Responsible Management Entities as a Method To Ensure Decentralized Wastewater System Viability

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ABSTRACT: It is generally accepted that small and decentralized wastewater systems are a viable option for urban, near urban, and rural communities. It also is accepted that proper system management, operation, and maintenance can measurably enhance system life and performance. To address this need, the authors present a philosophical argument for the formation of responsible management entities (RMEs) as a method for ensuring the viability of decentralized wastewater systems. RME is defined as a legal entity that has the technical, managerial, and financial capacity to ensure viable long-term, cost-effective, centralized management, operation, and maintenance of decentralized wastewater systems in accordance with appropriate regulations and generally accepted accounting principles (GAAP). Viability is defined as the capacity of a responsible management entity to provide adequate technical, managerial, and financial resources to protect the public health and the environment consistently, in perpetuity, and at a minimal cost to taxpayers. Finally, since research of existing operational decentralized wastewater systems as RMEs is ongoing and, therefore, limited, the authors often rely on personal experience to support their assumptions. However, a case study is presented, which describes a utility system that possesses, from the authors' perspective, the majority of those qualities and assets required by, and common to, all RMEs.

The U.S. Environmental Protection Agency in its *1997 Response to Congress on the Use of Decentralized Wastewater Treatment Systems* (EPA, 1997) recognized that "adequately managed decentralized wastewater systems are a cost-effective and long-term option for meeting public health and water quality goals, particularly in less densely populated areas." Even before the EPA published its response, communities, cooperatives, and private entities were effectively managing decentralized wastewater systems across the globe—albeit on a limited scale.

In addition, the currently proposed *Draft EPA Guidelines for Management of Onsite/Decentralized Wastewater Systems* (EPA, 2000) outlines the need for decentralized wastewater systems as follows:

> "The performance of onsite/decentralized wastewater is a national issue of great concern to the EPA. . . . Onsite/decentralized systems can provide a high level of public health and natural resource protection if properly selected, sited, designed, 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 surface and ground water quality. . . ."

The EPA draft guidelines provide a framework for the voluntary management, operation, and maintenance of small and decentralized wastewater systems. The major benefit of this approach is to allow each state regulatory authority to work with local interested parties in the development of a viable decentralized wastewater system management program that meets the specific and unique needs of that region. One of the options available under the EPA guidelines is the use of responsible management entities (RMEs). Therefore, it is not the intent of the authors to compete with the approach EPA has initiated in developing decentralized wastewater system management programs nationally. Instead, the authors intend this paper to magnify the argument in favor of decentralized wastewater system management programs and promote a cooperative and comprehensive approach.

Making a Case for RMEs

> "The barriers to formatting (small and decentralized wastewater system) infrastructure are neither technological nor economic—they are institutional. (Lindall, 2000)."

The concept of RMEs, as proposed by the authors, has its roots in the 1996 Safe Drinking Water Act Amendments (SDWA, 1996). In these amendments, EPA introduced the term "capacity development" to define the viability of a utility system. Capacity development refers to the technical, managerial, and financial resources available to a utility (in this case, a water utility) in its efforts to protect the public health and the environment.

Since then, EPA has required that states develop programs to ensure that all regulated public water systems (which are as small as 15 connections serving 25 year-round residents) have adequate technical, managerial, and financial resources. Further, EPA requires that all recipients of drinking water state revolving funds demonstrate that they have adequate technical, managerial, and financial capacity.

As sited earlier, the EPA rates failed and failing small and individual wastewater systems as a national priority. The reality is that most of these systems, as individual entities, do not have the capacity to correct these failures. For example, based on a review of applications for funding submitted to the U.S. Department of Agriculture's Rural Development in Minnesota since 1997, nearly 90 percent of small communities (i.e., populations less than 10,000) with failing wastewater systems lacked any capital reserves. Also, all of the communities that applied for assistance had existing sewer rates below the state non-

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metropolitan average. This data has led the authors to speculate that one of the major contributors to the "failure" of wastewater systems in small communities is a lack of technical, managerial, and financial capacity—in particular, financial and managerial skills and resources.

In response, both EPA and Rural Development are acutely aware that the potential public costs for addressing the existing needs are staggering. For example, the Minnesota Water Quality Board estimates statewide wastewater treatment needs to be approximately $600 million for conventional systems and $1.7 billion for onsite systems not adequately treating waste (Quality Board, 1995).

Therefore, it is not a large leap of logic to suggest that technical, managerial, and financial capacity is just as important for a wastewater system as for a water system. The authors attempt to draw similarities between these two needs— failing systems and potential costs—and demonstrate how RMEs can address these problems.

Common Wastewater RMEs

Following are descriptions of the common types of RMEs:

- **Publicly Owned Utilities and Publicly Owned Treatment Works**: Depending on the individual state laws which govern these systems, a publicly owned utility or treatment works may be owned and operated by a local unit of government, or it could be formed as a public utility district (PUD), which acts as an independent quasi-governmental and taxing authority.
- **Federal, Tribal, and State Owned Facilities**: Wastewater systems located on reservations, national parks, airports, prisons, and military bases are examples of federal, tribal, and state owned systems. Many of these facilities, particularly federal and state facilities, are operated under contract with private vendors. In the case of federal and tribal systems, regulatory jurisdiction usually falls under the EPA. In some cases, federal agencies have voluntarily agreed to accept state primacy agency jurisdiction.
- **Homeowner Associations**: Homeowner associations are structured and operate under bylaws typical of regulations for community property. Basic requirements of homeowner associations differ by region and can be dictated by local or state codes. In some locations, homeowner associations are required as a precondition to plat. The developer may establish the homeowner association prior to construction and will often remain a member until the subdivision has been filled. In the case of existing developments, homeowners may decide to join together to form an homeowner association. The primary disadvantage to these organizations is the lack of a professional dedicated staff with proper technical expertise to manage and operate a wastewater utility. In addition, internal political disputes often preclude responsible decision making.
- **Private Joint Venture**: In Minnesota, private management of wastewater systems is covered under Minnesota State Statutes Chapter 471A. Under this statute, a local unit of government, a utility district, or a homeowner association may contract for wastewater treatment with a private vendor, thus forming a private joint venture. The local unit of government or homeowner association will manage the contract and determine the level of service provided and the rates charged to the users. The key benefit of a private joint venture is the ability to hire professional management with capabilities beyond the capacities of the individual community or homeowners. Theoretically, several local units of governement and homeowner associations can combine under a super private joint venture to take advantage of certain economies of scale, which are available to larger utilities—one of the benefits of RMEs.
- **Cooperatives**: In essence, a cooperative is a business that is owned and democratically controlled by the people who use its services and whose benefits are derived and distributed equitably on the basis of use. Members of a cooperative benefit in two ways in proportion to the use they make of it. First, the more they use the cooperative, the more service they receive. Second, earnings are allocated to members based on the amount of business they do within the cooperative. Although this has some benefit for individual homeowners, cooperatives can provide a substantial incentive to commercial waste producers within the service area. In 1997, legislation was enacted in Minnesota for the creation of two water quality cooperatives as a pilot study. In addition, several rural electric cooperatives across the country have begun, or are planning to begin providing wastewater services. This is an extremely promising development on which considerable research is being performed.
- **Private/Individual Owners**: Homeowners, businesses, campgrounds, resorts, etc., utilize a wide range of wastewater technologies. The most common technology employed is the conventional septic system; however, depending upon site conditions and requirements to protect the receiving stream, advanced treatment technologies may be required. Therefore, the level of management, operation, and maintenance required to operate these systems varies and may be performed by the private entity/individual, or they may be contracted to a service provider.

Decentralized Systems and Regulatory Oversight

Historically, regulatory oversight of decentralized wastewater systems has been difficult. Some reasons for this include the following:

- Regulators lack the resources necessary to inspect all of the decentralized wastewater systems in their jurisdictions, including conventional septic systems, currently in use. Therefore, a form of regulatory triage has been instituted based on risk assessment, where the larger and potentially more threatening waste generators receive the highest level of attention. In this hierarchy, smaller, decentralized systems as well as onsite systems often receive the lowest level of attention. It should be noted that this perception has been changing recently as regulators begin to realize the cumulative impacts of failing decentralized wastewater systems on surface and groundwater resources.
- Decentralized wastewater systems are often owned and operated by private groups or individual citizens. Because of personal property rights and invasion of privacy issues, it is generally more difficult to regulate a private individual

than it is a publicly owned utility, for example.

- Regulation of decentralized wastewater systems has historically fallen to local units of government, which often lack the resources necessary to implement an effective regulatory program for these systems.
- Septic system contractors, pumpers, and fabricators have powerful industry groups who lobby against further regulation of the sector—a perceived encumbrance for many industries.

Lack of an Economy of Scale for Decentralized Systems

The greatest problem preventing adequate technical, managerial, and financial capacity in decentralized wastewater systems appears to be the lack of an economy of scale. Basically, some of the costs associated with technical, managerial, and financial capacity do not scale downward in proportion to the user base.

For example, two utilities, one with 1,000 users and the other with 1,500, may be required under their National Pollutant Discharge Elimination System (NPDES) permits to follow the same monitoring and reporting programs. In the case of the smaller system, the fixed costs for monitoring and reporting must be spread over a smaller user base.

Since the goal of any utility is to provide a reliable service at a reasonable cost, and since there is an upward limit to how much a utility can charge for a service, less of the budget in the smaller community will be available for the funding of other needs (i.e., technical, managerial, and financial capacity). This upward limit is known as affordability, and is based on actual system costs, market factors, and regulatory price controls.

From the existing regulatory perspective, not much can be done to improve this situation since limited requirements currently exist mandating a certain level of maintenance or funding. Instead, the possibility of sanctions related to a sewage spill, for example, provide an indirect incentive for funding adequate preventive maintenance. Therefore, a type of risk analysis, whether conscious or subconscious, is often performed by communities whereby higher user rates must be balanced against the potential costs associated with system failures.

As a result, problems associated with a lack of preventive maintenance will typically accumulate over time until a catastrophic failure occurs. At that point, massive amounts of state and federal financial aid, if available, may be necessary to correct the problems.

The most obvious solution, it would seem, is to increase the economy of scale for the utility. In some cases, this is termed regionalization. In traditional regionalization, two or more neighboring communities will cooperate in the construction, operation, and maintenance of a treatment facility. However, this still requires that the collection systems be interconnected to transport wastewater to the treatment facility. And, depending on the density of service connections, this may or may not be the most economical method for addressing the need.

It should be noted that the cost of collection lines can be as high as 80 percent of the total cost of a conventional wastewater system. Decentralized wastewater systems avoid this cost by treating and diposing/reusing the wastewater at or near the point of generation.

In the case of decentralized wastewater systems, the RME takes a step back and views the service area from a broader perspective. In this case, the entire decentralized system may consist of several small conventional centralized systems serving the “high density” developments as well as several cluster and onsite systems serving the “low density” developments. The key difference is that the high costs of interconnecting all users on a common collection system are avoided by choosing the most appropriate and economical system based on development density, site conditions, and waste characteristics.

In conclusion, the goal of the RME is to combine several smaller systems under a centralized management entity to provide management, operation, and maintenance and to create technical, managerial, and financial capacity. The net effect being the potential cost savings resulting from the use of appropriate decentralized wastewater system technologies and the increase in economy of scale. In the case of the Stevens County PUD, the case study featured in this article, this results in the ability to provide adequate technical, managerial, and financial capacity and a higher level of protection to the public and the environment.

Responsibility and RMEs

The two previous discussions deal both directly and indirectly with the issue of responsibility, the most important characteristic of an RME. From both a public policy and a regulatory perspective, the RME must agree to be legally, financially, and ethically responsible for the protection of the public health and the environment. Therefore, the choice of the word “responsible” in RME was not accidental and has many implications.

Currently, there are several types of entities that have “responsibility” for the management of wastewater systems (see list of common RMEs on page 26). As stated earlier, some of these entities act responsibly, have adequate technical, managerial, and financial capacity, and comply with existing regulatory standards. The opposite, unfortunately, can be said for others.

However, there is another side to the term responsibility, which deals with the ability of an entity to make responsible management decisions. In both small and large communities that own and operate a utility, local politics often have an undue influence on the ability of the system managers to make responsible decisions. As will be pointed out in the Stevens County case study, the smaller communities have a difficult time collecting fees and delinquent accounts from their neighbors. In addition, the politics of these small utilities will often become the topic of heated debates at the local coffee shop.

As a result, smaller systems can have a much more difficult time in making the right choices when it comes to critical issues such as rates, preventive maintenance, and capital depreciation. This has led the authors to develop the following observation:

> The ability of an entity to make responsible decisions is proportional to the size of its political universe.

In essence, the smaller the user base and the closer system managers are to their customers, the more difficult it can be for an entity to make responsible decisions such as raising rates. It should be noted that this phenomenon exists in both small and large communities. What is argued here, based on the experience of the authors, is that smaller communities have more challenges to overcome in the process. For example, most small communities have part-time mayors, city councils, and administrators who must perform multiple and diverse functions. Whereas a larger community can afford full-time paid staff to deal with such complex issues as regulatory compliance and finances.

The result of this lack of responsibility can often have extremely adverse effects. In one such case, a small town in Minnesota had not raised sewer rates in 30 years. Instead, increased costs from inflation were charged to the city's general fund. In 1999, the city's wastewater plant failed requiring a $2 million rehabilitation project. The city had no capital reserves set aside and had not been performing any routine preventive maintenance—even though the size of the community provided for adequate capacity to do so. The entire goal of the wastewater utility board over its 30-year life, it seemed, was to subsidize user rates and avoid political controversy. The cost of these repairs, in the interest of public and environmental safety, eventually fell upon the state and federal taxpayers.

Clearly, the inability of the community to effect responsible decisions caused or, at a minimum, aided in the failure of this system. It can also be argued that larger communities are just as susceptible to similar problems. What is different, however, is the resulting need for massive public assistance in the form of grants since large communities (i.e., population greater than 10,000) are not eligible for Rural Development grants. Further, larger communities, through economies of scale, have higher levels of affordability for debt. Therefore, the larger community's financing options are limited and would most likely consist of market rate bonds or the state revolving loan fund. Because of this, smaller communities appear to have less of an incentive to fund preventive maintenance and depreciation.

As can be seen by the following case study, the other critical need in responsible decision making is the ability to pay for qualified management and operations staff. As pointed out earlier, small cities often lack qualified individuals who are willing to basically volunteer their time to manage the utility. Further, even if adequate funding existed, many rural areas cannot locate qualified staff.

Again, the authors argue that RMEs are the solution to these problems.

Stevens County Public Utility District: A Case Study

This case study presents a mechanism for the management, operation, and maintenance of both water and decentralized wastewater systems under an RME. The RME is Stevens County Public Utility District, which is located in Washington State just north of Spokane.

Public Utility Districts in Washington

Public utility districts (PUDs) in Washington State are specifically authorized by Title 54 of the state code originally passed in the 1930s. Title 54 allows for the formation of a PUD by a vote of the people in any part of the state. Once formed, PUDs are empowered to provide electric, water, and wastewater services, usually in a countywide area. The law, however, does allow a PUD to operate "within or without its limits."

There are currently 28 PUDs in Washington. Of these, 23 provide electricity, 14 of which also provide water and/or wastewater services. The remaining five PUDs provide only water and/or wastewater services. They are:

- Jefferson County PUD
- Skagit County PUD
- Stevens County PUD #1
- Kitsap PUD
- Thurston County PUD

Stevens County PUD

Stevens County PUD encompasses the entire county plus a small portion of Spokane County that was annexed into the boundaries by election in 1987. The total area served by Stevens County PUD is approximately 90 miles long by 30 miles wide. The countywide population in 1990 was 30,948. It is a mostly rural area and includes a number of small cities and unincorporated areas. Incomes in the county are modest, unemployment is relatively high, and a higher-than-average percentage of the population is over age 62.

The southern portion of the county serves as a bedroom community to Spokane and, therefore, is more affluent. In general, economic conditions decline the further north one travels.

The Stevens County PUD does not have the exclusive right to provide water and wastewater service throughout the county. Rather, it can be viewed as an overlay district that can provide these services to any entity that requests them. To fill the gap, numerous cities and HOAs within the county also provide water and wastewater service.

Table 1 provides a summary of the satellite water and sewer systems managed by the Steven County PUD and the number of accounts in each system. The accounts are primarily residential and small commercial/industrial accounts.

Stevens County PUD as an RME

This section will provide a detailed example of how the Stevens County PUD has achieved the necessary elements of capacity development, as defined in this paper, which would lead to their status as a potential RME. Specifically, this section will show how the PUD has developed the technical, managerial, and financial capacity to operate the 14 water and five wastewater systems in their jurisdiction.

Table 1

Summary of Satellite Water and Wastewater Systems

Number of Accounts

System Name	Water	Sewer	Total
Loon Lake	638	0	638
Addy	81	0	81
Waits Lake	262	294	556
Suncrest	1083	0	1083
Spokane Lake Park	67	0	67
Long Lake	354	0	354
Riverside	52	0	52
Clayton	130	120	250
Deer Lake	638	837	1475
Panorama Lake	25	0	25
Jump Off Joe	64	0	64
Westshore	138	0	138
Halfmoon Ranchos	73	0	73
Valley	72	77	149
Blackstone	0	9	9
Total	**3,677**	**1,337**	**5,014**

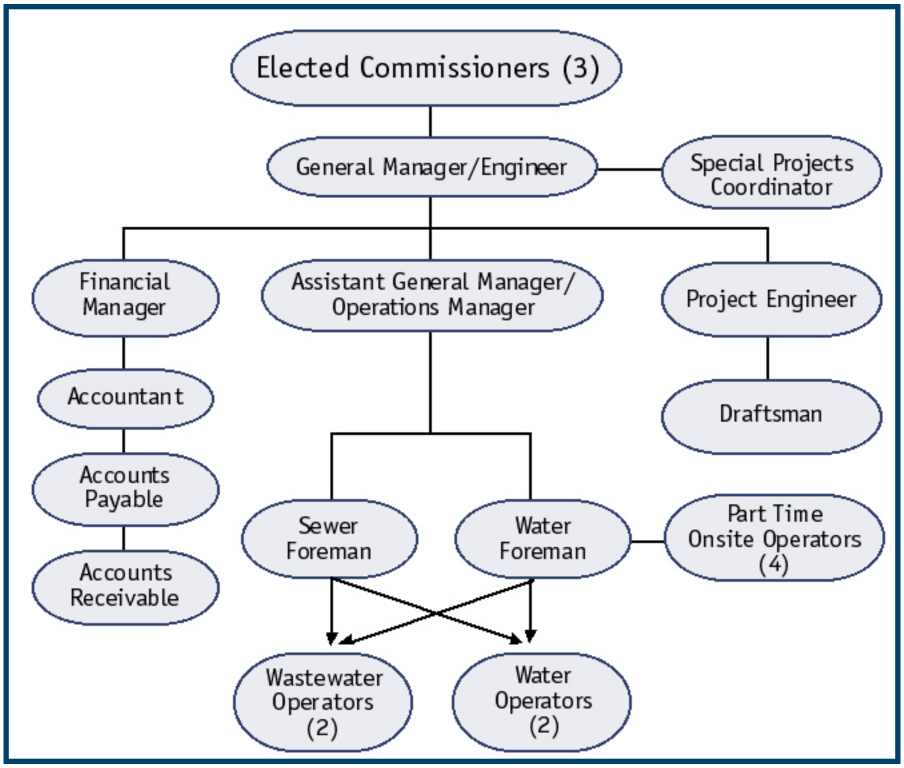

Figure 1

Stevens County Public Utility District Organizational Chart

Managerial Capacity

The clearest way to show the managerial capacity of the Stevens County PUD is by reviewing their organizational chart (see Figure 1).

A three-member board elected by residents living within the legal boundaries of the district has overall managerial and financial control of the Stevens County PUD. A general manager, in this case, a professional engineer registered in the State of Washington, is retained by, and reports directly to, the board. The financial, operations, and engineering staff report directly to the general manager. The financial management staff includes one certified government financial manager, one certified management accountant, and a special projects coordinator.

The special projects coordinator assists the general manager and staff in securing and managing loan and grant applications. This special projects coordinator is a unique and critical position within the district that provides for the planning and funding of existing system improvements/replacements as well as future development that may be incorporated into the system.

With respect to operations, there is a separate foreman for both the water and wastewater systems. These foremen work for the operations manager who also handles new hookups. Each of the foremen has two designated system operators. However, these operators are cross-trained to work on either water or wastewater systems, depending on the need. In addition, there are four part-time water operators who are responsible for the operation of the water systems that are located furthest from the Stevens County PUD's central office.

Financial Capacity

Table 2 is a summary budget showing the planned 1999 revenue projections and expenses for all systems operated by the Stevens County PUD and its administration.

Improvements to the various systems can be funded by the creation of local utility districts (LUDs). LUDs are authorized in Washington State as a financing mechanism used to repay bonds used in financing the improvements. The LUDs are incorporated as subdistricts of the Stevens County PUD. An assessment is levied against all parcels in an LUD that benefit from the improvements, including vacant parcels that will receive service at some time in the future.

When an LUD is created, and an assessment lien is filed against a property, the lien can be paid off at any time, or it can be billed annually. This annual billing is separate from the monthly billing for management, operation, and maintenance costs.

In cases where revenue bonds or other state or federal grant and loan funds are used for general system improvements, no assessments are made. Instead, the debt service is built directly into the user rates and billed on a monthly basis.

To accomplish this, separate accounting is maintained for each of the wastewater systems and for four of the water systems. All other water systems are part of LUD #60—Water Pool.

A separate account, titled PUD Administration, is established for those administrative costs common to all utilities. These costs are apportioned to each LUD based on an hourly overhead charge added to each employee's wages and benefits. The PUD Administration is considered the "parent company" and employs all personnel, owns and maintains all equipment, and owns the main office and shop facilities.

While this system of accounting is extremely fair and insures that customers in one system are not subsidizing customers in other systems, the bookkeeping and accounting does become rather complicated.

Technical Capacity

Technical capacity is a function of not only the expertise of the staff, but also a function of the type of water and wastewater systems installed. The staff's technical expertise is demonstrated by the fact that the Stevens County PUD has two licensed engineers and six certified operators on staff. Table 3 summarizes the various technologies in use for the different water and wastewater systems.

As can be seen, a wide range of technologies is employed by Stevens County PUD. While all water systems utilize wells (a total of 35) as a source, a wide variety of chemical treatments are used. Corrosion control, iron removal, and iron and manganese sequestering are utilized, as appropriate, depending on the chemistry of the individual source water.

A similar variety of simple technologies are used with respect to

Table 2

1999 Budget Summary

1999 Budget

Description	Revenue	Expenses
LUD#12- Clayton	$41,770	$53,932
LUD#13- Deer Lake Water	$165,602	$179,741
LUD#80- Deer Lake Sewer	$159,370	$292,360
LUD#19- Halfmoon Ranchos	$33,707	$47,163
LUD#20- Valley Water	$24,910	$37,636
LUD#21- Echo Estates	$0	$0
LUD#22- River Park Estates Water	$0	$1,000
LUD#60- Water LUD Pool	$929,222	$798,926
LUD#81- Clayton Sewer	$120,342	$172,263
LUD#83- Waitts Lake Sewer	$167,288	$130,133
LUD#84- Valley Sewer	$43,736	$33,967
LUD#85- Echo Estates Sewer	$0	$0
LUD#86- Blackstone Sewer	$1,836	$3,083
Total PUD Admin	$214,482	$173,862
Total	**$1,902,265**	**$1,924,066**

*Note: Water LUD Pool includes all water utilities except: Clayton, Deer Lake, Halfmoon Ranchos, Valley

wastewater treatment systems. Primarily, lagoons and recirculating sand filters are used for treatment. Land application, through pressure drainfields and spray irrigation, is the primary means of effluent disposal. In addition, an intermunicipal agreement was negotiated with another agency for treatment of the Deer Lake system.

One interesting aspect of all the wastewater collection systems is that they are effluent-only systems, either gravity or pressurized. The Stevens County PUD owns and operates all of the septic tanks. So, from the homeowner's perspective, these effluent-only systems have the appearance and function of a conventional system and, the homeowner does not have to deal with the operation and maintenance of septic tanks.

This use of appropriate decentralized technology to meet the individual needs of the various systems results in a cost-effective treatment regime. This is the definition of a decentralized utility system as utilized by RMEs and, therefore, is the clearest demonstration of Stevens County PUDs technical capacity.

Fiscal Management

As demonstrated earlier, one of the critical elements in setting up this type of decentralized RME pertains to the fiscal management of the entity—both initially, during the start-up phase, and during its continuous operation. The start-up phase is particularly critical since there is only a small customer base that cannot generate sufficient revenues for a professional management organization.

Start-Up Phase

The history of the Stevens County PUD is unique but does address the fundamental issue of how to fund the start-up of a new decentralized wastewater management system. The Stevens County PUD was established in 1936 and first began providing service in 1939 when the Burlington Northern Railroad turned over an existing water system to the City of Addy.

In 1952, the Stevens County PUD was given the Rural Electric Authority electric utility that served the northern portion of the county. In 1955, this electric utility was sold to an investor-owned utility, the Washington Water Power Company, for approximately $250,000.

No further changes were made to the structure of the PUD until two water systems were added, one in 1978 and the other in 1980.

In 1982, the current general manager was hired and a period of rapid growth occurred. At that time, the $250,000 had grown, with interest, to approximately $400,000.

Funding to support the general manager and the PUD during this initial phase came from two sources. The first was the funds available from the sale of the electric utility which served as seed capital to "jump-start" the RME. Second, the general manager was a licensed professional engineer, which allowed all engineering for system improvements to be performed internally. As a result, a portion of the general manager's salary, as well as other staff, was paid by using funds from levies, assessments, loans and grants procured for the development of the individual capital improvement projects.

In addition to the financial impacts of start-up, it is necessary to understand the motivation of the customers. With respect to the water systems, the factors that led to their consolidation under a single management entity included the following:

- Members of local homeowners associations and utilities became tired of running the systems—especially having to collect fees and delinquent accounts from their neighbors.
- Smaller systems inherently have a more difficult time in securing capital for repairs and improvements. In addition, privately owned systems are not eligible for federal and state loans and grants.
- When funding could be obtained, the utilities found it difficult and expensive to manage the improvements. As a result, volunteers who lacked proper training and experience had to manage these programs.
- Smaller systems, which lacked any economy of scale, had a difficult time meeting new rules while keeping rates manageable.

Operational Phase

The financial issues that must be dealt with during the operational phase are very different than those that must be dealt with during the start-up phase. Essentially, there are two fundamental challenges facing the RME during the operations phase:

- Control the overall costs of the utility.
- Provide separate cost accounting for each decentralized LUD, when appropriate.

This is relatively simple to do with respect to capital construction, depreciation, and operation and maintenance costs. It is much more difficult when attempting to account for the costs of centralized management.

To accomplish this, the Stevens County PUD chose to separate costs for the daily operation and maintenance of the decentralized LUDs from

Table 3

Water/Wastewater Systems Summarizes Characteristics

Water Systems

Name	Source	Treatment	Approved Connections
Loon Lake	5 Wells	Chlorine Disinfection & MN Sequestering	1084
Addy	2 Wells	Chlorine Disinfection & Polyphosphate Corrosion Control	115
Waits Lake	2 Wells	Chlorine Disinfection	302
Suncrest	5 Wells	Chlorine Disinfection	1085
Spokane Lake Park	2 Wells	Chlorine Disinfection	99
Long Lake	2 Wells	Chlorine Disinfection	940
Riverside	2 Wells	Chlorine Disinfection	72
Clayton	2 Wells	Chlorine Disinfection	150
Deer Lake	2 Wells	Chlorine Disinfection & Polyphosphate Corrosion Control	650
Panorama Lake	1 Well	Chlorine Disinfection & FE Removal	58
Jump Off Joe	2 Wells	Chlorine Disinfection	74
Westshore	2 Wells	Chlorine Disinfection	218
Halfmoon Ranchos	4 Wells	Chlorine Disinfection	153
Valley	2 Wells	Chlorine Disinfection	99

Sewer Systems

Name	Collection System	Treatment	Design Capacity	Final Disposal
Deer Lake	Effluent Only	None	N/A	Treatment by Loon Lake Sewer
Clayton	Effluent Only	Recirculating Sand Filter	50,000 gpd	Pressurized Drainfield
Watts Lake	Effluent Only	Aerated Lagoon (Includes Valley)	105,000 gpd	Circle Irrigator
Valley	Effluent Only			
Blackstone	Effluent Only		14,400 gpd	Pressurized Drainfield

the cost of centralized management of the PUD. As a result, individual accounts were created for most LUDs, allowing capital and depreciation expenses to be allocated directly.

The PUD then developed a job accounting system, which is used in conjunction with daily timesheets. As such, the operation and maintenance staff records both the amount of time and the type of work performed (usually a numeric code) on a particular LUD or a construction/improvement project. Central office management staff and commissioners similarly bill work that is directly related to a specific LUD or project.

In addition, rental rates were developed for individual pieces of equipment so that operation time and the type of work performed, using a similar numeric code, is recorded and charged to each LUD or project.

Electricity, parts, equipment and other consumable supplies are also charged to specific LUDs or projects directly.

Finally, as stated earlier, a surcharge or overhead is added to the hourly billing rate of the operators, office staff, commissioners and equipment to compensate for the costs of centralized management that are not directly billable. This allows for separate accounting and billing of centralized management costs directly under the PUD administration (parent company) account. These costs include, but are not limited to:

- billing and accounting;
- office and equipment/yard costs;
- general manager, office staff, and commissioner expenses that are not directly related to any LUD or project;
- Taxes, intergovernmental expenses, levies and fees;
- office supplies;
- organization dues and subscriptions;
- postage and telephone;
- employee training; and
- physical plant depreciation.

Stevens County PUD: Comments

In the authors' opinion, the Stevens County PUD clearly demonstrates adequate technical, managerial, and financial capacity and, therefore, should be categorized as an RME. Lessons that can be learned from this case study include the following:

- There is more to utility management than operation and maintenance. It requires significant technical, managerial, and financial capacity.
- The managerial and financial skills required are independent of the utility service provided.
- A critical mass must exist to develop adequate technical, managerial, and financial capacity. This critical mass is a function of population density, decentralized wastewater system technologies employed, requirements of the receiving stream (effluent limits), and level of service provided.
- Economies of scale, with respect to both costs and use of limited human resources, can be created.

RMEs can be capable of more responsible decision making by separating the decision making process from local politics (increasing the political universe within which decisions are made) and by developing, through economy of scale and proper use of decentralized wastewater technologies, the economic resources necessary to fund qualified staff. This, in return, should have a direct positive effect on the ability of an RME to provide adequate technical, managerial, and financial capacity.

Technical, Managerial and Financial Capacity—The Critical Mass Argument

Affordability and Critical Mass

The goal of any business is to provide a quality product at a price that is comparable to, or preferably less than, similar products. RMEs must also strive to achieve this goal—if not for market driven reasons, then as a public service entity. However, RMEs must also collect sufficient revenues

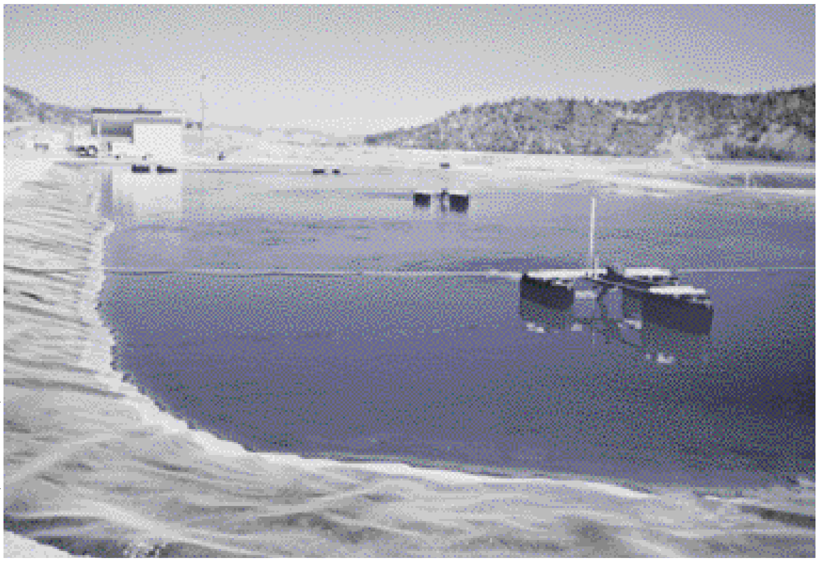

Photo courtesy of Stevens County, WA, PUD.

The Stevens County PUD employs a wide range of treatment technologies, such as the Waitts Lake sewer treatment plant lagoon with aerators (shown above).

to develop adequate technical, managerial, and financial capacity.

In most cases, this is extremely difficult due to an existing sense of entitlement resulting from two causes. First, utility rates are often subsidized through external means. Second, massive amounts of federal and state grants have historically been available to offset construction costs. In forwarding the RME concept, the authors have set as one of the critical goals the ability to reduce the amount of federal or other subsidies necessary to fund utility infrastructure and, thereby, reduce the cost to taxpayers.

The authors argue, therefore, that RMEs have the capacity, through economies of scale, to charge the true cost for service that is defined as:

> The cost of management, operation, and maintenance necessary to provide sufficient technical, managerial, and financial capacity including the ability to fund capital depreciation through effective asset management.

As stated earlier, however, there is an upward limit to the amount an RME can charge for service that is known as the affordable rate. In its simplest form, the affordable rate can be defined as the rate at or below that which the market can bear. More realistically, the affordable rate is tied directly to household incomes, local commerce and property values. In an effort to avoid these complications, Rural Development uses a method for determining affordable rates known as similar system rates, which is defined as:

> The cost of providing a similar service that is charged by a utility within the same geographic area and with the same demographic as the RME.

Therefore, when an RME develops a rate structure, it must first take into account the true cost of providing the service and then compare that to similar system rates. This results in the RME having to work within a rate band, which can differ depending on the location and demographic.

In some cases, especially during start-up when the number of users is low, the RME may not be able to adequately fund the true cost. Therefore, value decisions must be made on where and how resources will be expended.

However, if there is a sufficient number of users on the system to create a reasonable economy of scale, then the RME can charge at the similar system rate and cover all of the true costs of managing, operating, and maintaining the system. This "sufficient number of users" is termed the critical mass and is defined as:

> The number of billable accounts required to create an economy of scale such that the true cost of management, operation, and maintenance and provision of sufficient technical, managerial, and financial capacity (including the ability to fund capital depreciation) can be charged at an affordable rate.

When studying similar system rates, the RME must take into account several factors. For example, rates charged by a similar system may be artificially low due to regulation by a PUC or, as demonstrated earlier, subsidization at the local political level. Therefore, the RME must first categorize similar systems into three distinct categories:

1. **Non-Subsidized Systems**: All of the true costs for management, operation, and maintenance of the system are accounted for and directly billed to the end user. This system would be an RME by definition.
2. **Directly Subsidized Systems**: The management entity utilizes revenues from sources other than utility billings, assessments and/or levies to offset true costs. For example, a small town in Minnesota subsidizes its wastewater system through revenues generated by the city-owned liquor store.
3. **Indirectly Subsidized Systems**: The management entity utilizes assessments and/or levies to offset the operation and maintenance portion of true costs. In effect, the utility users are eventually paying for the true cost, albeit indirectly, and, therefore, the accounting becomes somewhat convoluted. This is very different than the conventional use of assessments to pay for capital improvements, which is a necessary tool for RMEs.

The reason it is important to consider these three categories is the perception the public has regarding what the true cost for a service is—in the end, a large component of affordability. For example, in the case of an existing utility that is directly subsidized, it is extremely difficult for new management (i.e., a newly elected city council) to raise rates to the level of true costs. The result is that the system continues to suffer from a lack of technical, managerial, and financial capacity.

In the case of nonsubsidized and indirectly subsidized systems, system managers may have a better chance of raising rates to reflect true costs since most reasonable people will quickly recognize that they are paying the same amount for service—whether it is through monthly fees or taxes.

In either case, it is extremely difficult for small systems to develop sufficient revenues for funding adequate technical, managerial, and financial capacity. However, RMEs could be in a position to assist all of these systems in achieving that goal. In short, RME's are capable of funding true costs at a similar system rate through the increase in economy of scale resulting from the consolidation of several of these systems, as well as through the cost savings generated from the use of appropriate decentralized wastewater system technology.

The following is a short list of other direct and indirect benefits:

- increased economic development and quality of life;
- the ability to fund preventive maintenance and capital depreciation which results in a lower need for federal and state subsidies;
- a simplified regulatory regime, whereby there is a single permit holder and a single responsible entity;
- The freeing-up of capital resources, otherwise used to subsidize the utility, for other important community needs;
- The ability to implement smart growth policies by controlling low-density development by using appropriate decentralized wastewater management technologies.

Financial Capacity and RMEs

Second in importance only to responsibility is the capacity for an RME to use generally accepted accounting principles (GAAP) in managing its finances. This may sound like an obvious requirement; however, one would be surprised at the lack of compliance. In short, an RME, in an effort to develop financial capacity, must account for and recover the cost of everything.

There are many reasons why small systems do not follow GAAP. The first is the size of the budget. For example, a small decentralized wastewater system may have an annual revenue stream less than $50,000 (compare this to the $2 million budget managed by the Stevens County PUD). The reality is that it does not take a complicated accounting system to manage a small budget.

In addition, smaller budgets based upon smaller economies of scale do not have the depth to cover expenses other than actual costs. Actual costs are those expenses that must be dealt with on a daily basis and are typically limited to operations, utilities, compliance and expendables (chemicals, supplies, etc.). Missing from this list are several very important components of technical, managerial, and financial capacity, including capital improvements planning, preventive maintenance, replacement, capital depreciation, asset management, debt reserves, and capital reserves—the so-called true costs.

In other cases, a system may have the financial resources necessary to fund most of the requirements for technical, managerial, and financial capacity but may lack the expertise necessary to manage them. One of the key benefits of RMEs is the ability to develop and fund a staff of experienced financial managers. In the case of Stevens County PUD, with a relatively small annual operating budget, they are able to fund several experienced financial professionals (refer to Figure 1). As a result, this staff has the ability to address complex financial issues, such as the management of a diversified loan portfolio and the requirements of GAAP.

Again, through consolidation of several decentralized systems, an RME can develop sufficient economy of scale to keep rates affordable while funding a qualified financial staff. It will be demonstrated that the same is true for managerial and technical staff.

Managerial Capacity and RMEs

There are three key elements to managerial capacity:

1. the ability to make responsible decisions,
2. the employing of qualified managers, and
3. the type and structure of the entity.

In the case of employing qualified managers, the same argument holds true as for funding other positions (i.e., a larger entity with economy of scale has the capacity to fund these positions).

This leaves the issue of RME type and structure. Several common types of management entities were described earlier in this article. In theory, any and all of these structures could be an RME. However, of these structures, there are two that can most easily provide adequate technical, managerial, and financial capacity while being able to make responsible decisions. These are publicly owned utilities as utility districts and cooperatives.

The key advantages of these two structures are:

- users have the ability to elect commissioners and board members providing for direct representation,
- these structures allow for the entity to legally cross political boundaries of local units of government,
- the entity is politically separated from other units of government, and
- these structures are generally recognized by regulatory and funding agencies as legal entities eligible to hold NPDES permits and receive state and federal assistance (Revolving Loan Fund, etc.).

To a lesser extent, private joint ventures are also a viable option and can be used in combination with the above two structures. For example, an RME may develop a private joint venture with a local septic pumping firm for pumping and other services. The following are additional advantages for forming private joint ventures:

- existing contractors are a ready source of qualified personnel, equipment, and experience;
- especially during start-up, private joint ventures allow for the delivery of operation and maintenance services without taxing the budget for personnel and capital equipment;
- existing contractors have the permits and resources necessary for the legal disposal of biosolids; and
- contracting for services can add to the economy of scale and lower the cost of operation.

In short, consideration must be made of the structure of the RME with the primary emphasis being the ability to increase technical, managerial, and financial capacity.

Technical Capacity and RMEs

There are two critical areas related to technical capacity. The first is the ability of an RME to employ qualified technical positions. In terms of hiring and maintaining qualified personnel, the same argument that's made under financial and managerial capacity holds true (i.e., economy of scale allows for their funding).

In reality, it can be said that having technologically capable staff is nothing new to the wastewater field. What RMEs do bring to the table—the second important factor—is the ability to utilize a broader range of wastewater technologies.

In general, decentralized wastewater system technologies can be separated into three categories:

1. **Individual Sew age Treatment Systems**: Individual or onsite sewage treatment systems generally serve single family residences or small businesses. The average home will produce about 75 to 100 gallons per capita per day (gpcd) of waste-

water flow. This means that an individual system generally receives 500 gallons per day (gpd) or less of wastewater. Individual sewage systems generally consist of a septic tank to remove solids and some form of soil based treatment/disposal. However, in areas where conventional soil based systems do not perform well, an onsite system may utilize advanced pretreatment and, in rare cases, surface discharge.

2. **Cluster Sewage Treatment Systems**: Cluster systems typically serve two or more homes that are connected by a conventional or effluent collection system. Typical daily flows for a cluster system range between 1,000 to 50,000 gpd. As in the case of individual onsite systems, cluster systems generally consist of a septic tank to remove solids—either individual tanks or a large community tank—followed by some form of soil-based treatment/disposal. Again, in areas where conventional soil-based systems do not perform well, a cluster system may utilize advanced pretreatment and even surface discharge.
3. **Conventional Centralized Systems**: Conventional wastewater systems are typically suited for high-density areas (i.e.,distance between service connections is less than 150-feet and on both sides of the road). Conventional systems typically consist of a gravity collection system that transports both the liquid and solid components of the waste to a central treatment facility. Treatment of the waste is performed using a wide array of technologies including biological filtration, stabilization ponds and mechanical treatment plants (extended aeration, sequencing batch reactors, etc.). Disposal of the treated wastewater is typically to a surface-water or through land application (spray irrigation).

An RME will most likely manage all of these categories within their service area. As such, an understanding of the proper selection of technologies is critical. Therefore, when choosing a wastewater technology, several factors must be considered, including, but not limited to:

- **Population**: Both the number of people being served and the density of the population must be considered.
- **Cost**: Typically, the most cost effective technology, in terms of both capital and life-cycle costs, which meets all of the other criteria should be considered.
- **Regulation**: The type of technology chosen must meet the needs of the local regulatory agencies in terms of protecting the environment and the public health.
- **Public Perception**: The community as a whole, both the public and their elected representatives, must buy into the type of technology being proposed.
- **Operation and Maintenance** (including noncost factors): The amount and type of operation and maintenance required would definitely have an impact on the life-cycle cost of a facility. However, issues such as permits, operating certification, operator training, and the location of the facility must be considered. For example, an RME may only have access to level three certified operators. In that case, the RME should not consider a treatment technology that requires a higher level of certification to operate. In addition, the level of knowledge and experience required to maintain complex systems requires years of professional training. These factors should have a direct impact on the selection of a technology.

The ability of an RME to utilize appropriate decentralized wastewater system technology has two beneficial results. The first deals with the ability to utilize systems that are designed based on performance and not prescriptive standards. Further, the wastewater is being treated and disposed/reused at or near the point of generation. This results in a higher level of protection of both public health and the environment.

The second deals with the issue of cost. As pointed out earlier, conventional systems may require substantial investments in collection systems. Decentralized wastewater technologies allow for the elimination of this cost.

In addition, decentralized wastewater systems may be more cost-effective in terms of economy of scale. For example, conventional wastewater systems become more expensive per capita as the population and density declines. RMEs can pick and choose technologies to fit the specific need. In contrast, conventional centralized systems often employ a "one size fits all" approach to wastewater (i.e., centralized collection and treatment).

RMEs are capable, therefore, of drawing from a wider menu of wastewater technologies which are more appropriate for the area being served. These value decisions, in return, add substantially to financial viability. The end result, it is argued, is the ability to charge affordable rates while covering the true cost of the system management, operation, and maintenance.

Conclusion

As pointed out, several barriers still exist that prohibit the full regulatory oversight of decentralized wastewater systems. EPA and state regulators have struggled for decades without success to resolve these problems. In conjunction with the current efforts of the EPA and others, the authors simply argue that RMEs are but one additional viable option.

How, then, do we go about implementing them? One sure method is to mandate their existence through law. However, political realities often prohibit this approach. Therefore, the authors propose a more subtle strategy.

First, regulators must take advantage of existing market forces which aid in the development of RMEs. For example, residential development in rural areas is often low density. This is primarily due to the need for large lot sizes to accommodate conventional septic systems. Developers, however, would jump at the opportunity to increase their profit margin by raising unit density. The historic problem, however, has been the issue of wastewater management.

It is proposed that RMEs would be in a position to work with developers and regulators on creating a more sustainable wastewater management program and create smart growth developments. Since most decentralized wastewater systems require land, this then becomes "green space." Wastewater can be used to irrigate lawns, parks, and commons or to create manmade wetlands and wildlife habitats. At the same time, a mixed higher density development is allowed providing for a better land management policy. In the end, the community benefits from an environmental, public health, and sustainable land use policy perspective while the developer increases his or her profit margin substantially.

For example, many communities currently have land use restrictions that prevent certain high density developments from occurring outside of a line defined as the municipal boundary. This policy is most often based on availability of access to the regional central wastewater system which is a key component to high-density development. As a result, land developers outside of this boundary often resort to low density development due to the larger lot size requirements of onsite wastewater treatment. This then often leads to ineffective land use, commonly termed sprawl.

In contrast, a land use policy may be developed that allows developers outside of the municipal boundary to secure permits for high-density development by contracting for their wastewater management needs through an RME. The result would be the construction of a local cluster wastewater system that allows for higher density development in accordance with smart growth policies. Because of the economic incentive provided to the developer by this alternative, there should result less low-density development and better use of land resources.

From a regulatory perspective, the RME is the responsible management entity versus a homeowner association, for example. It becomes apparent that, in terms of responsibility and technical, managerial, and financial capacity, the RME definitely is the better choice. This should provide some level of comfort to regulators in terms of reducing the risk of failure of a wastewater system due to mismanagement.

Another way in which market conditions may facilitate the development of RMEs is the case of rural electric cooperatives. In fact, rural electric cooperatives have already done for the electric industry what RMEs are proposed to do for the wastewater field. That is, they provide technical, managerial, and financial capacity to low density rural electric users through economies of scale. In the 1930s, this was known as rural electrification. Today, one may consider wastewater RMEs as promoting "rural wastewaterfication."

Further, due to the unpredictable results of deregulation, rural electric cooperatives are looking for ways to diversify services within their market area. As a result, several cooperatives throughout the country have already started providing wastewater management services.

Finally, as in the case of drinking water, the cost of managing wastewater systems and complying with new rules is increasing. This results in higher per user costs due to the lack of economy of scale. In the end, users will mandate from their political leaders that costs be controlled at the affordable rate. It is argued that RMEs provide the solution to this problem.

In short, the benefits of RMEs seem to be obvious and apparent. In addition, there are several ways to initiate their implementation. The goal, in the end, is to develop a long-range strategy that addresses the current problems with decentralized wastewater systems resulting in the development of technical, managerial, and financial capacity.

Finally, it is the recommendation of the authors that additional research (in concurrence with what's ongoing), be performed on existing utilities which operate as RMEs. Primary focus of this research should be to develop economic and business models that can be used by others interested in pursuing this approach.

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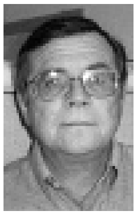

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