or the owner's designated representative and any prospective purchaser describing the functional status of the OWSDS and whether it is in conformance with the Washtenaw County Rules and Regulations governing the Supply of Groundwater and the Disposal of Sewage and Human Excreta.

Sec. 3:3 Reports of evaluations shall include, but are not limited to:

- The address of the site.
- The parcel identification number.
- The name of the owner or owner's agent.
- The location of the system(s).
- A description of the current operational or functional status of the system(s).
- Identification of any necessary repairs or replacement of all or portions of the system(s).
- The results of a bacteria and nitrate drinking water test, and other water quality parameters as required by the Division.
- Other relevant or unusual observations related to the system(s).
- Recommendations to extend the life of the system(s) and to prevent the premature failure of the sewage system(s).
- Educational material(s) about system(s) maintenance that have been approved by the Division.
- Completed forms approved by the Division.

Sec. 3:4 A certified copy of the inspectors' evaluation report of an OWSDS shall be provided to the owner and a copy filed with the Division. Such reports shall be freely available to the public through the Freedom of Information Act, MCLA 15.231 et. seq.

Performance Standards

Sec. 3:5.1 The evaluation shall determine whether the system(s) adversely affects the public health and environment or violates any other applicable rules or regulations.

Sec. 3:5.2 The evaluation shall determine whether the OSDS structure and its operational status are in substantial conformance with the standards of this Regulation.

Sec. 3:5.3 OWSS shall be evaluated for:

- their proximity to sources of contamination.
- substantial compliance with State of Michigan construction standards.
- compliance with bacteria and nitrate water quality standards as a minimum with other water quality standards in areas of known water quality concerns.

Sec. 3:5.4 Water samples shall be collected and analyzed at a laboratory certified by the Michigan Department of Environmental Quality to determine the presence of coliform bacteria, nitrates, or other contaminants as determined by the Division.

Registration and Certification

Sec. 3:6 All inspectors performing evaluations under this Regulation must be registered with the Division and certified before undertaking any evaluations. All qualified inspector

Corrective Action

Sec. 8:1 Upon receiving written notice from the Division of noncompliance with this Regulation, the owner, buyer or authorized agent shall, within thirty (30) days, submit a proposed corrective action and contract for services in order to bring the affected system into compliance with applicable laws. In addition, the owner, buyer or authorized agent shall place into an escrow account a deposit of a surety or performance bond or cash in an amount equal to one and one-half times the estimated cost of the contract guaranteeing performance of such contract. The Division shall review the proposed corrective action and amend it as required to conform to federal, state and local laws, rules and regulations. All necessary corrective action shall be completed within one hundred eighty (180) days following Division approval of the proposed correction action plan. Once the Division gives final approval of the completed corrective action, the system shall be deemed to be in substantial conformance with this Regulation and any affidavit previously filed with the Registrar of Deeds shall be discharged. If an OWSDS presents an immediate health hazard, the owner or other responsible party shall take such measures, in cooperation with the Division, that will immediately reduce or eliminate the impact of such failure until the full remediation plan can be implemented as described earlier in this Paragraph.

Sec. 8:2 A person who disputes any Division decision concerning the violation of this Regulation shall have the right to a hearing and appeal using the appeals process in Article XI. Any appeal shall not stay an owner's, buyer's or authorized agent's obligation to take measures to reduce or eliminate the impact of a failure until a full remediation plan can be determined and implemented.

ARTICLE IX

Enforcement and Compliance

Sec. 9:1 If, after investigation, the Division believes that a person is violating these Regulations, the Division shall attempt to enter a voluntary agreement with the property owner to resolve the violation. If a voluntary agreement cannot be reached, the Division may issue a violation notice to the owner. A statement of facts upon which the notice is based shall accompany the violation notice.

Sec. 9:2 The Division may, after presenting proper credentials and other documents as may be required by law, and upon stating the authority and purpose for the investigation, enter and inspect any property at reasonable times to ascertain compliance or noncompliance with this Regulation or Rules promulgated under this Regulation. This may include:
Inspection at reasonable times of any parcel containing an OWSDS and related systems.
Collection of evidence and information for the purpose of determining compliance with this Regulation or Rules promulgated under the Regulation.

Sec. 9:3 If an owner, transferee or purchaser does not comply with the requirements of this Regulation, a Health Officer or his/her duly authorized representative may record an affidavit that details the non-compliance with the Washtenaw County Registrar of Deeds.

ARTICLE X

Specific Enforcement Options

Violation of the Regulation

Sec. 10:1 After learning that this Regulation has been violated, the HCBA/PHAC or the Health Officer or his/her designated representative may:
Issue a Cease and Desist Order and/or suspend any permit, certificate or other approval issued pursuant to this Regulation to the owner or other party violating this Regulation, and afford the owner or other interested party Notice and Opportunity for Hearing.
Request that Washtenaw County Corporation Counsel file a legal action to enjoin the violation.
In addition, the Health Officer may seek to recover any and all costs related to correcting, removing or abating the violation.

Issuance of Monetary Civil Penalties

Sec. 10:2 If a local health department representative or Health Officer believes that a person is violating a provision of this Regulation or an order issued pursuant to this Regulation, the representative may issue a citation within ninety (90) days after the alleged violation is discovered. The citation shall state with particularity the nature of the violation, including reference to the Section of the Regulation alleged to have been violated, the civil penalty established for such violation, if any, and a right to appeal the citation pursuant to MCLA 333.2461 and Article XI of this Regulation. The citation shall be delivered or sent by registered mail to the alleged violator.
Any party issued a citation may, within ten (10) days from the date the citation is issued, request an informal conference at which time the person may indicate why s/he believes that s/he has not violated this Ordinance.

Any party issued a citation may appeal the citation to the HCBA/PHAC or its designated committee within thirty (30) days after the citation is issued. The appeal shall be conducted in accordance with Article XI of this Regulation. A person aggrieved by a final decision of the Health Officer or the HCBA/PHAC or its designated committee, may petition the Circuit Court of the County where the premises is located for review. The time period for appeal shall begin to run the day after the date of such final decision.

Schedule of Monetary Civil Penalties

Sec. 10:3 Monetary civil penalties may be imposed according to the following schedule:
First violation: Up to $ 200.00
Second violation: $ 500.00
Third and subsequent violations each: $ 1000.00

Sec. 10:4 A civil penalty levied under this Section may be assessed for each violation or day that the violation continues. The civil penalty may be for a specified violation of this Ordinance or promulgated Rule, that the Health Officer has the authority and duty to enforce.

Sec. 10:5 A decision by the Health Officer not to issue a citation shall not be construed as a waiver of any other rights or remedies authorized by law or this Regulation.

Conviction of Misdemeanor

Sec. 10:6 Any person who violates this Regulation is guilty of a misdemeanor, punishable by imprisonment for not more than ninety (90) days, or a fine of not more than $200.00 or both. Conviction by jury, court or voluntary plea and acceptance by court under this provision shall not waive any other claim for fines, costs, injunction or other relief authorized by this Regulation. Each day that a violation of this Regulation exists shall constitute a separate offense.

Assessment against the Property

Sec. 10:7 If an owner does not have his/her property evaluated as specified by this Regulation, the Division shall cause an inspection to be performed and may charge all costs and fees for the evaluation to the owner of the premises.

Sec. 10:8 If the owner or party violating this Regulation refuses on demand to pay such expenses incurred by the Department to abate, correct or remove a violation, unsanitary condition or nuisance, the sum shall be assessed against the property and shall be collected and treated in the same manner as taxes assessed under the general tax laws of this State.

Right to Obtain Samples

Sec. 10:9 An inspection under Sec. 9.2 shall include the right to obtain samples where the Health Officer has reason to believe that there is a likelihood of contamination of surface water, ground water, water supply or other unsanitary conditions. Upon written notice, an owner or occupant of premises from which such inspection is sought shall co-operate with the Health Officer or his/her designated representative.

ARTICLE XI

Hearings and Appeals

Sec. 11:1 If an owner or interested party is adversely affected by any decision under this Regulation, s/he may request in writing a Hearing before the HCBA/PHAC or its designated Committee within thirty (30) days of the date of such decision. The Health Officer shall issue a Notice of Hearing within fifteen (15) days after receiving the request. A Hearing shall then be held at the next regular meeting of the HCBA/PHAC (or its designated committee), scheduled for such purposes; provided, however, that a Hearing shall be conducted no later than sixty (60) days after the Notice of Hearing is mailed to the owner or interested party. The HCBA/PHAC (or its designated committee) shall affirm, reverse or modify the contested decision by a majority vote of the entire Board. The decision by the HCBA/PHAC (or its designated committee) shall be in writing and state the reasons and grounds for such decision. A copy shall be furnished to the owner, any interested person, and the Health Officer within thirty (30) days of the decision.

ARTICLE XII

Miscellaneous Provisions

Severability

Sec. 12:1 Each provision of this Regulation must be interpreted in a way that is valid under Michigan law. If any provision is held invalid, the rest of the Regulation shall remain in full effect.

Sec. 12:2 All amendments to this Ordinance shall be approved by the Washtenaw County HCBA/PHAC and the Washtenaw County Board of Commissioners after a public hearing required by Section 2442 of Act 368 of the Public Acts of 1978, as amended, has been held. All amendments shall become effective at a time provided for under Michigan law.

Lake Panorama On-Site Wastewater Management District

Rules and Regulations

Chapter One

1.0 Administrative

1.1(1) Term of Office. The Administrative Committee members shall be appointed by the Guthrie County Board of Health to three-year terms. Members may be reappointed to consecutive terms.

1.1(2) Vacancies. Vacancies on the Committee shall be filled by the Board of Health within two months of the vacancy. Members of the Committee shall either be residents of Guthrie County or property owners within the Management District.

1.1(3) Officers. At the first meeting of each calendar year the Committee shall select a Chairperson and Vice-Chairperson as officers. The County Sanitarian shall serve as secretary.

1.1(4) Meetings. The Committee shall meet at least four times per year at a time and place designated by the Committee.

1.1(5) Budget. The Committee shall submit a budget request to the Board of Health annually. This budget shall be submitted to the Guthrie County Health Department at least two weeks prior to the Board of Health meeting at which the health budget is to be proposed.

1.1(6) Rules and Regulations. All rules and regulations or amendments shall be presented to the Board of Health for approval prior to submission to the Guthrie County Board of Health.

1.1(7) Quorum. Any three members shall constitute a quorum.

1.1(8) Voting. All motions of the Committee shall be approved by a simple majority of those members present.

1.1(9) Removal of member. By simple majority vote the Committee may recommend to the Board of Health the removal of a Committee member. Such removal may be recommended for improper conduct or lack of attendance at two consecutive regular meetings.

a. Failure of the Board of Health to act upon receipt of such a recommendation at its next regular meeting shall result in automatic removal of the member.
b. The Board of Health may vote to delay a final decision on the recommendation until the subsequent meeting of the Board in order to collect additional information.
c. Removal of a Committee member shall be effective immediately upon motion of the Board of Health.

1.1(10) Notice of Meeting All members shall receive at least one week's advance notice of any regular meeting. Special meetings or emergency meetings may be called at the discretion of the Chair person with all members notified, if possible, and with at least 24 hours advance notice.

1.1(11) Policies. The Committee may direct the sanitarian to prepare policies for the day-to-day operation of the District. Such policies need only be approved by the Committee. The Board of Health, at its own initiative, may revoke any policy of the Committee.

Chapter Two

Section 1. Jurisdiction.

Chapter 137 of the 1999 Code of Iowa specifies in Section 137.7 the following power of the County Board of Health:

May provide such personal and environmental health services as may be deemed necessary for the protection and improvement of the public health.

Under the authority granted by Chapter 137 the Board of Health and Board of Supervisors adopted Guthrie County Ordinance No. 2 titled Lake Panorama On-Site Management District Ordinance establishing the Administrative Committee and empowering the Committee to develop rules and regulations relating to the District.

These regulations shall supersede and replace other regulations of the Committee, which have been in effect to date.

Section 2. General Requirements

2.1 Applicability These regulations are applicable to all sewage and wastewater treatment systems located within the Lake Panorama On-Site Management District except those approved by other appropriate governmental agencies, i.e. Department of Natural Resources.

2.2 Definitions The definitions applied to these regulations shall be the same as those delineated in the Guthrie County Board of Health regulations.

2.3 General regulations

2.3(1) Conformance with County Health Regulations Regulations of the Board of Health that are not addressed in these regulations shall be enforced by the Sanitarian within the District when appropriate. Any system exceeding the six-bedroom requirement must be designed by an engineer and approved by the Committee, and the Dept. of Natural resources where appropriate.

2.3(2) Connection to public sewer

a. No on-site wastewater treatment and disposal system shall be installed, repaired, or rehabilitated where a public sanitary sewer is available or where a local ordinance requires connection to a public system.
b. When a public sanitary sewer is not available, every building wherein persons reside, congregate, or are employed shall be provided with an approved on-site wastewater treatment and disposal system.
c. It is prohibited to discharge and wastewater from on-site wastewater treatment and disposal systems (except under an NPDES permit) to any ditch, stream, pond, lake, natural or artificial waterway, county drain tile, surface water drain tile, land drain tile, or to the surface of the ground.

2.3(3) Permit No on-site system shall be installed or altered until an application for a permit has been requested and a permit has been issued by the Sanitarian. The installation shall be in accordance with these regulations and those of the Board of Health where applicable. Either the owner or installer or both may be cited for violation of these regulations. No permit shall be issued until a complete set of plans for the home is submitted for evaluation of all aspects bearing on the requirements of these rules.

2.3(4) Flow criteria The flow requirements in designing on-site wastewater systems shall be based upon the rate of 150 gallons per day per bedroom. Flows for non-resident structures shall be designated by the Committee on an ad-hoc basis.

2.3(5) Fees Permit, percolation test fees, and other fees shall be established by the Board of Health.

2.3(6) Permit validity Permits shall be valid for one year from issue date. From the date the house construction begins, the on-site system must be installed within one year prior to occupancy whichever is earlier.

2.3(7) Repairs to existing systems At such times as parts if the existing system fails, need repair, or replacement then such parts shall be repair to the standards delineated in these rules rather than those in effect at the time of the original installation.

Section 3 Site analysis

1. A site evaluation shall be conducted prior to issuance of a construction permit. Consideration shall be given, but not limited to, the impact of the following: topography, drainage ways, terraces, floodplain, percent of land slope, location of property lines, location of easements, buried utilities, existing and proposed tile lines, existing, proposed and abandoned wells, amount of available area for the installation of the system, evidence of unstable ground, alteration (cutting, filling, compacting) of existing soil profile, and soil factors determined from a soil analysis, percolation test and soil survey maps.

2. No construction of any kind, including driveways, basement digging, etc. may be started until a meeting has been held on-site between the Sanitarian and the owner/contractor for the project. This is to assure that the site is properly laid out to allow the on-site system to be installed in the properly designed location. Any changes shall be approved by the Sanitarian.

3. On sites with existing on-site systems any improvements to the lots shall be reviewed by the Sanitarian prior to the improvements. Consideration shall be given, but not limited to, the impact of the following: landscaping, building additions, driveways, sidewalks and walkways, decks and patios, tiling, utilities installation, heat pump wells, lot boundary changes and easements. Such improvements shall only be allowed if the on-site system must be modified to assure the proper operation of the on-site system.

4. All on-site systems shall be located in accordance with Table I of the Board of Health regulations. Due to the limited spatial dimensions of properties, the Committee provided some reasonable allowances to these distances where appropriate.

Section 4. Surface discharges

All discharges from on-site systems which are discharged into any surface water or to the surface of the ground shall be treated in a manner that will conform with the requirements of NPDES General Permit No. 4 issued by the Department of Natural Resources, as referenced in 567-Chapter 64. Prior to the installation of any system discharging to waters of the State a notice of intent to be covered by NPDES general Permit No.4 shall be submitted to the Department. Systems covered by this permit must meet all applicable requirements listed in the NPDES permit.

Section 5. Building sewers

5.1 Type Building sewers used to conduct wastewater from a building to the primary treatment unit of an on-site system shall be constructed of Schedule 40 plastic pipe (or SDR 26) or stronger with solvent-weld or bell-and-gasket type joints.

5.2 Size Such building sewers shall not be less than 4" in diameter.

5.3 Grade Such building sewers shall be laid to the following minimum grades:

a. 4-inch sewer12 inches per 100 feet.
b. 6-inch sewer8 inches per 100 feet.

5.4 Cleanouts

a. A cleanout shall be provided where the building sewer leaves the house and at least every 100' of run.

b. An accessible cleanout shall be provided at each change in direction or grade if a 90-degree elbow is used.

Section 6. Primary treatment-septic tanks

6.1 General requirements

6.1(1) Tank required Every on-site system, except mechanical/aerobic systems, shall have as a primary treatment unit a septic tank as described in this rule.

6.1(2) Prohibited waste All wastewater from the facility serviced shall discharge into the septic tank except as follows:

a. Softener brine from a water softener is prohibited to enter any portion of the septic system. Such brine must be discharged to a brine pit or other approved discharge site.
b. Discharge from hot tubs and spas is prohibited to enter any portion of the septic system. Such water shall be discharged to the yard or other such area in a manner that does not create a nuisance condition.
c. Septic tanks shall not be used for the disposal of chemical wastes or grease in quantities which might be detrimental to the bacterial action in the tank or for the disposal of drainage from roof drains, foundation drains, or area drains. Sumps shall not discharge to the tank.

6.1(3) Easements. No septic tank shall be located upon property under ownership different from the ownership of that property or lot upon which the wastewater originates unless easements to that effect are legally recorded and approved by the Committee.

6.1(4) Effluent discharge All septic tank effluent shall discharge into a secondary treatment system in compliance with these regulations.

6.1(5) Capacity The minimum liquid holding capacity shall be as specified in the following chart (capacity may be obtained by using one or more tanks)
1, 2 or 3 bedroom homes 1250 gallons
4 bedroom homes 1500 gallons
5 and 6 bedroom homes 2000 gallons

The presence of a high volume water use fixture such as a whirlpool bath, or other jetted style tub, or similar appliance requires and additional 500 gallon capacity tank system.

6.1(6) Tank design. Tank design shall be in accordance with the County regulations except as follows:

a. Access must be provided to all parts of the septic tank necessary for adequate inspection, operation, and maintenance.
b. An access opening shall be at least 18" in the smallest dimension if the tank has no other openings. Alternatively, a single opening at least 24" in diameter may be provided at the center of the tank allowing access to both compartments, with two smaller openings at least 6" in diameter over both inlet and outlet.
c. If the top of the tank is to be greater than 12" below the finished ground surface, a riser must be installed over each manhole to bring the top of the manhole lid to within 6" of the finished ground surface.
d. The lid of the tank or the riser, if greater than 12" must be donut-style lid such that there is a smaller lid no less than 6" nor greater than 12" for an opening. This is to facilitate the inspection program. Lids above grade level are exempt except that lids may not exceed 3' in diameter and may not be below grade. Existing lids in pits must have access lid of 6"-12" in these larger lids. At the time of sale such existing lids shall be modified to remove the pit.
e. All access manholes into the tanks must be a plastic manhole cast into the tank lid with a fitted accompanying lid to assure water-tightness. If a riser is needed, it must be a compatible until that is sealed to the manhole with appropriate material and the lid appropriate for the riser.
f. Without special permission of the Committee no tank shall be deeper that 5' from final grade to top of tank.

6.1(7) Connecting pipes

a. Minimum diameter The pipes connecting septic tanks installed in series and at least the first 5' on the effluents side of the last tank shall be a minimum of 4" in diameter Schedule 40 plastic.
b. Tank connections All inlet and outlet connections at the septic tanks shall be made by flexible boot gaskets cast into the concrete and adaptable to the 4" Schedule 40 plastic by using a metal strap clamp to assure water tightness. Other gaskets may be approved if appropriate by the Sanitarian.
c. Joints All joints in connecting Schedule 40 plastic pipe shall be approved plastic pipe connections such as solvent welded or compression-type gaskets. No joints are allowed in the fill space between a tank and undisturbed ground.
d. Unstable ground Schedule 40 plastic pipe shall be used extending across excavations or unstable ground to at least 2' beyond the point where the original ground has not been disturbed in septic tank installations. If the excavation spanned is more than 2', it must be filled with sand or compacted fill to provide a firm bed for the pipe. The first 12" of backfill over the pipe shall be applied in thin layers using material free from stones, boulders, large frozen chunks of earth, or any similar material that would damage or break the pipe.

6.1(8) Prohibited construction There shall be no construction of any kind covering any portion of the septic tank.

Section 7 Secondary treatment

Soil absorption systems are the best available treatment technology and shall always be used where possible.

7.1 General requirements

7.1(1) Location All subsurface absorption systems shall be located on the property to maximize the vertical separation distance from the bottom of the absorption trench to the seasonal high groundwater level, bedrock, hardpan, or other confining layer, but under no circumstances shall this vertical separation be less than 3'.

7.1(2) Soil evaluation A percolation test or professional soil analysis is required before any soil absorption system is installed. A percolation test shall be performed by Health Department Staff or be a registered, professional engineer who shall consult the Sanitarian prior to conducting the percolation test or soil analysis. The Committee shall review all percolations tests and soil analyses submitted and may reject tests deemed not properly performed. The Committee may at any time develop a requirement for both a soil analysis and a percolation test.

a. The percolation test procedure is outlined in the Board of Health regulations.
b. If a professional soil analysis is performed, soil factors such as soil content, color, texture, and structure shall be used to determine a percolation rate.
c. An area is deemed suitable for conventional soil absorption if the average percolation test rate is between 1 min. and 60 min. per inch. Rates for systems such as mounds and drip irrigation can be up to 120 minutes per inch.
d. Prior to construction, an additional test hole 6' deep shall be provided in the center of the proposed absorption area to determine the location of groundwater, rock formations, or other confining layers. This hole shall be provided by the contractor by digging with a backhoe.
e. If a seasonal high groundwater level is present within 3' of the trench bottom, then corrective measures to eliminate this problem must be performed.
f. In situations where specific location or site characteristics would appear to prohibit normal installation of a soil absorption system, design modifications may be approved by the Committee, which could overcome such limitation.

7.1(3) Site limitations

a. Roof, foundation, and storm drains shall not discharge into or upon subsurface absorption systems. Where appropriate, eave troughs shall be required.
b. Grading, improvements, driveways, and other structures cannot create drainage pathways onto lateral field areas.
c. There shall be no construction of any kind, including driveways, over the subsurface absorption system. Vehicle access to the subsurface system is prohibited.
d. Connecting solid lines under driveways shall be constructed of Schedule 40 plastic or equivalent. Measures to protect from freezing shall be employed when necessary.
e. No subsurface system shall be constructed on any property under ownership different from the ownership of the property or lot upon which it originates unless easements to that effect are legally recorded and approved by the Committee.

7.1(4) Split fields. Subsurface rock trench fields installed in areas with percolation test rates of 21-60 min./inch shall be composed of two equal fields each containing 75% of the total lateral field length specified in Table I. Each field shall receive the effluent in alternating years. Such alternating of laterals shall be done by the Sanitarian. All alternating fields shall be pressure dosed.

7.2 Trench requirements

7.2(1) Percolation charts The following charts are used to determine appropriate subsurface trench lengths.

a. Table I specifies the lineal feet of subsurface trenches required in accordance with the results of the standard percolation test under normal conditions.
b. Table II lists an optional method of determining length of subsurface trenches when space is a problem. This table for increased rock usage shall be used only when the size of lots limits the use of the standard length trenches. This table is only applicable to percolation test rates of 20 min/inch or less.
c. Table II must not be used when the soil profile indicates it is not proper nor can it be used when the potential for a water table problem exists. Under no circumstances can the trench depth exceed 36".
d. Table III must be utilized additionally to determine actual rock depth for percolation test rates greater than 20 min./inch.

Table I

Soil Absorption System Sizing Chart (Lineal feet of absorption trench)

Min. Per Inch	Two-bedroom 300gpd	Three-bedroom 450gpd	Four-bedroom 600gpd	Five-bedroom 750gpd	Six-bedroom 900gpd
-10	200	265	320	385	460
11-15	230	300	400	500	600
16-20	275	365	440	530	635
21-25	325	420	500	600	720
26-30	360	470	565	680	815
31-35	390	510	615	740	890
36-40	420	550	660	790	950
41-45	450	585	700	840	1010
46-50	475	615	740	890	1070
51-55	495	645	775	930	1115
56-60	510	660	800	960	1150

Table II

Alternative Option for Increased Rock Usage

Perc rate>20 min./inch

Depth of gravel below distribution line	Reduction in trench lengths as taken from Table I
16"	20%
20"	33%
24"	40%

Table III

Rock Depth for Various Percolation Rates

Percolation rate (min./inch)	Depth of Rock
0-20	12 inches
21-40	16 inches
41-60	20 inches

e. For any percolation test rate a reduction of 20% in total length can be allowed when dosing is employed.
f. Lateral trench reduction for both dosing and increased rock depth shall be calculated as follows:

Percolation rate (min./inch)	Total gravel depth	% Reduction from Table I
0-20	16"	30%
0-20	20"	40%
0-20	24"	45%
21-60	24"	25%

g. If soil analysis is utilized, the person analyzing the site shall determine a value from the soil analysis to fit Table I. From Tables II and III section f. above may be utilized where appropriate.
h. Soils with percolation rates of 20 min./inch or more shall have a backhoe bucket with side raker teeth utilized t install rock trench lateral fields.

7.2(2) Conventional subsurface soil absorption trenches shall not be installed in soils that have a percolation rate less than one min./inch or greater than 60 min./inch.

7.2(3) Construction Details

a. Depth Lateral. trenches shall not exceed 36" in depth. Not less than 6" of porous soil shall be provided over the laterals. A shallow trench with as near the minimum cover as possible is strongly recommended. Minimum separation between trench bottom and groundwater, rock formation, or other confining layer shall be 36" even if extra rock is used under the pipe.
b. Length. No gravity absorption trench shall be greater than 100' long. Pressure laterals may be longer if approved by the Sanitarian.
c. Separation distance. At least 5' of undisturbed soil shall be left between each trench edge on level sites. Additional separation of 2' is recommended on sloping sites.
d. Grade. Trench bottom should be constructed level from end to end.
e. Compaction Prior to construction. the subsurface absorption system shall be located and fenced with snow fence, or equivalent, to prevent compaction of the area with no removal of the fence at any time during home construction, except to install the system. After installation, the fence shall be re-installed until the home is completed. Warning signs, provided by the Sanitarian, must be posted on the fence.
f. Fill Soil. Soil absorption systems shall not be installed in fill soil. Disturbed soils which have stabilized for at least five years may be approved upon soil analysis or percolation test results. The Committee may reject any fill site deemed to not be suitable for an absorption system.
g. Graded sites. Removal of upper layers of soil from an absorption system site is prohibited. Areas graded down may not be used as soil absorption system sites except as approved by the Committee after suitable soil analysis and testing.
h. Soil Smearing. Soils with significant clay content shall not be worked when wet. The Sanitarian, upon observing significant smearing, shall have the authority to stop work on the absorption system until the soil has dried to allow minimal smearing.

7.2(4) Gravel systems. Only rock trench lateral field systems shall be allowed as the preferred subsurface soil absorption system. Rockless pipe systems and chamber systems shall not be used. Also allowed shall be drip irrigation systems.

a. A minimum of 12" clean, washed river rock shall be used in the trench. This gravel shall be of such size that 100% will pass a 2.5" screen and 100% will be retained on a .75" screen. Limestone or crushed rock is not allowed as a rock medium.
b. Lateral trenches shall be 24" in width. A trench width of up to 36" is permissible with Committee approval.
c. The trench bottom should be level.
d. Untreated building paper, synthetic drainage fabric, straw, or other approved material shall be laid so as to separate the gravel from the soil backfill.
e. Transit readings shall be taken n all lateral lines at the proximal and distal ends to assure proper grade. Additional readings may be required for any connecting piping from distribution boxes or manifolds to secure proper fall.
f. Gravity systems. Additional requirements for such systems shall be as follows:

1. Pipe Distribution. pipe shall be PVC rigid plastic meeting ASTMStandard 2729, or other suitable material approved by the Committee. The inside diameter shall not be less than 4" with perforations at least .5" and no more than .75" in diameter spaced no more than 40" apart. Two rows of perforations shall be provided located 120 degrees apart along the bottom half of the tubing (each 60 degrees up from the bottom center line). The end of the pipe shall be capped.

2. Distribution. Distribution on sloped sites shall be by either drop boxes or a distribution box method. Serial distribution may be allowed with permission of the Sanitarian. On flat sites either serial distribution, a manifold distribution, or a distribution box may be employed.
a. Drop boxes and distribution boxes shall be of plastic composition.
b. Manifold layouts shall be of water-tight piping laid on a level, undisturbed bed. Only 90-degree tees may be the lateral to the manifold. The effluent line shall used to connect to the manifold in approximately the middle of the manifold and equidistant between two laterals.
c. Distribution shall be laid out in an approved manner that does not allow water to follow a trench from one distribution line to another.
d. Distribution boxes shall not feed any lateral greater than 100' in length.
e. Laterals in a distribution box or manifold system shall all be equal in length, except that a line may vary from the common length by 10% in special circumstances.
f. Distribution boxes shall have a 45-degree or more inlet letdown.
g. Speed levelers must be installed on all lateral outlets.

3. An observation port shall be installed at the outer end of every lateral line. This shall consist of a Tee at the end of the lateral pipe with section of the perforated pipe extending down to the bottom of the rock layer and a piece of solid pipe extending from line level to 2" above grade. All piping shall be glued together with a cap (not glued) covering the above grade pipe.

4. Such ports shall be maintained by the homeowner to be visible and at least 2" above the surface of the ground. Caps and ports must be kept in proper repair at all times to allow for the Sanitarian to inspect the conditions of the laterals. Caps must be of the proper size for the port.

g. Pressure systems Additional requirements for such systems shall be as follows:
1. The manifold and distribution pipe shall be rigid, plastic pipe (Schedule 40 or equivalent) of 1-2" inside diameter. The lateral pipe shall be laid in the rock layer as near to level as possible.
2. All joints shall be pressure fittings solvent welded.
3. The distribution pipe shall be placed in the upper 3" of rock with the holes turned downward.
4. No perforations shall be allowed in the last 3" of the outer end of the lateral pipe nor in the first 3' of the lateral pipe.
5. The length of pressure laterals is not limited to 100' nor do all laterals in a system have to be of equal length.

6. The system shall be pressure-tested for proper operation prior to covering where possible or deemed necessary.
7. Discharge holes in the pipe shall not be smaller than 3/16" nor larger than 3/8" without special permission.
8. Hole spacing shall not be less than 2' nor more than 10'.
9. Pump head shall correspond as closely as possible to that needed to pressurize the highest elevation lateral to 3' of head minimum.
10. The system is to be designated so that approximately equal volumes of water ate delivered to each lateral on a per foot basis. This is accomplished by varying the hole size and spacing and if necessary using valves or pipe restrictions to regulate flow to a particular lateral.
11. An observation port shall be installed at the outer end of every lateral line. Such ports shall be of 4" rigid, solid, plastic pipe of less than Schedule 40 weight. The pipe shall be within 3' of the end of the with the pipe extending from the bottom of the trench to at least 2" above final grade. In the rock layer, the pipe shall have a series of ¼" holes installed but shall be solid through the dirt layer.
12. Such ports shall be maintained by the homeowner to be visible and at least 2" above the surface of the ground. Caps and ports must be kept in proper repair at all times to allow inspection of the lateral condition. Caps must be of the proper size for the port.
13. The manifold line shall be laid in such an approved fashion as to prevent effluent from seeping from line to line.
14. Any lateral field of 400' or more must be pressure dosed.

7.3 Mound systems. Under suitable site conditions the use of a mound system is allowed. The mound system shall be installed according to the current Board of Health regulations in effect at the time the mound is approved for installation. The Committee reserves the right to add additional stipulations if necessary to protect the health and condition of the Lake and residents.

7.4 Drip irrigation systems. Specifications given in these rules are minimal and may not be sufficient for all applications. Technical specifications are changing with experience and research. Other design information beyond the scope of these rules may be necessary to properly design a drip irrigation system.

7.4(1) Pretreatment. These systems must be preceded by a secondary treatment system with National Sanitation Foundation approval discharging a treated, filtered effluent with BOD and TSS values less than 20 mg/L.

7.4(2) Groundwater separation. Drip irrigation systems shall have a minimum vertical separation distance to high groundwater level or bedrock of 20".

7.4(3) Maximum slope. Drip irrigation systems shall not be installed on slopes of more than 25%.

7.4(4) Emitter layout

a. Discharge rate Systems shall be designed so that emitters discharge approximately 1 gpm at 12 psi or other rates suggested by the manufacturer and approved by the Committee.
b. Grid size Drip lines shall be run in parallel lines at least 2' apart. Emitters shall be placed in the drip lines on 2' intervals with emitters offset 1' between adjacent lines. Each emitter shall cover 4 square feet of absorption area.
c. Field size The field shall be sized according to the application rate given in Table IV. Where appropriate the manufacturer's representative may provide input into sizing of the system.
d. Depth of lines Drip lines shall all be laid on the contour 6-12" deep with a maximum line length of 100'.
e. Interconnection Drip lines shall all be connected to supply and return headers such that the entire system will automatically drain back to the pump pit upon completion of the pumping cycle. Vacuum breakers shall be positioned at the high point of the supply and return headers.

7.4(5) Pump chamber These pump pits shall meet all appropriate specifications of pump pits listed in section 7.7. Additionally, the following shall apply:

a. Pump pits shall be at least 1000 gallons in capacity.
b. Pump pits shall have an audible and visible alarm system either in the house or at the pump station.
c. Pumps shall cycle to deliver a dose of 20-50 gallons of water then shut off for at least one-half hour before restarting to repeat the cycle as long as there is sufficient effluent to activate the pump float.

d. There shall be a high level alarm that activates when the tank is 75% full.
e. No check valve is allowed on the pump line.
f. A filter shall be present on the discharge line after the pump but within the pit that will not allow solids that might plug the emitters to enter the pump line.
g. A service contract shall be maintained by the homeowner with an approved company to do a service check on this system quarterly. This service report shall be automatically sent to the Committee by the service company within ten days of completion of the service for that quarter.

Table IV

Length of Drip Line Required per Bedroom

Perc rate (min./inch)	Length of Drip Line (feet/bedroom)
1-5	50
6-15	75
16-30	100
31-45	200
46-60	250
61-90	400
91-120	600

7.5(1) Intermittent sand filters. Such sand filters may be allowed by the Committee with special variance if it is determined it is not possible to install a subsurface soil absorption system.
a. Pretreatment These systems must be preceded by a secondary treatment system with National Sanitation Foundation approval discharging a treated, filtered effluent with BOD and TSS values less than 20 mg/L.
b. Location. Such sand filters shall be located as far from the shoreline as practical but in no case shall the sand filter be deeper than the Lake elevation nor in the water table.
c. Sampling. A sampling port shall be available at the discharge point of the filter or shall be installed in the discharge line after the effluent filter in the pump pit. Monitoring and effluent sampling of intermittent sand filters must meet the requirements of the NPDES General Permit No. 4. Such sampling shall be performed annually or as directed by the Committee. The annual sample must be collected in the months of June, July, or August.
d. Contaminant levels The maximum carbonaceous BOD5, total suspended solids, and fecal coliform count requirements are as follows:

Effluents Discharging to:	Fecal Coliform	BOD5	TSS
Class "A" waters:			
Primary contact waters:	200	25	25
All other water use classifications	no limit	25	25

e. Free access filter. It is assumed that such filters will be free access sand filters. Such filters shall be dosed by pumping.
f. Gravel specifications. The bottom of the sand filter shall have a 12" layer of gravel meeting the specifications of section 7.2(4)a with the collector lines laid in the bottom 6" of rock.
g. Collector lines. One collector line shall be laid for each 3' of bottom surface area. Such lines shall be Schedule 35, or equivalent, with perforations as specified in section 7.2(4)f1.
h. Sand barrier. A 3" layer of clean, washed pea gravel shall cover the rock prior to the sand layer being added. Filter fabric shall not be used.
i. Sand. A minimum of 30" course, washed sand shall be placed over the pea gravel.. The sand shall meet the Iowa DOT standard for concrete sand: 100% shall pass a 9.5 mm screen, 90-100% shall pass a 4.75 mm screen, 70-100% shall pass a 2.36 mm screen, 10-60% shall pass a 600 micron screen, and 1- 1.5% shall pass a 75 micron screen.
j. Distribution. Distribution of effluent over the sand layer shall be accomplished by the use of a 1 ½" Schedule 40 manifold laid on the sand inside a 4" pipe meeting the standards of section 7.2(4)f.1. This 4" pipe shall be

capped at the end with a ¼" holes drilled at the end to allow drainage after the pump shuts off. The pressure manifold pipe shall have ¼" holes drilled on 4' centers. There shall be one distributor line for each 2' of filter width.
k. Access. Such filters must be covered to protect against severe weather conditions or to avoid encroachment by weeds or animals. The cover also serves to reduce odor conditions. Covers may be constructed of treated wooden planks, or other suitable material. Insulation is recommended. A minimum space of 18" shall be available between the cover and the sand surface to allow easy maintenance. Such filters shall not be buried by sod or soil. All portions of the sand surface shall be accessible from the accesses.
l. Size. Such filters shall be 20 square feet per bedroom with a minimum square footage of 60 square feet.
m. Discharge line. The discharge line from the sand filter to the point of discharge shall be perforated pipe meeting the standards of section 7.2(4)f.1. It shall be laid in the trench surrounded by pea gravel or septic rock meeting standards of section 7.2(4)a. This is to allow as much treated effluent as possible to enter the soil prior to discharge.
n. Pump pit The pump pit shall meet the specifications in section 7.7. A filter shall be present on the discharge line after the pump but within the pump pit that will meet the same requirements as the filter specified for drip irrigation systems.
o. Service contract. A service contract shall be maintained by the homeowner with an approved company to do a service check on this system quarterly. The service report shall be automatically sent to the Committee by the service company within ten days of completion of service for that quarter.

7.5(2) Existing non-aerated intermittent sand filters. There are in existence such sand filters that are preceded by septic tank treatment with a dosing chamber to dose the sand filter.

a. Such systems shall be allowed to exist until such time as the Committee adopts rules that would replace such septic tank/sand filter systems with another system.
b. Should such a sand filter fail and need to be replaced the system must be replaced with an aerated system per section 7.5(1).
c. The homeowner shall maintain all plumbing fixtures in proper working in order to limit the hydraulic load.
d. Low volume toilets and showerheads shall be utilized.
e. Water pressure should be 65 psi or less.
f. Garbage disposal units are prohibited.
g. Should such system's septic tank need to be replaced the system must be replaced with an aerated system as per section 7.5(1).
h. The septic tank outlet shall have a gas baffle in addition to the standard baffle required.
i. The sand filter construction shall be maintained in at least the same condition as required by the rules in effect at the time the sand filter was installed.
j. There shall be no construction over the discharge line of the sand filter.
k. Sampling of the effluent shall be done on the same schedule as other sand filters.
l. Septic tanks preceding such sand filters shall be pumped when scum depth exceeds 3" or when sludge depth exceeds 12".

7.6 Individual mechanical aerobic wastewater treatment systems

7.6(1) Use Mechanical/aerobic systems may be used only when the Sanitarian determines that the site is unacceptable for a full-sized soil absorption system. Because of the higher maintenance requirements of mechanical/aerobic systems, preference should always be given to septic tank/lateral field systems.

7.6(2) Certification All such systems shall be certified by an ANSI-accredited third-party certified to meet National Sanitation Foundation Standard 40, Class I, including appendices (May 1996 or as revised).

7.6(3) Installation and operation All such systems shall be installed, operated, and maintained in accordance with the manufacturer's instructions and the requirements of the Committee. The aerobic plants shall have a minimum treatment capacity of 150 gallons per bedroom or 500 gallons, whichever is larger.

7.6(4) Effluent treatment The effluent from such systems shall receive additional treatment through the use of free access sand filters, drip irrigation, or mounds as specified above.

7.6(5) Maintenance contract A maintenance contract with a manufacturer-certified technician shall be maintained at all times.

a. Maintenance agreements and responsibility waivers shall be recorded with the County Recorder and in the abstract of title for the premises on which such systems are installed.
b. Mechanical aerobic units shall be inspected for proper operation at least quarterly.
c. The inspection report for each unit shall be forwarded to the Sanitarian within ten days of the completion of that quarter's inspection. Any additional service calls shall have the inspection report forwarded to the Sanitarian within ten days.
d. Sampling of the effluent from the unit must be done annually in the months of June, July or August with the report submitted to the Sanitarian.
e. Test results shall meet the limitations set forth in section 7.5d. Any system, or portion of system, failing to meet these standards must be promptly repaired, and a retest conducted within 30 days of the repair.
f. Should inspection by the Sanitarian reveal problems, or suspected problems, the maintenance company shall inspect the system within 5 working days and collect additional samples if deemed necessary by the Sanitarian.

7.7 Pump pits. All pump pits shall comply with these regulations. Pump pits following aeration systems may have additional requirements.

7.7(1) Sizing. Pump pits shall be of a 1000-gallon minimum size. The optimum gallonage to pump per cycle is 150-250 gallons with the balance available as freeboard in case of pump failure or electrical outage.

7.7(2) Material. Pump pits may be constructed of the same materials as approved for septic tanks. However, plastic or fiberglass tanks cannot have more than 2' of cover over the tank.

7.7(3) Required use. Pump pits are required when elevation dictates to reach the lateral files and also on any lateral field system that is 400' or more in size. Dosing is required on all split-field systems.

7.7(4) Access. A manhole of no less than 22" shall be provided into the pump pit. This manhole shall extend above grade at least 4" and shall not be obstructed by heavy objects, rock cover, or ant other obstruction that limits access into the pump pit. All pump pits shall be vented which may be accomplished by loose fitting lids.

7.7(5) Alarm. All pump pits shall have an audible and visible alarm either mounted at the pump station on an outside mounting or within the home. Such alarm shall be installed so that it is activated when the pump pit exceeds a 350-gallon volume of effluent.

7.7(6) Wiring. All wiring shall be done so that it is water and airtight. No plugs or other open connections shall be used. Preference is given to watertight electrical boxes mounted outside the pump pit.

7.7(7) Repair. Any systems being repaired or replaced that involve pump stations being installed or changed shall have the pump pit volume of at least 1000 gallons used.

7.8 Pumps. All pumps shall meet specifications for sewage pumps and shall be sized such that the pump will deliver the effluent to the treatment system in a manner that allows proper distribution of the effluent into the treatment system. All pumps shall be plumbed with a quick disconnect for easy removal.

7.9 Alternative methods of wastewater disposal. Other methods of private sewage disposal not described in these rules shall only be allowed after special approval of the Committee. There must be a preponderance of evidence to show that any such system is capable of properly treating the effluent generated by the residence.

Chapter 3

Section 8 Operation, maintenance, and repair

8.1(1) Purposes

a. The purpose of this chapter of rules is to extend and maintain the useful life of all existing on-site wastewater treatment systems within the District without causing undue cost or hardship to the owner.
b. The District shall make every attempt to utilize subsurface disposal of wastewater. Surface disposal is considered temporary and as a last resort.

8.2 Definitions

a. Part-time residence: Structure having substantially continuous occupancy less than six months per year.
b. Permanent residence: Structure having substantially continuous occupancy more than six months per year.

8.3 Inspection of existing systems

8.3(1) General requirements

a. Inspections shall be made when weather permits.
b. Such inspection will be unannounced unless the inspector directs the assistance of the resident.
c. Wastewater treatment systems at permanent residences shall be inspected at least once each year, except that tank conditions shall be checked at least once each three years.
d. Wastewater treatment systems at part-time residences shall be inspected at least once each two years, except that the tank conditions shall be checked at least once every six years.
e. Tanks with access ports below ground level shall be opened by the owner or owner's agent prior to the inspection if greater than 1' to the top of the access port or if obstacles to opening are present.
f. Any tank opened that has the access greater than 12" below grade shall have a riser added to bring the access to 6" or less below grade. Any lid diameter greater than 16" shall have the lid changed to a donut-style lid to provide a smaller access opening to facilitate inspection.
g. The District shall maintain a permanent file of inspections and historical data for each structure served by an on-site disposal system.
h. Mechanical/aerobic systems shall be inspected by the certified technician as specified in section 7.6(5). However, the Sanitarian shall do an inspection as per c and d above.

8.4 Inspection items

8.4(1) Tank inspection. The tank inspection shall include:

a. sludge and scum levels
b. determination of the conditions of the baffles, where feasible.
c. Determination of the integrity of the tank, walls, lid, and other structural components, where feasible.

8.4(2) Mechanical parts The following shall be checked:

a. pump and pump chamber
b. dosing siphon
c. aerator
d. timer and alarms, when possible
e. wiring
f. sampling of effluent shall be done according to appropriate portions section 7.

8.4(3) Disposal area. The treatment system shall be checked as follows:

a. surface conditions; i.e. wetness, unusual plant growth, erosion, and other visible signs

b. any drop boxes, distribution boxes, alternating valves, etc. that may be exposed to the surface
c. any surface discharge area checked for conditions indicating improper functioning of the secondary treatment system.

8.5 Operation and maintenance To aid in the proper operation and longevity of systems the following items are required and specified.

8.5(1) Septic tanks shall be pumped when scum levels exceed 4" in thickness or when sludge levels exceed 16" in depth, except as noted for sand filters. Scrubbing or disinfecting tanks after pumping is prohibited.

8.5(2) At no time shall vehicles, construction equipment be driven on the septic tank, pump pit, secondary treatment system, or other damageable parts of the system.

8.5(3) Metal, cement, or other construction equipment, or pumping equipment be driven on the septic tank, pump pit, secondary treatment system, or other damageable parts of the system.

8.5(4) Mechanical equipment such as pumps, siphons, aerators, and alarms shall be maintained in an operational condition as specified in the manufacturer's recommendations.

8.5(5) Wiring, connectors, and electrical components shall be repaired or replaced if deemed necessary by the Sanitarian in order to assure proper equipment operation and to prevent safety hazards.

8.5(6) At the time of sale of a residence older portions of the system that do not meet current standards of installation, such as wiring, may be required to be upgraded to current regulations.

8.5(7) Improperly operating systems cannot be repaired until the owner and Sanitarian agree on an acceptable plan for repair that conforms to these rules as best is possible. It is realized that on some existing sites the rules may not be able to be adhered to strictly and variances to certain sections may be necessary. Serious system problems will be reviewed by the Committee for approval of repairs.

8.5(8) At the time of abandonment of the old pre-1980 aerators, observation ports shall be installed on as many of the existing lateral lines as can be located.

8.6 Maintenance of the split fields

a. The Sanitarian shall be responsible for switching the alternating valve.
b. The valve shall be diverted from field to field once each year at approximately the same time each year.
c. Any system which develops symptoms of failing to operate satisfactorily under this dosing schedule may have the dosing schedule modified by the Sanitarian.

8.7 Tank pumping

a. A property owner can only hire persons or firms holding a current license from the Guthrie County Board of Health to clean septic tanks within District.
b. When work begins on cleaning a tank, it shall be continued without interruption until the work is done and the tank is properly closed.
c. Contents pumped from tanks may not be applied to land within the District except in a location and manner approved by the Sanitarian and the Lake Panorama Association in order to protect the surface and groundwater quality as well as for public health concerns.

8.8 Disinfection. The Committee may require the disinfection of certain systems that surface discharge. Such disinfection systems shall be commercially manufactured units that meet the Committee's approval.

8.9 Types of repairs To correct failing or problem systems the following may be utilized. This list is only a partial listing and others may be approved by the Committee.

a. converting gravity-fed systems to doses systems
b. converting a single field to a split field
c. re-leveling the distribution box
d. increasing the dosing chamber size
e. implementing water conservation practices and installing water conservation devices
f. installing a second lateral field and developing a split field system
g. installing of curtain drains, terraces, and other water diversion structures
h. redirecting runoff and foundation drain water
i. increasing the lateral field size
j. installation of a mound system
k. segregation of black water and grey water systems
l. developing a pressurized subsurface absorption system
m. installation of a dosed, pressure sand filter
n. removal of structures affecting the subsurface absorption field.

8.9(1) The Committee shall establish a time limit for the completion of the repairs

8.9(2) Any consultants or other professionals hired as directed by the Committee shall be the responsibility of the homeowner as regards payment for services.

8.10 NPDES Permits For systems designed to discharge treated effluent into waters of the State or onto the surface, it will be necessary to obtain a Notice of Intent to fall under the requirements of NPDES General Permit No. 4. The Committee is responsible for determining that the requirements of the permit are met including the monitoring program. However, the homeowner is responsible for all costs associated with meeting these requirements.

8.11 Variances Variances to these rules may be granted by the Committee provided sufficient information is submitted to substantiate the need and propriety for such action. Applications for variances and justification shall be in writing and copies filed in the Committee minutes.

The rules were approved by the Administrative Committee at the April 10, 2000 meeting.
The rules were submitted to the Guthrie County Board of Health for review.

The Guthrie County Board of Health held a public hearing on these rules at its May 17, 2000 meeting.