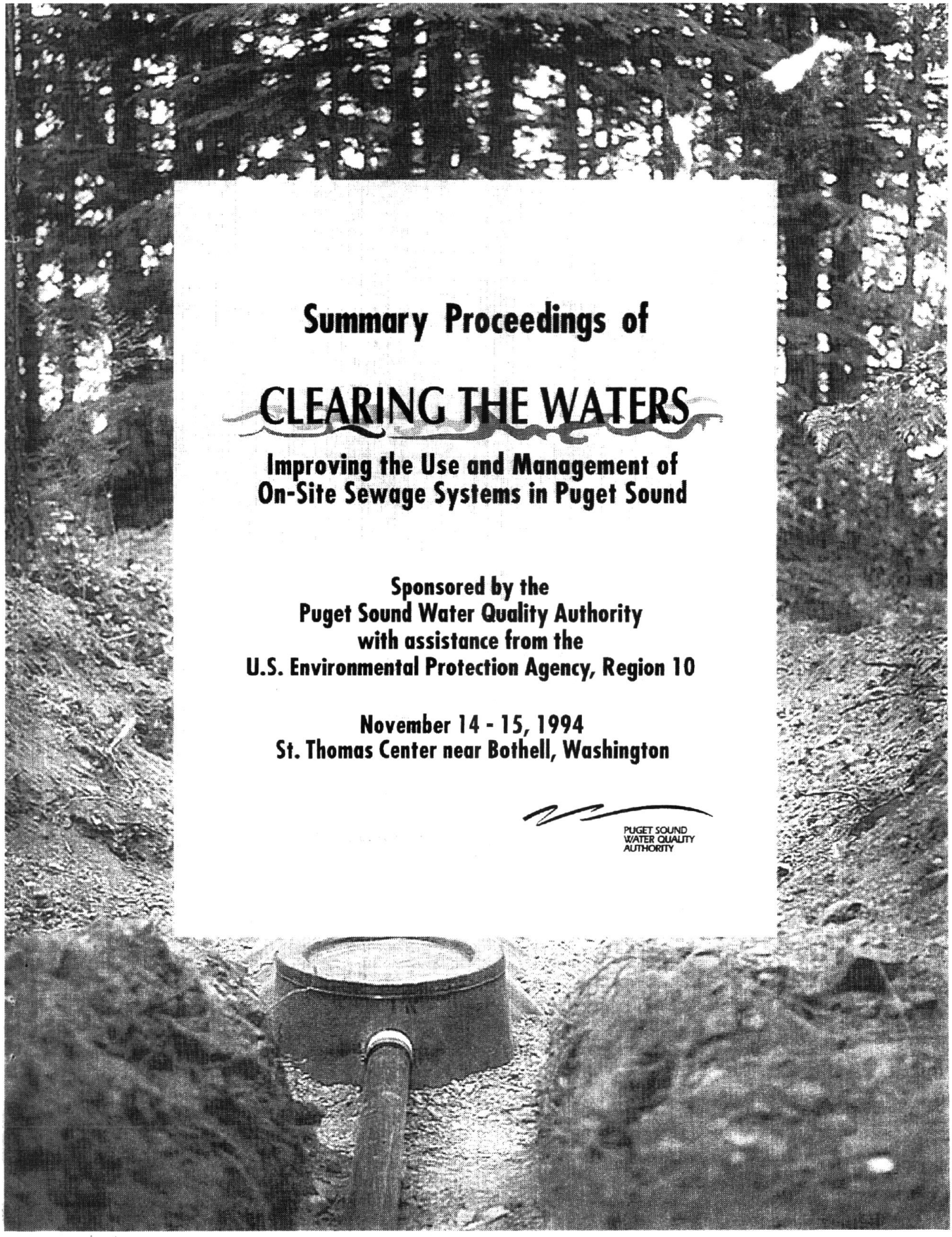

Summary Proceedings of

CLEARING THE WATERS

Improving the Use and Management of On-Site Sewage Systems in Puget Sound

Sponsored by the
Puget Sound Water Quality Authority
with assistance from the
U.S. Environmental Protection Agency, Region 10

November 14 - 15, 1994
St. Thomas Center near Bothell, Washington

PUGET SOUND
WATER QUALITY
AUTHORITY

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Puget Sound Water Quality Authority
P. O. Box 40900
Olympia, WA 98504-0900
(360) 407-7300 or 1-800-54-SOUND

PUGET SOUND WATER QUALITY AUTHORITY

Edited by Stuart Glasoe and Matthew Booker
Layout by Zoe Rasmussen

April 1995

To participants at *Clearing the Waters* and other readers:

How we handle our sewage has long been a difficult issue for the people of Puget Sound. Over time, the issue has brought into question a number of seemingly incompatible needs, such as water quality, land use, public health, recreation, property values, housing and shellfish. Today, because of a large and growing population and increasing reliance on on-site sewage systems, the urgency to reconcile these needs and to improve sewage treatment is greater than ever around Puget Sound.

Clearing the Waters brought together groups and individuals who have differing interests and backgrounds, but who share a common vision about effective management of on-site sewage systems. The conference succeeded in building partnerships and in providing practical information on a number of important topics.

Some key themes and findings emerged over the course of the two-day conference:

- On-site sewage systems are a legitimate method of treating sewage. For many small communities and rural homeowners, these systems provide the only practical means of sewage treatment.

- Individual and community systems should be managed as a component of the public-services infrastructure of local governments.

- Sewage treatment is an important land-use issue, influencing both land-use activities and development patterns. On-site systems should be designed and used in ways that support sustainable land uses.

- When properly sited, designed, installed, operated and maintained, on-site systems provide effective sewage treatment. The mishandling of any of these responsibilities jeopardizes the integrity and value of a system and often results in personal and public liabilities.

- Greater attention must be paid to "life-cycle management" of on-site sewage systems in the Puget Sound basin. We need operation and maintenance programs that recognize local autonomy and that emphasize utility structures, private-sector services, public education and professional training.

- Education and outreach are essential to changing people's habits, which in turn improves the performance of on-site sewage systems. Homeowners will care for their systems if they understand the personal and financial benefits associated with a properly functioning system.

- Training and certification are central to improving competency and the quality of work in the on-site sewage profession. The new training center at Washington State

University, Puyallup, will help to strengthen the standards and expertise of the industry.

- Public funding for sewage projects is generally inadequate and too inflexible to meet the needs of rural homeowners and small communities. Where possible, public funding programs should be adjusted to better support the appropriate use of on-site sewage technologies.

- Successful sewage projects are characterized by collaborative problem-solving involving homeowners (community action), local community leaders (political leadership), septics practitioners (technical expertise), and public agencies (meaningful technical and financial assistance).

- A number of alternative technologies are available for use in the Puget Sound region. However, the appropriate and widespread use of these technologies is hampered by a variety of obstacles, most of which are institutional in nature.

We have made great progress in recent years in areas such as public education, professional training, local regulation, system repairs, monitoring and maintenance, and a variety of other activities—all of which are combining to greatly improve the use and management of on-site sewage systems throughout the Puget Sound basin.

Much remains to be done, and we encourage you to stay involved. Our joint efforts to address these issues will continue to reveal that our needs for clean water, affordable housing, and effective sewage treatment are indeed compatible and attainable objectives around Puget Sound.

Thank you for your help with these issues and your dedication to protecting the valuable waters and resources of the Sound.

Sincerely,

Nancy McKay

Nancy McKay
Executive Director
Puget Sound Water Quality Authority

CLEARING THE WATERS

CONFERENCE PROGRAM

Monday, November 14, 1994

8:00 - 9:00 **REGISTRATION**

9:00 - 9:15 **WELCOME AND INTRODUCTION** *(CEDAR ROOM)*

Nancy McKay, Executive Director, Puget Sound Water Quality Authority
Hugh Spitzer, Vice-chair, Puget Sound Water Quality Authority

9:15 - 10:15 **A NATIONAL VIEW OF ON-SITE SEWAGE TREATMENT** *(CEDAR ROOM)*

What have we learned about the use and management of on-site sewage systems? Have on-site systems emerged as a legitimate "treatment" option?

A. Robert Rubin, Extension Specialist and Associate Professor, North Carolina State University
—Mr. Rubin's keynote address will be followed by audience discussion.

10:35 - 12:00 **REGIONAL PERSPECTIVES ON USE AND MANAGEMENT OF ON-SITE SYSTEMS** *(CEDAR ROOM)*

Are we effectively addressing the many public health, water quality, land use and financial issues associated with on-site sewage systems?

Gerald Emison, Deputy Regional Administrator, Environmental Protection Agency, Region 10
Eric Slagle, Assistant Secretary, Environmental Health Programs, Washington State Department of Health
Larry Ward, Board Member, Building Industry Association of Washington and Washington Building Code Council; President, Kitsap County Home Builders Assoc.
The Honorable Hans Dunshee, Washington State Representative
—Panel discussion involving questions and comments from the audience, moderated by Hugh Spitzer (Vice-chair, Puget Sound Water Quality Authority).

12:00 - 1:00 **LUNCH** *(DINING ROOM)*

1:00 - 2:15 **CREATIVE SOLUTIONS AND APPROPRIATE TREATMENT TECHNOLOGIES** *(CEDAR ROOM)*

What are the main options for sewage treatment? How can we design more creative and practical solutions?

George Tchobanoglous, Professor, University of California, Davis
—Mr. Tchobanoglous' keynote address will be followed by audience discussion.

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PUGET SOUND WATER QUALITY AUTHORITY

Monday, November 14, 1994 (continued)

2:30 - 5:00 **CONCURRENT SESSIONS** *(SESSION A: CEDAR ROOM / SESSION B: AUDITORIUM)*

A. OPERATION AND MAINTENANCE PROGRAMS *(two-part session)*

2:30 - 3:30 Principles and Objectives of Operation and Maintenance Programs

What do the pros say about proper use and maintenance of on-site sewage systems?

Stephen Wecker, Director of Environmental Services, Pac-Tech Engineering
Dave Lowe, President, Dave's Designs; President, WA State Pumpers Association
Bill Stuth, President, Stuth Company; President, WA On-Site Sewage Association

—Panel discussion involving questions and comments from the audience.

3:40 - 5:00 Management Methods for Septic Maintenance Programs

How do the components of a septic maintenance program fit together?

Dave Lenning, Program Manager, Wastewater and Drinking Water Programs, Thurston County Health Dept.
Jim Henriksen, Supervisor, Wastewater Program, Seattle-King County Department of Public Health
Jerry Deeter, Assistant Director of Environmental Health, Bremerton-Kitsap County Health District

—Case studies followed by discussions with the audience, moderated by Bill White (Director, Clallam County Dept. of Community Development).

B. AVAILABILITY AND USE OF ALTERNATIVE ON-SITE TREATMENT TECHNOLOGIES

Are we making use of the best technologies for on-site sewage treatment?

Mark Soltman, Wastewater Management Supervisor, Community Environmental Health Programs, Washington State Department of Health
Larry Fay, Environmental Health Director, Jefferson County Health Department
Donald Strong, President, D. R. Strong Consulting Engineers, Inc.
George Tchobanoglous, Professor, University of California, Davis

—Presentations by panelists will be followed by discussions with the audience, moderated by Robert Seabloom (Emeritus Professor of Civil Engineering, University of Washington).

THE PUGET SOUND WATER QUALITY AUTHORITY WOULD LIKE TO THANK THE MEMBERS OF THE ON-SITE SEWAGE CONFERENCE STEERING COMMITTEE, WHO HELPED ORGANIZE THIS CONFERENCE:

Jerry Stonebridge, Stonebridge Construction Company, Inc.
Craig Cogger, Washington State University, Puyallup Research and Extension Center
Doug Osterman, King County Planning and Community Dev.
Larry Fay, Jefferson County Health Department
Ray Pelzel, Harvest Realty, Inc.
Mike Shelton, Island County Commission
Dave Lowe, Dave's Designs, Inc.
Bill Stuth, Sr., Stuth Company, Inc.
Mark Soltman, Washington State Department of Health
Hugh Spitzer, Puget Sound Water Quality Authority
Stuart Glasoe, Puget Sound Water Quality Authority staff

Tuesday, November 15, 1994

9:00 - 10:20 CONCURRENT SESSIONS *(SESSION A: CEDAR ROOM / SESSION B: AUDITORIUM)*

A. CERTIFICATION OF ON-SITE SEWAGE PROFESSIONALS

What is the status and direction of certification in the Puget Sound region?

Bill White, Director, Clallam County Department of Community Development
Jerry Stonebridge, President, Stonebridge Construction Co., Inc.; Vice-president, Washington On-Site Sewage Association
Mary Jo Adams, Instructor, Water Supply and Wastewater Technology Program, Green River Community College

—Presentations will be followed by discussions with the audience, moderated by Karen VanDusen (Director of Community Environmental Health Programs, WA State Dept. of Health).

B. COST ANALYSIS AND AFFORDABILITY

Do economic factors support the use of on-site sewage systems?

Alan Bushley, Partner, R. W. Beck and Associates
John C. Wilson, Jr., Senior Project Manager, Barret Consulting Group
Cheryl Strange, Water Quality Financial Assistance Program Manager, Washington State Department of Ecology

—Presentations by panelists will be followed by discussions with the audience, moderated by Edward Cebron (Principal, Financial Consulting Solutions Group; Commissioner, Woodinville Water District).

10:40 - 12:00 CONCURRENT SESSIONS *(SESSION C: CEDAR ROOM / SESSION D: AUDITORIUM)*

C. UPGRADING EXISTING SYSTEMS

Do we have effective policies, programs and protocols for identifying failed systems, assisting homeowners and communities, and enforcing corrective actions?

Laura Porter, Mason County Commissioner
Linda Hofstad, Environmental Health Specialist, Thurston County Health Department
Howard Leibrand, Health Officer, Skagit County Health Department

—Presentations by panelists will be followed by discussions with the audience, moderated by Tim McDonald (President, Washington State Public Health Officials; Health Director, Island County Health Department).

D. UTILITIES AND FINANCE MECHANISMS FOR ON-SITE PROGRAMS

What finance tools are available to local governments for their on-site sewage programs?

Hugh Spitzer, Attorney at Law, Foster, Pepper & Shefelman
Katy Isaksen, President, CCAinc

—Presentations by panelists will be followed by discussions with the audience, moderated by Hugh Spitzer.

12:00 - 1:00 LUNCH *(DINING ROOM)*

Tuesday, November 15, 1994 (continued)

1:30 - 3:30 **CONCURRENT SESSIONS** *(SESSION E: CEDAR ROOM / SESSION F: AUDITORIUM)*

E. OPERATION AND MAINTENANCE PROGRAMS *(two-part session)*

1:00 - 2:00 Principles and Objectives of Operation and Maintenance Programs

What do the pros say about proper use and maintenance of on-site sewage systems?

Stephen Wecker, Director of Environmental Services, Pac-Tech Engineering
Dave Lowe, President, Dave's Designs; President, Washington State Pumpers Association
Bill Stuth, President, Stuth Company, Inc.; President, Washington On-Site Sewage Association
—Panel discussion involving questions and comments from the audience.

2:10 - 3:30 Management Methods for Septic Maintenance Programs

How do the components of a septic maintenance program fit together?

Bob Sweeney, Environmental Health Supervisor, Southwest Washington Health District
Joye Bonvouloir, Environmental Health Director, Island County Health Department
Linda Atkins, Environmental Health Specialist, Jefferson County Health Department
—Case studies followed by discussions with the audience, moderated by Stephen Wecker (Pac-Tech Engineering, Inc.).

F. LAND USE AND ON-SITE SEWAGE SYSTEMS

How are the use and management of on-site sewage systems linked with land-use planning, utilities planning, sewage management, and the protection of water resources.

Dick Settle, Professor, Seattle University School of Law
Louise Miller, Councilmember, Metropolitan King County Council
Mike Shelton, Island County Commissioner
Joy Keniston-Longrie, Environmental Programs Division Manager, King County Department of Metropolitan Services
Craig Cogger, Extension Soil Scientist, Puyallup Research and Extension Center, Washington State University
—Presentations by panelists will be followed by discussions with the audience, moderated by Steve Wells (Assistant Director for Growth Management Services, Washington State Department of Community, Trade and Economic Development).

3:45 - 4:15 **CONFERENCE THEMES AND NEW DIRECTIONS** *(CEDAR ROOM)*
Nancy McKay, Executive Director, Puget Sound Water Quality Authority

CLEARING THE WATERS

Improving the Use and Management of On-Site Sewage Systems in Puget Sound

TABLE OF CONTENTS

A NATIONAL VIEW OF ON-SITE SEWAGE TREATMENT

Keynote Speaker

A. Robert Rubin
Extension Specialist and Associate Professor, North Carolina State University

Message

On-site sewage systems have emerged as a legitimate sewage treatment option, reflecting a shift in emphasis from wastewater disposal to wastewater treatment and environmental protection. With the availability of different types of systems, we must select the technology that is best suited to a particular setting. To serve the needs of homeowners and small communities, on-site sewage systems must be effective, reliable, affordable, and flexible. Increased reliance on on-site technologies has created a strong need for management programs that help ensure the proper use and maintenance of these systems.

Keynote Address

References to the handling of wastes can be traced back to biblical history and Greek mythology. Hercules' fifth task, for example, required him to divert a river through the Aegean stables to wash away the manure of 10,000 animals.

Problems with sewage have been with us since we started populating the earth and gathering in small communities. With time, the rise in population centers led to more difficult problems with human wastes. Through the Middle Ages and into recent times, epidemics of disease have resulted from improper wastewater treatment, including the recent outbreak of cholera in Peru in 1993-1994.

Everyone has to have a place where they can manage their wastes—places that are safe and sanitary. The fifth law of thermodynamics says that "everything has to go somewhere." We are placing greater demands on the natural environment every day, and as a result the environment is becoming more and more sensitive. Our charge today is to devise better ways of managing our wastes in these sensitive environments.

On-Site Sewage Regulation in the United States

After World War II, the GI bill came out with the goal of educating people and helping them buy their own homes. The U.S. Public Health Service had some interest in on-site wastewater issues, but their concerns focused primarily on getting rid of the water, not on the protection of public health or environmental quality. Septic systems were not seen as a long-term wastewater management alternative, but instead were viewed as a temporary solution until sewers were available.

It soon became apparent that this philosophy was resulting in high failure rates and other problems, which contributed to the following federal actions in the 1950s and 1960s:

- The Water Pollution Control Act of 1956 (Public Law 84-660) allocated funds for municipal wastewater treatment facilities.
- The U.S. Public Health Service published the *Manual of Septic Tank Practice* in 1957. The manual was modified in 1967 based on research examining soil systems as receivers of wastewater.
- The Water Quality Act of 1965 (P.L. 89-234) established the Federal Water Pollution Control Administration (precursor to the U.S. Environmental Protection Agency).
- The Clean Water Restoration Act of 1966 (P.L. 89-753) instituted better enforcement of environmental laws.

In the 1970s, regulatory and research activities shifted emphasis from wastewater disposal to wastewater treatment and environmental protection. Key milestones during the decade included the following:

- The Clean Water Act of 1972 (P.L. 92-500) provided funds for innovative and alternative wastewater treatment systems. Also in 1972, the U.S. Environmental Protection Agency (EPA) funded research and development activities related to on-site sewage systems.
- The American Society of Agricultural Engineers convened its initial on-site wastewater treatment conference in 1974. The ASAE convened its seventh conference in 1994.
- The Clean Water Act of 1977 (P.L. 95-217) increased local responsibility for wastewater management.

In 1980, the EPA issued the *Design Manual for On-Site Wastewater Treatment and Disposal Systems*, contributing to the current philosophy which stresses "the soil as a treatment system" and the use of engineered soil modifications as a means for enhancing soil treatment. Many states revised their local codes in the early 1980s to emphasize soil-based siting criteria, and replaced "percolation tests" with "site evaluations."

Through the 1980s and early 1990s, these changes have led to greater acceptance of engineered solutions and the emergence of more sophisticated pretreatment and delivery systems. The advances have also heightened awareness of the need for long-term monitoring and management of systems.

Issues and Concerns

With as many as a half-million on-site sewage systems around Puget Sound, these systems combine to form the largest wastewater treatment system in the region. It is not surprising that large inputs from these systems can be very deleterious to human health and environmental quality (e.g., fecal contamination and pathogens, nutrients and algal blooms) as well as property values and aesthetics.

So when we develop on-site sewage systems, what are some of the important considerations? Obviously it is paramount that we protect public health and environmental quality. But we also

have to make sure that on-site sewage systems are reliable—typically homeowners don't manage or maintain their septic systems. The systems have to be efficient and economical—we have to get the best possible treatment for as little investment as possible. And they have to be aesthetically pleasing—no one wants a system that smells.

The systems we develop must also be flexible and have the capacity to cope with changes in waste strength and wastewater flow from day to day. And if we are going to consider long-term use of on-site sewage systems then we have to look more carefully at current and projected land uses, assimilative capacity of the receiving environment, site and soil conditions, and long-term management schemes for these systems. We cannot assume that sewers will be put in eventually, so we need to design and use on-site sewage systems with an emphasis on life-cycle management and sustainable land uses.

Soil Suitability and Groundwater Protection

In order to effectively treat sewage and protect water quality, primary consideration must be given to soil suitability, topography and landscape position. The following are soil properties that we look for in siting an on-site system:

- *Texture*—Determines the rate at which water moves through the soil. A lot of people think that sandy soils provide good treatment because water moves through them quickly, but in fact they are terrible because water moves through them too quickly.
- *Drainage/permeability*—Another factor that determines the rate of water movement.
- *Color*—Provides evidence of where the water table is or has been. We can't treat sewage in saturated soil.
- *Structure*—Tells how the particles hold together. The better the soils aggregate or hold together, without compacting, the better the water movement.
- *Depth*—Ensures adequate contact time and distance within the soil for wastewater treatment.

We have to change our thinking from disposal to protection. It upsets some people when I say this, but the primary resource that we need to protect is groundwater. Because surface water and groundwater are integrally connected, if we protect groundwater then we are also protecting the adjacent surface water. This is very critical in areas where you have shellfish tidelands or shallow, unconfined aquifers in close proximity to homes. Factors that influence or threaten the protection of groundwater include erodible or permeable soils, use of soluble and persistent chemicals, excessive rainfall and irrigation, inadequate vegetation for nutrient uptake, and poor timing or excessive loading of wastewater.

On-Site Sewage Treatment Systems

A variety of on-site technologies are available and in use across the county. These systems either rely on surface water discharge (point source discharge) or land discharge (diffuse or nonpoint discharge). With the availability of different types of systems, we can select the

technology that is best suited to a particular site, soil and receiving environment. The following is an overview of some of the more common options for on-site sewage treatment.

Conventional septic systems—These classic septic tank/gravity drainfield systems have been around a long time, and we have a lot of information about their performance. One thing we know is that these systems do not spread wastewater uniformly across the drainfield.

Alternating trench systems—These systems allow us to move wastewater from one drainfield to another. The system aims to improve treatment by getting more wastewater into the soil, and by allowing one drainfield to rest while the other is in use. These systems are relatively simple, but someone has to turn the valves to ensure proper use of the fields. This is an example of what we mean when we talk about long-term maintenance and management.

Pressure distribution systems—These systems provide better treatment by spreading the wastewater over the entire drainfield through pressurized lines. This allows for better calculations in sizing and designing the systems. It's important to keep surface drainage off the site in order to protect the shallow soil resource where the treatment occurs. Performance can be affected if the systems are not "water tight," so make sure seams and joints are tight and use a single-compartment pump tank rather than a multiple-layer pump tank.

Mound systems—This technology allows us to bring in good soil to construct an elevated drainfield that provides treatment above the original soil surface. Again, it's important that surface water is diverted off the field to make sure that the system does not flood. We also need to do a better job of siting and designing these systems to make sure the wastewater flows properly through the mound and achieves the necessary treatment.

Sand filter systems—These systems pass the wastewater through a filter or bed of sand before discharge to a drainfield. These are simple technologies that provide very good treatment, but it is critical that the systems are properly inspected and maintained. In North Carolina for example, we have a sand filter system treating wastewater from about four or five mobile homes. The wastewater is diverted to a pump tank, discharged onto a drainfield then recirculated back onto the sand filter surface. With this simple system we are getting BOD (biochemical oxygen demand) levels below five, ammonia levels below two, and phosphorus levels below one milligram per liter.

Drip irrigation systems—These systems pump wastewater through a disk filtration system for application onto a drainfield. These systems have been working very well in North Carolina. We've met all the state groundwater standards with shallow drip irrigation systems. We've also used surface irrigation technology extensively on individual residential lots (using sand filter, disinfection, and spray irrigation). Again, it is critical that someone inspects these systems to make sure they are functioning properly. Pretreatment and disinfection are needed in sensitive areas to keep organisms out of shellfish waters.

Constructed wetlands—These systems, also known as *aquatic systems,* have a place in wastewater management. In the future, we will see a lot more interest in constructed wetlands as part of the rural wastewater infrastructure.

Management and Maintenance Programs

In setting up a management program, there are a number of issues and considerations to keep in mind. The program should be developed and instituted at the local or community level. You need to decide how the program will be managed. Will it be handled by a public agency, by the private sector, or jointly through a public-private partnership?

It's critical that you emphasize public involvement in your decision-making processes. We need public meetings and other educational forums that encourage an open exchange of information. We also need ongoing educational and training activities, such as the training center being set up at Washington State University, Puyallup. We have to work with diverse groups and interests to hear their ideas and to get our message across to them.

We also need to deal with septage and other biosolids, a direct consequence of sewage treatment. New federal regulations (40 CFR Part 503) lay out specific provisions for septage management. These rules are self implementing, which means that ignorance is no excuse for not being in compliance.

And we need to set up our on-site sewage programs so that they are integrated and consistent with other needs and objectives, including land use planning, water conservation, stormwater management, shellfish protection, groundwater protection, and solid waste management. These are some of the issues that go along with centralized management of a rural infrastructure.

Conclusion

We can have waters that are clean and safe, both for recreational use and as sources of drinking water, but it will take a concerted effort on everybody's part. We have the technologies to provide good sewage treatment, but the more we rely on technology to address our concerns the more we have to ensure that these technologies are properly monitored and managed.

Keynote Speaker

George Tchobanoglous
Professor, University of California, Davis

Message

What we define as "innovative" or "alternative" technologies are really only improvements in equipment that are based on very old and simple principles. On-site sewage systems can be made to work on practically any lot and can achieve almost any desired level of treatment. However, the use and design of these systems must take into consideration the assimilative capacity of a lot, the level of treatment needed to protect public health and the environment, and long-term management of the system.

Keynote Address

"Creative solutions" and "appropriate technologies" are terms which are really inappropriate for this presentation and our modern on-site sewage technologies. When placed in the appropriate historical context, we begin to see that our present technology is really very simple, very old, and in fact can be made to work quite well under a variety of conditions.

Typical problems with on-site systems include the failure of old systems and premature failure of new systems. A second issue is groundwater contamination, although there is a lot of debate about nitrogen and its presumed impacts. And finally there are legitimate public health concerns.

What are some of the issues with on-site systems? Perhaps first and foremost is the inappropriate estimation of the soil's assimilative capacity. There really is no such thing as a failed septic system drainfield. Every drainfield will accept some amount of water. A failed drainfield is simply one that will accept less water than the amount being applied. The question is, can the wastewater that is applied in a particular area be transported away from the lot without causing a problem? With this approach, assimilative capacity becomes the central consideration in the design of a system.

There are several other design-related issues that cause problems, including undersized disposal fields and the carryover of grease and other solids from the septic tank. Problems associated with grease are becoming more complex because we cook with many different kinds of oils today, not all of which solidify at the temperatures encountered in septic tanks. Another issue is the defloculation of soil caused by sodium that is present in the wastewater. It's a relatively common problem that can be addressed through use of a defloculating agent. And finally we have problems with the discharge of phosphorus and nitrogen, and those really are design issues because we know how to deal with them.

Contaminants and Fate Processes

Historically we have been concerned with the presence of organic matter, which is measured as biochemical oxygen demand (BOD). The level of organic matter is a legitimate concern because it determines the amount of oxygen that we have to supply. However, the "five-day BOD" parameter is totally artificial and has no meaning at all. Other contaminants of primary concern include suspended solids and pathogens. Increasingly we have to look at the entire list of contaminants, including nutrients, organic pollutants (from household products), and heavy metals (from plumbing in older homes).

Fate processes are important because they tell us how these constituents are altered as they are applied to the water column or to the soil. For example, absorption is a significant process with metals, trace organics, ammonia, and phosphate. If we are concerned about phosphate, then we might well modify the leachfield to provide maximum absorption of phosphate—an example of a design issue that we can address.

There are not hundreds of these fate processes, instead there are a few and we understand them quite well. As we look at these processes—for example, algal synthesis, bacteriological conversion, chemical reaction, filtration, gas absorption, ion exchange, and natural decay—we see that there is no "silver bullet" out there that we can use to solve all our problems.

On-Site Treatment Options

Treatment options for unsewered areas can be organized in terms of primary treatment, advanced primary treatment, biological treatment and disinfection. There are lots of technologies and an almost endless range of possibilities for combining these technologies to achieve the desired level of treatment. But how do you decide whether you need any of these? What is it that you are worried about and are trying to protect? Once you determine this, how much credit are you going to give for alternative types of treatment? These are the pivotal questions that dictate our sewage treatment decisions.

Septic Tanks—For years, the standard septic-tank model has used a two-compartment arrangement, but the reason for this is basically structural. Studies have measured no difference in effluent quality from divided and undivided tanks. Working from this standard model, Orenco Systems in Oregon has developed an effluent filter that attaches to the end of a single-compartment septic tank. A biological growth forms on the filter screen that reduces the suspended solids and BOD before the effluent leaves the tank. This development, in turn, has allowed the use of well pumps for moving septic-tank effluent where previously we used only centrifugal pumps. As we look at on-site systems, one of the most dramatic things that has happened is the availability of this kind of technology. However, I have an article on effluent screens that dates back to 1895. I point this out to illustrate the fact that it's not that the concept is new, it's just that the implementation and production are more advanced today. This example also illustrates how we are able to adjust our designs and technologies to better manage wastewater to achieve a higher quality effluent on a more consistent basis.

One of the fundamental principles of on-site treatment is that you *must* have a water-tight tank. If water flows in, it disrupts the biological activity. In a properly functioning septic tank, the residual that remains in the tank is little more than the lignin in the toilet paper. Everything else literally breaks down.

Sand Filters—In this type of system, the wastewater is distributed evenly across the top of the sand bed and is treated as it passes through the medium. The popularity of sand filters is attributed, in part, to the fact that they can be fully or partially buried, or placed above ground or in containers. By attaching a simple, inexpensive device to control the dosing, we now have the capability with these systems to dose anywhere from 12 to 72 times per day. This lighter, more frequent dosing increases the probability that an organism or contaminant will attach to a sand grain by capillary action and provide maximum oxygen transfer that literally mineralizes the entire content of the wastewater.

The performance of these systems depends heavily on the size and quality of the sand. Here's a simple technique for determining quality. Fill a jar half full of sand, fill the remainder with clear water, shake it well and let it settle. If anything more than a barely perceptible layer of silt settles on top of the sand, your system will fail when the silt blocks the flow of wastewater through the granular medium. This is the principle mode of failure for sand filters.

Research conducted at the University of California, Davis evaluating the performance of intermittent sand filters is yielding good results. The effluent quality is generally suitable for drip irrigation, and warrants consideration of a host of other alternatives for applying the water. Results with virus removal indicate that performance is dependent on loading rates, i.e., virus removal decreases as loading rates increase.

Aquatic Systems—With a typical emergent-plant system (also called constructed wetlands), treatment is carried out by bacteria that are attached to the root zone. As such, die-back of vegetation during winter months does not affect performance because the vegetation does not really contribute to performance. What's most important about the plant is that it transports oxygen down to the root zone, and methane back out of the root zone to the atmosphere. I'm a great enthusiast for these systems, but there are some inherent problems associated with their use. In many parts of the country effluent can be discharged from aquatic systems to just about any watercourse without a permit. But in other areas, including Washington, you need an NPDES permit for surface water discharge, which brings with it requirements for monitoring and other things that are impractical for individual systems.

Historic Perspective

To put these issues in proper historical context, we can look at a 1920 public health bulletin entitled *The Treatment of Sewage from Single Houses and Small Communities.* The bulletin provides information on the design and performance of an early Imhoff tank, which is actually superior to today's conventional septic tank. The system described in the bulletin also employed a mechanical tilt doser and an intermittent sand filter that established loading rates, sand sizes and other specifications that are exactly what we use today. And the performance of this system was as good as anything we see today. The point is that although they did not have today's equipment (e.g., pumps and pressure distribution), they understood and applied the same principles and concepts that we use today. We may be developing more innovative equipment over time, but there really is no such thing as innovative or alternative technology.

Disposal Options and Effluent Quality

General options for disposal include subsurface disposal, evaporation systems, surface disposal, wetlands, and discharge to water bodies. The system that probably makes the most sense is a gravelless trench at the surface of the soil. But this concept has been distorted over time. One reason for this is that our standard regulations for on-site sewage systems have evolved on the basis of successive trials, leading to exaggerated and enlarged design standards. The corollary reason has to do with the out-of-sight, out-of-mind thinking. Deeper must be better, right? Actually it's the wrong approach if you want to take advantage of nitrification, absorption, bacterial activity and other treatment processes. You have to put the wastewater where the soil is. With shallow-trench systems you take advantage of bacteria which live in the upper layer of soil.

With the option of ultra-violet disinfection, the key is to keep the water running past the UV light tube so that a growth does not accumulate on the tube. UV disinfection is simple, inexpensive, and very effective.

As noted previously, the fundamental design considerations for on-site systems are 1) the assimilative capacity of the lot and 2) the level of treatment needed to protect public health and the environment. You can achieve almost any effluent quality desired depending on how you combine different treatment units. You simply have to decide what water quality problem you want to address.

Long-Term Management

It is likely that the U.S. Environmental Protection Agency will soon say that on-site systems are a real part of wastewater management in the United States. Further, they are likely to push that responsibility onto the states. While it's relatively easy for EPA to change direction, we have to understand that people have been told for years that we don't want on-site systems and that centralized sewer systems are needed to protect the environment. These are difficult issues that we are all going to face as we continue to design our programs.

I know that the approach in Washington is to allow each county to develop its own regulations. But while I'm in philosophical agreement with this approach, there needs to be some uniformity in these programs to ensure consistency with recommended practices and standards of the profession.

As for long-term management of on-site systems, there is no single model that will work in all locations. Someone simply has to take responsibility for looking at the systems and making sure that they function properly. The fact is, on-site systems can be made to work on practically any lot, but *not* without on-site management districts to ensure responsible operation and routine monitoring and maintenance.

REGIONAL PERSPECTIVES ON THE USE AND MANAGEMENT OF ON-SITE SEWAGE SYSTEMS

Panel

Eric Slagle
Assistant Secretary, Washington State Department of Health

Larry Ward
Board Member, Building Industry Association of Washington
President, Kitsap County Home Builders Association

Gerald Emison
Deputy Regional Administrator, U.S. Environmental Protection Agency, Region 10

Moderator

Hugh Spitzer
Vice-chair, Puget Sound Water Quality Authority

Message

On-site sewage treatment is here to stay in the Puget Sound region. The challenge is to provide cost-effective treatment of wastewater while protecting the environment and public health. The proper management of on-site systems is an integral part of the general public-services infrastructure that local governments must provide. Operation and maintenance programs should consist of public/private partnerships with government in an oversight role. Good education of the public and practitioners is the first and most important step toward a strong septics management program. On-site sewage management is basically a local issue that must rely on local funding and problem-solving. The local utility model is the preferred model for providing necessary services and for generating operating revenues.

Eric Slagle, Washington State Department of Health

There are about a half million operational on-site sewage systems in the Puget Sound basin, with an estimated 25,000 new systems added each year. On-site sewage treatment is a contentious and emotional issue. It is linked with land use, property rights, and major economic impacts, such as the state's $50 million per year shellfish industry. On-site systems are essential to our way of life. There is probably $3 billion per year in construction that relies on on-site systems. On-site sewage systems allow local governments to accommodate growing populations at a time when many regional sewer systems are at capacity and cannot accept additional connections. In areas where sewers are not available or affordable, on-site systems provide the only feasible means for sewage treatment.

We must acknowledge the fact that on-site systems provide a long-term solution to sewage treatment. We can no longer view these systems as temporary solutions while we wait for the

expansion of sewage treatment plants or collector systems. To this end, we must emphasize sewage treatment and protection of the environment and public health, not just *disposal* of wastewater.

The formula for a good on-site management program has three primary components—providing the public and practitioners with good education and information, providing incentives for proper on-site system management and maintenance, and only then looking to the regulatory structure to enforce compliance. Enforcement should be relied upon as a last resort.

Operation and maintenance, which is covered under the new on-site sewage regulations, is the part of the solution that needs the greatest attention today. The local utility model has emerged as the most effective way to address this need. In setting up the utility framework, we have to consider linking on-site systems with small public water systems to address the environmental and public health issues. To be truly effective, our management programs have to address and protect the hydrologic continuum—ground and surface water. Issues to explore in this context are water conservation, graywater management and wastewater reuse.

Larry Ward, Building Industry Association of Washington

It is vital for the building industry to have a clean environment. It attracts business. The building industry wants on-site systems that are simple, inexpensive, and effective in protecting the environment. However, builders are concerned that we are "dying the death of a thousand cuts" due to taxation and regulatory complexity. With the Republican revolution we can expect smaller state government, more incentives for free enterprise, regulatory reform, and more local government initiative and primacy on many environmental issues, including the management of on-site systems. We have to start switching our emphasis away from centralized solutions back to local communities. Local health districts are the place where this revolution should occur.

People are frustrated by over-regulation and the inflexibility of regulatory systems. Property rights advocates are pushing to do away with large parts of the state's environmental regulations. The building industry is concerned that all environmental regulations could be dismantled or otherwise modified—a situation that would not be conducive to the future of the building industry.

An example that illustrates the problems with current regulations is Kitsap County's on-site management program. It is an excellent program, but it will become illegal under the new state on-site sewage regulations. The county's on-site problems have to do with older systems that were built and installed before the current local regulations were instituted. What Kitsap County really needs is a program to identify and repair failing older systems, not an entirely new regulatory structure. We should be attacking the problem and cleaning up old, failing systems instead of over-regulating the new systems that work quite well.

On-site management practitioners want to know what the regulatory agencies expect in terms of human health and environmental protection. Current technologies can achieve just about any level of treatment. We need to see performance standards for on-site systems and protocols for measuring performance.

On-site management must be a private-sector solution wherein the spirit of free enterprise is followed. No one is suggesting that we should put in septic tanks that don't do the job. What we want are systems that work with the least cost and least bureaucracy. The building industry is really frustrated by the inability to use proven, alternative systems that are working in other states. We would like local health districts to be able to make administrative judgements in their own jurisdictions.

Gerald Emison, U.S. Environmental Protection Agency, Region 10

None of us—businesses and government agencies alike—can expect to do business as usual in the future as it pertains to the management of on-site sewage systems. If we have substantial growth in the number of on-site systems and that growth is accompanied by substantial failures, the environmental damage will be horrendous.

We must address both the direct public health impacts from on-site systems as well as the indirect impacts to the environment. Direct threats to human health include pathogens and nitrates. These threats can be handled through the proper operation and maintenance of all systems and the identification and repair of failing systems.

Greater emphasis should be placed on the protection of ground and surface water, paying particular attention to nitrates. We can't expect to continue pushing the development envelope without addressing proper land use, potential for failures, and siting criteria and standards for determining failures and repairs.

In general, people are not getting the services from government that they want and need to properly manage their on-site sewage systems. Though regulation is an essential part of any management program, government must become more service-oriented with its programs and less heavy-handed about regulation and enforcement.

PRINCIPLES AND OBJECTIVES OF OPERATION AND MAINTENANCE PROGRAMS

Panel

Stephen Wecker
Director of Environmental Services, Pac-Tech Engineering, Inc.

Bill Stuth
President, Stuth Company, Inc.
President, Washington On-Site Sewage Association

Dave Lowe
President, Dave's Designs, Inc.
President, Washington State Pumpers Association[1]

Moderator

Bill White
Director, Clallam County Department of Community Development

Message

Professional, routine monitoring and maintenance are essential to ensuring effective sewage treatment and lasting performance of on-site sewage systems. Unfortunately, the lack of attention to these needs has dramatically affected the performance of on-site systems throughout the Puget Sound region. As local health jurisdictions begin establishing comprehensive septic maintenance programs, successful implementation will require much attention to public education, professional training, and the development of standard methods and procedures for monitoring and maintenance.

Stephen Wecker, Pac-Tech Engineering, Inc.

For most people, on-site sewage systems are a bury-it-and-forget-it issue. There's also an interesting dichotomy in our thinking about "treatment" and "disposal," as if good treatment somehow alleviates the need for proper disposal. The issues of treatment and disposal are obviously interrelated.

Our on-site programs date back to the 1940s and 1950s. Simple technology that was originally developed for use in rural settings was broadly applied to a booming housing market at the end of World War II. Since then we have seen a lot of movement to develop better treatment technologies, particularly for use in disposal-tight sites. While the scientific principles have been around a long time, we've come a long way in putting the components together and getting the systems to work.

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[1] In January 1995, the Washington State Pumpers Association merged with the Washington On-Site Sewage Association. The organization retained the name of the Washington On-Site Sewage Association.

We've gone from very simple systems to very complex systems. I liken it to a "technology train" that has taken us to the point of almost absolute treatment. But unfortunately the boxcar of the train—the maintenance and monitoring component—hasn't even left the station yet. All systems, both old and new, are suffering from the lack of attention to maintenance and monitoring.

What is maintenance? It's looking at the components of an on-site system. What is monitoring? It's an attempt to look at how well we are protecting the environment. Complementing these two components is education. People have to understand that if you flush it down the toilet or put it down the drain, you're going to have to deal with it and the environment is going to have to deal with it. Education is essential in any attempt to come up with long-term solutions to our on-site sewage problems.

We need to reach a point where homeowners acknowledge the need for maintenance. As for the cost of maintenance services, it's not unlike what others have long paid for public sewer service. People need to realize that an unmaintained system is a liability to the facility it serves. When buying a car, people look for a car that has been well maintained and comes with complete service records. We need to reach that same kind of motivation and self-interest in our dealings with on-site sewage systems.

Bill Stuth, Washington On-Site Sewage Association

Together with regulators, educators, and other interests, the Washington On-Site Sewage Association (WOSSA) has established a training center on the grounds of Washington State University (WSU), Puyallup. The training center is designed to provide training, continuing education, professional interaction, research and, ultimately, professional certification related to the design, use and management of on-site sewage systems. WSU Cooperative Extension is responsible for the research while industry professionals are taking the lead with the training.

The training center is unlike any other in the United States with its hands-on approach. The facility consists of fully functional systems and components that operate on clear water. The setup is very user-friendly. All the systems are linked together, which allows us to configure the systems in a variety of ways. Systems already in use at the facility include septic tanks, pump tanks, pressure distribution systems, slope distribution systems, sand filters, chamber systems, mound systems, a couple of proprietary devices and a recirculating gravel filter.

The goal of the training center is to familiarize professionals with a wide range of treatment options and to explain how the different systems function. Moreover, our goal is to use the center to enhance and set the standards of the industry.

During the training we place strong emphasis on the flow of wastewater through the systems. This is because problems associated with flow are the most common and constitute as much as 90 percent of monitoring. Other parameters addressed in the training include pH, dissolved oxygen, temperature, BOD (biochemical oxygen demand), suspended solids, grease, nitrates and coliform.

So why do we need a training center? One reason is that technology has surpassed the industry's understanding of technology. We work with a variety of systems, but we also have a

monitoring methods for all systems—something that we can accomplish in part through the training center. If we don't standardize our monitoring methods, we'll run the cost of monitoring so high that the whole effort will self-destruct.

But before we can develop appropriate standards and procedures, we need to first develop a better understanding of our monitoring needs. A program that we use at our company bases the monitoring needs of a system on three functions: 1) degree of risk to the environment, 2) complexity of the system, and 3) user. This is the kind of methodology that we need to start developing at the local, county or state level—monitoring priorities that take into consideration relevant risk factors such as lot size, proximity to water supply or water body, method of treatment, etc.

Our intentions with monitoring and maintenance are all very good, but the issues are not as simple as one might think. The training center will help to clarify some of these issues.

Dave Lowe, Washington State Pumpers Association

There are a few points about the training center at WSU Puyallup that I want to emphasize. The first is that development of the center and the curriculum has generated a lot of positive interaction and education between the industry and the regulatory community. The second thing is that we are able to work with functional systems, which allows us to provide not only hands-on training but also some problem-solving by actually experimenting with the different pieces of equipment. And finally, the center provides the means to establish a base level of training and continuing education that didn't exist before. One issue that we have yet to resolve is the mechanism that we will use to link the training program with formal certification.

The training center should serve as a focal point for homeowners, regulators and maintenance professionals in putting together a framework for the O&M programs now required under the state on-site sewage regulations. Although homeowners, regulators, and maintenance professionals all have added responsibilities for O&M, the state regulations do not establish a format or framework for these programs. The training center can serve as a great tool in sorting through these issues. By providing a trained and qualified industry, we can establish a necessary link between the homeowner and regulator. And with good education and implementation we can perhaps even generate a *demand* for these monitoring and maintenance services.

The following are other issues to consider as we set up these O&M programs:

- *Monitoring access*—Many systems are not currently set up to accommodate monitoring. This will require the installation of risers or other monitoring ports on many existing systems. We also have to ensure that new designs incorporate the necessary monitoring features.
- *Flexibility and priorities*—In designing and implementing general requirements for monitoring and other things, we need to give consideration to variations in circumstances and conditions. Priorities and risks will vary from one system to the next, and from one setting to the next.
- *Data and evaluation*—We have to make sure that the information we generate is really needed, and we have to then use this information wisely to refine and redirect our efforts.

- *Roles and responsibilities*—Who's going to do the maintenance and what's the necessary level of expertise? A key to this is making sure that we have qualified maintenance professionals, which underscores the purpose of the training center. How the programs will actually be structured and implemented by the local health jurisdictions remains to be seen. The local health jurisdictions should provide oversight and audit functions and leave the bulk of the field work to the private sector.
- *Enforcement*—How are we going to ensure that the maintenance gets done? This again is something that will depend on how the programs are structured. Education is seen as an important tool in making sure that monitoring and maintenance activities are actually carried out. It's going to be easier to ensure follow-through if we are working with individuals and communities that understand that ongoing, regular maintenance is in their self interest.

Panel

Dave Lenning
Program Manager, Thurston County Health Department

Jim Henriksen
Supervisor, Seattle-King County Health Department

Jerry Deeter
Assistant Director of Environmental Health, Bremerton-Kitsap County Health District

Bob Sweeney
Environmental Health Supervisor, Southwest Washington Health District

Joye Bonvouloir
Environmental Health Director, Island County Health Department

Linda Atkins
Environmental Health Specialist, Jefferson County Health Department

Moderators

Bill White
Director, Clallam County Department of Community Development

Stephen Wecker
Director of Environmental Services, Pac-Tech Engineering, Inc.

Message

Local health jurisdictions are using a variety of tools and management structures to improve the use and maintenance of on-site sewage systems. These include operational permits, private maintenance contracts, operator warranties, pumping notices, as-built stickers, community presentations, educational materials, and professional training and certification. As a result of these efforts, we now have a number of experiences and approaches that can be used to refine and redirect septic maintenance strategies across the Puget Sound region.

Dave Lenning, Thurston County Health Department

In addressing on-site sewage issues locally, it helps to have a good board of health. The Thurston County Board of Health has been very progressive on these issues. The following are key policies they have passed that have shaped our on-site sewage program:

- On-site systems and sewers should be sited in appropriate areas based on good, comprehensive wastewater-management planning.
- On-site systems should be designed, constructed, and maintained for long-term use (defined in policy as at least 25 years).
- Personal responsibility should be encouraged.
- Operational permits should be used to ensure proper operation and ongoing maintenance.
- Local management districts should not be precluded.
- Water quality monitoring should be implemented to evaluate the cumulative effect of on-site systems on ground and surface water and to refine planning and decision-making.
- Owners of on-site systems should pay the costs of monitoring and permitting.

The following are additional goals and policies that we have used, and continue to use, in developing and revising the operational permit program: 1) the private sector may be called upon to carry out the field work; 2) all permits should contain maintenance requirements which vary according to the type of system and other conditions; 3) eventually all systems in the county should have an operational permit; 4) the permit should contain conditions to accommodate any needed repair, upgrade, or conversion to a sewer or off-site system; and 5) in urban areas the permit may contain conditions related to sewer-interception schedules and comprehensive sewer plans.

Our permit program started in the late 1970s, focusing first on large on-site systems, certain types of alternative systems, and systems in geologically sensitive areas. In September 1990, following an extensive public process, we established requirements for a county-wide program. We knew it was impractical to permit all systems at the start, so we decided to take a phased approach and issue permits for all new systems, systems being repaired, and systems on properties being sold. Currently, 25-30 percent of the estimated 40,000 systems in the county are under an operational permit. While this is good progress, it's unlikely that we will reach 100 percent of the systems by the year 2000.

A characteristic of our program is that it is very staff intensive—one issue that we will continue to address in the coming years. Both the initial and renewal inspections are done by health department staff, and our investigations are probably the most stringent in the state.

The permit itself is quite simple—as short as one page. We generally issue four-year permits, but in exceptional circumstances we may reduce this to as little as six or twelve months (e.g., repairs or sewer connections). Each permit is tailored to the type of system and other relevant factors. It provides the homeowner with useful information pertaining to proper use and maintenance. In the past we required pumping every three to five years, but we are changing this to emphasize regular inspections and pumping only when necessary. The homeowner is given educational brochures and a copy of the as-built drawing. We enter the permit information into a database and file a "statement of record" with the county auditor's office.

The permit program is financed entirely by fees. In 1994 the fee schedule included a $40 administrative fee, a $30 annual monitoring fee, and a $134 initial inspection fee. At present there is no inspection fee associated with permit renewal.

Benefits of the program are numerous—owners are informed of needed maintenance, systems are inspected and pumped, proper sewage treatment is assured, costly repairs and sewer extensions are reduced, public resources are protected, and so on. But we have also encountered a number of problems with the program, including the following:

- Two lawsuits have been filed against the county because we do not currently permit all existing systems. One lawsuit has been dismissed and the other is pending.
- The renewal program is not currently active, due in part to the pending lawsuit.
- The water quality monitoring program has not yet been instituted, also due to the pending lawsuit. Monies have been collected (over $300,000) but nothing has been spent.
- Public understanding of and support for the program is poor. People are not used to paying routine fees for septic systems. They understand sewer, water, and other utilities, but they don't understand the concept of a septic utility.
- Public education needs greater attention. The key is letting people know how the problems of inadequate maintenance affect their pocket book.
- People misunderstand the nature of the operational permit, believing that it signifies approval of their system.
- Enforcement has been hampered by the lack of a renewal program.

What our program will look like in a few years is very uncertain. Despite its flaws, the program has formed the basis for a long-term, on-site sewage management program in Thurston County.

Jim Henriksen, Seattle-King County Health Department

King County currently does not have a system to ensure periodic maintenance of on-site systems. We do have an advisory group looking at various issues related to code revision, and one of these issues is ongoing operation and maintenance.

Proper operation and maintenance really begins with the site evaluation to determine what kind of system a site can accommodate. The design is developed by a qualified designer or professional engineer and is then submitted to the local health department for review and approval. The system is installed by a qualified installer and is inspected by both the designer and the regulator. We send a copy of the final as-built drawing and educational material to the property owner following installation, but the information does not necessarily reach the homeowner if, for example, a developer still retains ownership.

For individual systems, homeowners are responsible for ensuring proper use and maintenance. For particularly difficult sites (i.e., waiver sites), we generally require periodic inspection of the

system by a designer or professional engineer. And for community systems installed after 1984, we require some form of public management.

Approximately 100,000 on-site systems are located in King County. Under our current management system, we estimate that about 13,000 pumpings and other maintenance activities occur in the county each year.

With respect to monitoring, we conduct operational assessments of existing systems in response to applications from lenders, and for remodels and expansions. These assessments consist of a visual inspection to look for any problems or obvious signs of failure, but we do not open or uncover any system components. We also conduct sanitary surveys in defined geographical areas to assess the performance of systems. And each year we assess all 450-500 on-site systems located in the City of Seattle.

In addition to providing the as-built and educational information at the time of system approval, we send the same information to the address three years later along with a reminder that the system should be inspected. We make publications and videos available to the public through the county library system, and we do a lot of direct education with homeowner groups. Low- and moderate-income homeowners can obtain financial assistance through the King County Housing Authority to upgrade or repair a failing system or to connect to a sewer system at the time of a problem.

So where do we go from here? In the short term, our first step will be to create a database of all known systems in King County. We have good information for systems installed since 1990, but incomplete records for systems installed prior to that date. We are also stressing good implementation of regulations to ensure that systems are designed and constructed to facilitate ongoing monitoring and maintenance (e.g., access points and monitoring ports).

We are also looking at ways to enhance public education and awareness through, for example, better notification on title reports, periodic maintenance reminders to homeowners, and informational stickers with system diagrams. We also see a need to enhance pumper training, maintenance reporting, and certification requirements. Currently there is no quality control to assure that individual technicians really know what they are doing.

In the long term, we will be looking at the results of these initial tasks before committing to a larger program. Following an initial assessment, we will then review our options and select the best approach for meeting the requirement for periodic inspections by the year 2000. Whatever type of program we put in place, it must meet a demonstrated need, generate broad public support, produce measurable results, and be cost-effective.

Jerry Deeter, Bremerton-Kitsap County Health District

Kitsap County expects to have its operation and maintenance program in place by mid-1995. Our approach calls for private-sector implementation with the health district focusing on start-up and ongoing oversight and enforcement. We have an estimated 50,000 systems in the county. Another 1,400 new systems are installed in the county each year, so it's important that we get things started as soon as possible.

There are several reasons why we feel an operation and maintenance program is needed. The evolution to more sophisticated treatment systems has resulted in failures and other problems. We've documented a 28 percent failure rate, for example, for mound systems in the county. These complex systems need routine monitoring and maintenance in order to continue functioning properly, and we want systems to reach their full life-expectancy. Many interests in the county are asking for leadership and direction in setting up a program to address these needs.

The level of maintenance will depend on the type and complexity of the system, site conditions, and proximity to areas of special concern. Further, we feel that any reduction or waiver from regular standards must be compensated by greater attention to monitoring and maintenance.

Based primarily on revenues from local septage-tipping fees (two cents per gallon), our effort to institute an operation and maintenance program started in 1993 and has focused on the following activities:

- *Database*—We are converting "road files" for all on-site sewage systems to the county assessor's account numbers. When finished, the data system will give us an efficient way of sending maintenance notices and other information to the public.
- *Education*—We do a lot of presentations to a variety of groups and interests. We also distribute a lot of educational material, but we need to make sure this information reaches the right audiences and is put to good use. We've produced a video that is available to the public through the health district and local libraries.
- *Shoreline surveys*—We are conducting shoreline surveys in priority areas based on water quality data, sensitive shellfish areas, and past problems with failures.
- *Funding*—We set up a low-interest loan fund to help homeowners repair and upgrade their failing on-site systems. The county also established a surface water management program that will provide the district with roughly $700,000 to $800,000 per year. About $180,000 of this is dedicated to sanitary surveys. Another $255,000 (the amount diminishes over a three year period) is dedicated to the local revolving fund. In the forth year, we are looking at redirecting this portion of the fund (approximately $150,000) to our operation and maintenance activities.
- *Regulations*—We are continuing to revise our local on-site regulations to establish the necessary structure for our operation and maintenance program.
- *Certification*—Operator certification is being strengthened to require training at the Puyallup center along with local testing, licensing, bonding, and continuing education.

Maintenance professionals are using an "operator warranty" to notify us when the necessary maintenance has been performed, to inform us of any system failures, and to inform us of expired maintenance contracts. An interesting feature of our program is that we guarantee new systems for two years. If there is a failure, we determine the cause, identify the responsible party, and correct the problem.

We are taking a different approach with subdivisions and large on-site sewage systems. The public utility district will manage these systems (including all billings and maintenance) in the rural parts of the county—just as they are already managing the large water systems in these areas. And in the sewered, suburban areas of the county, our public works department will manage these systems.

Bob Sweeney, Southwest Washington Health District

The Southwest Health District covers Clark, Klickitat and Skamania counties along the Columbia River valley. Each county offers its own set of challenges because of differences in politics and site conditions.

The benefits of a good maintenance program include improved sewage treatment, resource protection, prevention and correction of failures, education, information gathering, and perception management. We believe we have done a good job with site evaluations, designs, and inspections. But attention to maintenance has been lacking. Historically we have relied on a variety of tools, including voluntary actions, complaints, as-builts, educational handouts, maintenance plans for alternative systems, sanitary surveys, and assessments for lending institutions. These methods are now augmented by a maintenance program that we adopted in December 1992 and implemented in March 1993.

Cost estimates for optional maintenance programs that we studied ranged from $75 to $300 every four years for inspections, pumping, and possibly some retrofitting (e.g., risers, screens, etc.). But it's necessary and cost-effective. Without maintenance, homeowners are looking at $1,500 to $10,000 and more for repair and replacement costs. The public also bears significant costs associated with public health hazards and degradation of water quality.

Representatives from the three counties, twelve cities, septics industry, and many others helped with the development of our program. The health board made sure that the health district and utility district retained the option to carry out inspections. Although we have not yet set up an inspector classification, we have begun training utility technicians and pumpers to perform the detailed inspections. While developing the program we encountered a lot of opposition from the pumpers. This surprised us because we expected the program to create a boon in business for the industry. Instead, many pumpers felt threatened, and opposed the program out of fear that larger companies and the districts would take away their business.

We considered a number of options for funding the program—general fund, grants, loans, maintenance district, user fees, and operational permits. What we selected was a septage-tipping fee of 3.5 cents per gallon plus a surcharge on permits (increased to $10 in January 1995). The overall cost of the program is about $150,000 per year.

Responsibility for inspecting the systems rests with the homeowner, pumper, utility district or health district. An inspection entails measuring the scum and sludge; inspecting the baffles, pumps, and other parts; evaluating the treatment area; and then reporting the information back to the district. If the inspection is not performed, the district follows up with notices and, as a last resort, fines of up to $25 per day.

Requirements for inspection and pumping apply to on-site systems in urban boundaries, areas of special concern, alternative systems, non-residential systems with flows greater than 1,000 gallons per day, and specially selected systems, such as those with no available reserve area. These systems must be inspected every four years. However, inspection by a licensed professional is required only once every eight years (i.e., every other inspection), at which time the system must be pumped or the inspector can certify that pumping is not needed. The new state on-site sewage regulations require inspections every three years, so we will either revise our regulations accordingly or request a waiver.

Other issues that we are currently dealing with include delineating the areas of special concern; sludge/biosolids treatment and disposal; and communication with decision-makers and stakeholders, particularly county commissioners.

Joye Bonvouloir, Island County Health Department

Approximately three-quarters of the 68,000 people in Island County rely on groundwater as their source of drinking water, and a comparable percentage use on-site systems as their method of sewage treatment. The demands on these resources and systems are only expected to increase as our population continues to grow in the coming years.

Island County's on-site sewage program revolves around the proper siting and design of systems, quality construction, and ongoing operation and maintenance. Our operation and maintenance program consists primarily of education, code requirements, and a database that we use to track pumping records. We have one full-time environmental health specialist who carries out the education, loan assistance, monitoring and enforcement activities.

Community education and outreach are central features of our program. There are over 700 homeowner associations and civic groups in the county that we try to reach. We also have quite a high transitory population associated with the naval air station. We tell everyone that maintenance is the key, and we try to take the mystery out of owning and operating an on-site system. Our goals are to prevent premature failures, promote good operation and maintenance, and assist in correcting problems.

As new systems are approved, we give the property owner an as-built sticker to permanently affix to the home—typically on the electrical panel or fuse box. The sticker provides notice that the home is served by an on-site system, shows where the system is located, provides tips on operation and maintenance, includes a space to record pumping and inspection activities, and gives names and numbers to call if there is a problem. As the property owner changes, the sticker stays with the home.

Another component of our program is monitoring and enforcement of failing drainfields. This work typically requires sampling and dye tests to convince homeowners that they have a problem. We also have our loan program to assist with upgrades and repairs.

Under local code, pumpers are required to submit records to us on a regular basis. We use this information to track pumping activities and, as necessary, to follow up with homeowners on particular problems. By linking this database with the assessor's records, we are now able to

track pumping and maintenance of systems on a continuous basis, regardless of changes in ownership.

For residential systems, we recommend that they be inspected every three years, and pumped when the solids reach one-third the volume of the tank. At one point we proposed mandatory inspections, but the idea proved to be too controversial. Once each year we search the database and send reminders to owners of systems for which we have no record of pumping in the past three years. With these "friendly reminders" we emphasize the personal cost savings associated with regular maintenance. Each year the number of pumpings increases while the number of notices that we have to send decreases.

Our local code requires annual inspections of mobile-home parks and community drainfields, and semi-annual inspections of food-service establishments. These inspections are linked with permits that we issue for mobile-home parks and food-service establishments.

So where does all the septage go? Starting in 1989, our solid waste advisory committee helped develop a septage management plan to determine the best way of providing long-term treatment and utilization of the biosolids. The two preferred methods that we identified were aerobic digestion with land application, and lime stabilization with land application. We selected the aerobic-digestion option for several reasons, including level of treatment, beneficial use, environmental impacts, and ease of operation. We financed construction of the facility with a Centennial Clean Water Fund grant and a $900,000 local bond. The plant started operation in October 1994. The biosolids are currently applied at both a silviculture site and an agricultural hay-crop site.

It's clear to us that education and code requirements are necessary for ensuring good performance of on-site systems, but unless we also have knowledgeable professionals providing quality maintenance services, we will not make many gains.

Linda Atkins, Jefferson County Health Department

Jefferson County has had an operation and maintenance program for alternative systems for several years. Although there are only 20,000 people in the county, development pressures continue to be very strong along the county's sensitive shoreline areas.

Historically our health department has been very reticent to allow alternative treatment systems, due in part to the need for careful operation and routine maintenance. We were not sure—and even today are not sure—that homeowners are willing to pay close attention to their on-site sewage systems. The state regulations require monitoring of all alternative systems, and our health department takes that requirement seriously.

In 1987 the health department reached agreement with the Jefferson County Public Utility District (PUD) to monitor alternative on-site systems in the county. This seemed to be a rather natural arrangement since the PUD was already involved in inspecting and managing water systems.

The following are key components and characteristics of our program:

- *Contract*—Applicants are required to enter into a monitoring contract with the PUD at the very start of the permitting process. Unfortunately, subsequent property owners were not always told about the monitoring contracts when properties were sold. To rectify this problem, we now attach a copy of the contract to the property deed.
- *Fees*—The PUD charges an initial administrative fee ($50 to $75) then charges additional inspection fees at the time of service ($45 to $55).
- *Inspections*—We use inspection frequencies of one, three, five and ten years based on state guidelines for alternative systems. The schedule begins at the time of final inspection. We also require an inspection at six months, which has been very beneficial in identifying and rectifying early problems. The inspections present good opportunities for education. The health department retains responsibility for enforcement.
- *Pumping*—If pumping is needed, the PUD informs the homeowner and the information is recorded on the inspection report. The PUD does not get directly involved in pumping.
- *Design*—In the design phase we make sure that all systems can accommodate monitoring. We require risers to grade on all pump chambers, monitoring ports in the drainfield, dose counters to help monitor flows, and so on. We also require the designer to provide an O&M manual to the PUD and the homeowner.
- *Education*—Education and outreach to homeowners is a major part of our program.

Based on our experiences, the following are considerations that we believe are particularly important in the design of an operation and maintenance program:

- Establish mechanisms to notify property owners of monitoring contracts and obligations.
- Provide adequate and ongoing training of monitoring personnel.
- Use the inspections as opportunities to educate homeowners.
- Develop a system to facilitate the transfer of information between the monitoring personnel and the health department or enforcement agency.

We need to focus our monitoring on systems and parameters that give us valuable information. We have not been finding many major problems, but we have detected many things that would have led to major problems. We have succeeded in getting homeowners interested and involved in the management of their systems, but this only marks the beginning of the process for long-term maintenance.

THE AVAILABILITY AND USE OF ALTERNATIVE ON-SITE SEWAGE TECHNOLOGIES

Panel

Mark Soltman
Wastewater Management Supervisor, Washington State Department of Health

Larry Fay
Environmental Health Director, Jefferson County Health Department

Donald Strong
President, D. R. Strong Consulting Engineers, Inc.

George Tchobanoglous
Professor, University of California, Davis

Moderator

Robert Seabloom
Emeritus Professor of Civil Engineering, University of Washington

Message

A variety of alternative technologies are available for use in the Puget Sound region. However, the effective and widespread use of these technologies, as well as the approval of other technologies, is hampered by a variety of problems. These include the lack of information or confidence with certain systems, limited funding for applied research and experimentation, regulatory constraints, the lack of reliable operation and maintenance programs, and insufficient training and expertise among service providers. Over time, the development of stronger and more uniform standards and protocols, enhanced research, improved operation and maintenance programs, and better training and certification will all aid in expanding the availability and use of alternative technologies.

Mark Soltman, Washington State Department of Health

In Washington, any on-site system other than a conventional septic tank/gravity drainfield system is considered an alternative system. The state Department of Health, which coordinates the work of the Technical Review Committee (TRC), is responsible for approving the general use of alternative systems in the state. Once approved, authority for permitting the installation of individual systems rests with local health departments, the state Department of Health, or the state Department of Ecology depending on the size of the system. Local health departments have authority for systems with volumes less than 3,500 gallons per day (gpd); state Health for systems with volumes between 3,500 and 14,500 gpd; and Ecology for systems with volumes greater than 14,500 gpd.

The TRC has been in existence since 1974 and was recently expanded from seven to nine members under the new state on-site sewage regulations. The TRC is not responsible for documenting the performance of alternative systems, but instead is responsible for evaluating information provided by others which documents the performance of the proposed technologies. The TRC maintains a list of approved systems and proprietary devices, but by law does not give any preferential endorsement of these systems.

In coming years, the use of alternative technologies should improve as we establish a more comprehensive framework for the proper application of these systems. This will depend upon the creation of reliable operation and maintenance programs, service-based utilities, training and certification programs, and a legitimate public-service infrastructure for on-site sewage systems.

There are two key areas where our efforts need attention. The first involves increased cooperation between the public and private sectors to find common-ground solutions. The second involves the need for research and study on matters of public health, engineering and environmental science, which is best carried out through the state universities. The training center at Washington State University, Puyallup, is an excellent example of the kind of cooperation, applied research and training that has to happen if we are to improve the overall effectiveness of on-site sewage treatment.

Larry Fay, Jefferson County Health Department

Jefferson County started allowing the use of alternative technologies in 1987 when we made arrangements with the Jefferson County Public Utility District (PUD) to provide inspection and maintenance services for these systems. Of the approximately 500 on-site sewage permits issued annually in Jefferson County, about 60 percent are for conventional systems and the rest are for alternative technologies. Of the permits for alternative systems, about half are for pressure distribution systems.

Jefferson County has taken a non-regulatory, minimalist approach to on-site sewage systems. So far our approach has worked well, particularly because of our emphasis on education and outreach. Because we work primarily from guidelines and not regulations, we have greater flexibility to make common-sense judgments. The downside of this approach is that we may have some potential liabilities.

Performance of alternative systems is monitored through regular inspections carried out by the PUD. We require an initial inspection at the time of construction plus a follow-up inspection at six months, which has been very effective in detecting early problems. We've seen that if alternative systems are designed for easy inspection and maintenance, owners become better educated and involved in the operation of their systems.

Implementation of the new on-site regulations, especially the operation and maintenance program, will be difficult in Jefferson County. A lot of people reject the idea that we are all part of a larger sewage treatment network. The objections of private property rights advocates will be a major obstacle to overcome in this regard. As a result, public education programs will be critical in allaying homeowner concerns. Lack of funding is also a problem.

The state Technical Review Committee (TRC) should more aggressively pursue and evaluate the performance of emerging technologies, including recirculating systems, wetland systems, graywater systems and aerobic proprietary systems. The TRC could also assist in creating an incentive program that encourages greater exploration, testing, and development of new technologies. Finally, the lack of standards for measuring performance and monitoring systems is problematic for on-site sewage systems in general, and for alternative systems in particular.

Donald Strong, D. R. Strong Consulting Engineers, Inc.

Public policy, local regulations and political will, particularly in urban areas, favor regional collection and treatment over on-site treatment. King County, for example, requires that community systems be owned and operated by a public entity, but most public entities are not interested in this responsibility and liability. This is a real loss, because community systems have definite benefits in certain circumstances. They provide flexible, long-term treatment and are generally very cost-effective. In rural areas, these same influences seem to favor individual homeowner solutions even where community systems are more logical and affordable. There is no clear state policy concerning these issues.

Mound and sand systems have a high incidence of failure at the interface between the mound material and surface. This is due primarily to the build-up of fine material from unwashed gravel and sand. Inspection of gravel and sand excavation sites is recommended. The definition of "clean" gravel varies greatly across the region, which could be resolved through the development of a simple field test and consistent material standards.

The following are some important steps that should be taken to significantly reduce the incidence of on-site system failures:

- More frequent inspections and better oversight during installation.
- Early post-installation inspections to find and fix problems as soon as possible.
- Better training and certification for installers.
- Better homeowner education to ensure proper use and maintenance of systems.
- Annual inspections to ensure routine monitoring and maintenance, with reports submitted to the local health district.

George Tchobanoglous, University of California, Davis

Different kinds of on-site systems have flaws or problems which are essentially endemic, but most of which can be avoided or resolved with proper design and management.

The use of wetland systems on individual homes, for example, is problematic. In the southeastern states, where many wetland systems have been installed, many have failed. Mosquitos, vegetation and odors are all endemic problems. Odors are a particularly significant problem.

With mound systems, gravity flow has been the dominant method for distributing wastewater. Unfortunately, the designs typically fail to adequately transport water off the system. In most

cases, pressure dosing provides a simple solution. In Stinson Beach, California, we have put in almost every kind of conventional on-site sewage system, most of which are pressure-dosed. Many of these systems have sand filters in addition to septic tanks. The only failures we have had are caused by excessive fine material in the sands.

In order to prevent on-site system failures, it is critical that you examine the systems as they are installed, monitor them on an ongoing basis, and repair any problems as quickly as possible. This is true for conventional systems, but it is especially true for alternative systems.

COST ANALYSIS AND AFFORDABILITY OF ON-SITE SEWAGE TREATMENT

Panel

Alan Bushley
Partner, R.W. Beck and Associates

John C. Wilson, Jr.
Senior Project Manager, Barrett Consulting Group

Cheryl Strange
Water Quality Financial Assistance Program Manager, Washington State Department of Ecology

Moderator

Edward Cebron
Principal, Financial Consulting Solutions Group

Message

The affordability of sewage treatment varies from one locale to the next, and is influenced by such factors as the type and cost of the system, regulatory constraints, financial and managerial considerations, and land use and environmental constraints. Any definition of affordability must include not only the immediate cost of installation, but also the life-cycle cost of operation and maintenance, the repair or replacement cost associated with improper use or inadequate maintenance, and the value that accrues to a property with a properly functioning system. Public funding has influenced the affordability of sewage treatment across the state. Although these funding sources are diminishing, they are also being fine-tuned to better meet the needs of small communities and individual homeowners.

Alan Bushley, R.W. Beck and Associates

Do economic factors support the use of on-site sewage systems? In general, the answer is yes, but for any locale there are a number of factors that affect affordability. These include the technology that is selected, the cost of that technology, regulatory constraints, financial and managerial considerations, and land use and environmental constraints (e.g., slope, groundwater, soils).

How do costs for different systems compare? The traditional septic tank/gravity drainfield is the least expensive type of system ($3,000 to $5,000). Homeowners are fortunate if they have the space and soil conditions to allow the use of such systems. All other systems are more expensive and vary greatly in cost (e.g., $10,000 to $15,000 for a septic tank/mound system).

Cost estimates for small community systems typically range from moderate to high. These include recirculating sand filters, lagoons, proprietary treatment systems, and mechanical

treatment systems. Constructed wetland systems are a higher cost option, due primarily to the expense of complying with regulatory requirements. To make wetland systems more affordable, they need to be recognized and approved by state agencies as a legitimate wastewater treatment option.

Although many of these technologies are not very complicated, there is concern about their operation and performance. The regulatory agencies are rightfully cautious in approving alternative systems, but it's important for state and county agencies to be flexible.

Regulations can have a major influence on the cost of on-site systems from one locale to the next. What are the applicable regulations and how flexible are they? How easy is it to obtain approval for an innovative system? What level of treatment is required? Does an NPDES permit have to be obtained for surface discharge? How feasible is this? What are the requirements for operation, monitoring and maintenance? What levels of treatment must be obtained before the treated water can be reused for irrigation, industrial cooling, or other uses?

There needs to be a local agency that assumes responsibility for the funding of on-site sewage systems. Financial resources need to be available for initial installation, operation and maintenance, and repair and replacement. A well-organized structure for operating and managing the system must be in place. Technical information and assistance must be provided to system owners and users.

On-site sewage systems offer a legitimate and long-term wastewater treatment solution. On-site treatment is the only practical and affordable option for many areas around Puget Sound. The only way to ensure that on-site systems will be viable in the long term is to take an area-wide approach. The role of county government is very important in providing leadership and resources to facilitate the proper organization, management, and financing for good treatment. Regulatory flexibility is important to allow new technologies to be adopted and used where appropriate. We also need to emphasize results-based regulations in lieu of the current design-based approach to encourage better wastewater treatment solutions.

John C. Wilson, Jr., Barrett Consulting Group

Affordability really cannot be defined until all costs are known. When seen in isolation, costs are easily misunderstood or misrepresented. When something is defined as "affordable," we have to ask, "In comparison to what?" An on-site system that is abused today is either postponing costs or transferring costs to others.

We need to recognize that there are standard cost elements for all on-site systems. The cost of construction is the sum of the collection, treatment, and disposal components plus taxes and contingencies. The *total* project costs must also take into consideration the cost of design, permits, easements, property acquisition, and other ancillary costs.

Once defined, these costs must then be evaluated to determine the full, life-cycle cost of a system. We need to consider the required level of service attention, that is, the frequency and technical skill needed to care for a system. We need to outline the operation and maintenance costs, which include such things as power, chemicals, labor charges, and septage disposal. We need to consider how long a system or individual components will last—perhaps 10 to 20 years

for mechanical and electrical equipment, and 50 years for pipe and concrete. And when a system is rebuilt or replaced, there may be salvage value for parts of the old system.

When thinking about affordability, we must also consider other benefits that accrue to, or costs that detract from, the property. These include the *responsibility* that accompanies private ownership of an individual system or public ownership of a community system; the *risk* associated with system failure, natural catastrophe, or a change in income; the *financing* that may be in the form of a commercial loan or government assistance, and *property limitations* that influence current and future use of the system.

On-site systems that perform well and conform to code add value to a property. Systems that do not meet these standards may be cheap to put in, but when the owners want to sell these properties, they lose. In addition, when homeowners remodel their houses, building permits usually require a conforming on-site sewage disposal system, which can present the homeowner with a very large and unexpected cost.

Homeowners and developers alike tend to place far greater emphasis on short-term capital costs than on long-term maintenance and replacement costs. Homeowners who expect to live in a house for a long time are more likely to value the savings and reliability associated with proper maintenance and long-term performance, even if the system is more expensive to install initially. There are very real differences in attitudes about installation and maintenance costs depending on the homeowner and particular circumstances.

Cheryl Strange, Washington State Department of Ecology

The affordability of on-site sewage systems is directly influenced by our public funding programs. The availability of state and federal funding has had a dramatic influence on the affordability of wastewater treatment in many areas around the state. Unfortunately our programs have tended to emphasize remediation rather than prevention, which has detracted from the overall effectiveness of these efforts and the protection of water quality.

Funding programs must strike a balance between short- and long-term considerations in finding cost-effective solutions to sewage treatment. This means that in calculating the costs of a project, we need to take into consideration the costs associated with fixing, upgrading and replacing failed systems as well as the costs associated with not doing something. It is only then that we begin to demonstrate the full importance and value of adequately managing and maintaining our sewage treatment systems.

Since its inception in the mid 1980s, the majority of money available through the Centennial Clean Water Fund for wastewater treatment has gone to secondary treatment plants. While it is unlikely that we will see a dramatic shift in this trend and significantly greater funding for community systems and individual on-site sewage systems, we have made grant and loan monies available for community systems, on-site system repair and replacement, and educational programs.

So what's being done to make things more affordable? In our funding programs we are streamlining review and approval requirements where it makes sense. We are trying to instill more flexibility to encourage better planning and decision-making. We are shifting greater

control and responsibility to local governments and small communities, telling them what the targets are and then letting them find the best course of action and most appropriate solutions. We are developing programs that will deliver customized assistance to small communities. And we are doing a better job coordinating our funding decisions through a variety of means, including involvement in the Infrastructure Assistance Coordinating Council. This is all very important because we will likely have less public funding available for sewage treatment projects in the coming years.

On-site sewage systems are a viable treatment option in many areas around Puget Sound, particularly in areas with appropriate development patterns and good site and soil conditions. The tough situations are those areas where on-site systems are inappropriate and sewers are not available or affordable. We need to find new ways to help finance solutions in these areas, to develop effective operation and maintenance programs, and to continue with the development of new technologies that show promise in this region.

UTILITIES AND FINANCE MECHANISMS FOR ON-SITE SEWAGE PROGRAMS

Panel

Hugh Spitzer
Attorney at Law, Foster, Pepper & Shefelman
Vice-chair, Puget Sound Water Quality Authority

Katy Isaksen
President, CCAinc.

Message

A number of finance tools are available to local governments for their on-site sewage programs. Local jurisdictions should choose the finance and management scheme that is most appropriate for their situation. The utility approach is increasingly popular due to its flexibility and emphasis on service delivery.

Models for Inspection and Maintenance Programs

Before looking at financial and legal models for inspection and maintenance programs, you first have to determine how much government, versus private-sector activity, you plan to rely on. The structure of your program will drive the financial tools that are available to use.

In setting up an entity for an inspection and maintenance program, you need to look at the history, needs, and goals of a community, particularly as they relate to the issue of sewage treatment. A community may opt for a privatized program that involves, for example, a system to periodically notify homeowners who then are obliged to contract with a private firm for inspection and maintenance services. A contrasting model on the other end of the spectrum would be one where all services are provided through a public, governmental agency and the homeowners pay periodic service charges or rates.

In addition to looking at the public-private models, it's useful to also understand the distinction between the regulatory public-health model and the utility model. Traditionally, local health jurisdictions have managed on-site sewage systems using statutory and regulatory police powers that are designed to protect public health and safety. This authority allows health jurisdictions to charge fees, but only for the allocable share of the cost of regulating individual activities. The utility model, in contrast, is a more service-oriented approach that employs a broader set of tools, takes into consideration the needs of people and the impacts of their activities, and allows greater flexibility in addressing those needs. The utility model allows the jurisdiction to charge ongoing rates to fund the program.

There are advantages to setting up a utility that covers many types of activities, such as stormwater management, on-site septic system management, and flood control. The state accountancy act allows for the internal transfer of funds under a utility from one activity area to another to cover unforeseen or start-up costs. This can be very helpful when trying to come up with funds to set up a septic inspection and maintenance program. A utility also affords the flexibility to provide low-income assistance in the form of lower rates, rate subsidies, or even

financing for septic installations. Probably the single best reason for the utility model is that it provides a comprehensive approach for managing a community's resources.

Stormwater facilities may be a good example of why utilities are a better approach than private ownership. As new developments have been constructed around the region, stormwater detention ponds have often been required as mitigation. But over time, we have seen that the maintenance of these facilities—which is supposed to be carried out by the owners of these facilities, generally homeowners associations—has not been performed. As a result, local utilities are now having to step in to take care of these facilities. On-site inspection and maintenance utilities should heed this example and find ways to clarify and strengthen ownership and maintenance responsibilities.

Revenue Options for On-Site Programs

The accompanying table summarizes the main options that cities and counties have for regulating and managing on-site sewage systems and generating funds for those programs. In the 1995 legislative session, the Water Quality Authority is again introducing legislation designed to streamline the authority of local governments to establish efficient, service-oriented utilities for on-site sewage management and other activities.

Grants and loans are available from the state for use by local governments. The primary programs are the Water Quality Account (Centennial Clean Water Fund) and the State Revolving Fund administered by the state Department of Ecology, and the Community Development Block Grant (CDBG) program administered by the state Department of Community, Trade and Economic Development (DCTED). Currently, the Ecology funds are available only as loans for the repair and upgrade of on-site systems. The CDBG funds are federal Housing and Urban Development funds which can be used as grants to low- and moderate-income homeowners to repair or upgrade failing septics under the category of "household improvement."

Type of Organization	**Revenue Options**	**Chapter of RCW**
Program or Utility Operated by Cities and Towns	Rates and Charges General Obligation Bonds Revenue Bonds Fines and Penalties Includes Utility Local Improvement Districts and Local Improvement Districts	35.67, 35.92, 35.41
Program or Utility Operated by Counties	Rates and Charges General Obligation Bonds Revenue Bonds Fines and Penalties Special Assessments Includes Utility Local Improvement Districts and Local Improvement Districts (This is the broadest option available to counties for performing on-site sewage activities.)	36.94
Districts	**Revenue Options**	**Chapter of RCW**
1. Sewer Districts and Water Districts	Rates and Charges General Obligation Bonds Revenue Bonds Special Assessments	56.04, 56.08, 57.04, 57.08, 56.16, 56.20, 57.16, 57.20
2. Aquifer Protection District	Fees for Withdrawal of Groundwater Fees for On-Site Sewage Disposal (must be per household)	36.36
3. Lake Management District	Rates and Charges Special Assessments Revenue Bonds	36.61
4. Shellfish Protection District	Rates and Charges Tax Revenues Inspection Fees and Similar Fees	90.72
5. Health District	Permit Fees	70.05
6. Public Utility Districts	Rates and Charges General Obligation Bonds Revenue Bonds	54.16.230, 54.24

CERTIFICATION OF ON-SITE SEWAGE PROFESSIONALS

Panel

Bill White
Director, Clallam County Department of Community Development

Jerry Stonebridge
President, Stonebridge Construction Company, Inc.
Vice-president, Washington On-Site Sewage Association

Mary Jo Adams
Water Supply and Wastewater Technology Instructor, Green River Community College

Moderator

Karen VanDusen
Director of Community Environmental Health Programs, Washington State Department of Health

Message

Training and education are essential in making sure that on-site sewage systems are properly sited, designed, installed, monitored and maintained. Certification provides an important means for measuring and ensuring professional competency and familiarity with changing technologies, professional practices and regulatory requirements. Cooperation and joint ventures between the public and private sectors, such as the training center at Washington State University, Puyallup, will improve the quality and success of certification programs.

Karen VanDusen, Washington State Department of Health

It doesn't matter how good a design or a particular system is if the *people* who are doing the siting, designing, installing, inspecting and maintenance don't know how to do it correctly.

We have had some system of certification in Washington for installers since 1974, and for designers since 1984. Engineers are also called "certified" if they have a professional engineer's license. The groups that we really have not yet dealt with are the inspection and maintenance professionals and the public health professionals who do the permitting.

One factor driving the Department of Health's efforts to set up a certification program is Element OS-3 of the Puget Sound Water Quality Management Plan. The Water Quality Authority would like to see us develop a certification program, to modify the necessary WACs and RCWs to see that something is established, and to set up continuing education as a part of that program.

The new on-site sewage regulations call for the Department of Health to establish guidelines for qualifications for on-site professionals involved in the design, installation, inspection and

maintenance of these systems. Although the development of guidelines is not the same as the development of a certification program, this work should lead to greater consistency of approaches, the potential for reciprocity, and greater assurance of competency among professionals.

Certification is a term that means different things to different people. What are people's expectations when they talk about certification? For the Department of Health, we will be focusing on experience, education, testing and some type of credential system (e.g., certification, registration, licensing). In an era of regulatory reform and public-private partnerships, whatever evolves on the issue of certification may well be influenced by what comes from the private sector and the training center at WSU Puyallup.

Bill White, Clallam County Department of Community Development

Through the mid-1980s, the Clallam County Health Department did almost all of the site work for the on-site systems. Between 1986 and 1988, we created a designer program, tested it, made some adjustments and established a certification program. Today, designers and professional engineers do almost of all the design work for on-site systems. The county's role is to provide review, quality control, approval, inspection and persuasion.

The following are reasons why we felt we needed to institute a certification program in Clallam County:

- *Workload versus permit fees*—Without a change in policy, we knew we were looking at an ever-increasing and changing workload due to the reliance on alternative systems. Our program had to pay for itself and we felt we had reached the ceiling. We were also getting pressure for quicker turnaround with our reviews and permitting processes from the development community and county commissioners.
- *Homeowner education and involvement*—We thought that if we had more people working with homeowners, rather than just field sanitarians, we might do a better job of educating homeowners and getting them involved with their systems.
- *Quality control and improvements*—Working from the philosophy that two heads are better than one, we thought that if more people looked at the systems and issues, not just county staff, we would get a better end product.
- *Liability exposure limits*—We were concerned that the combination of limited staff and quicker processing times might start to open up liability exposure.
- *Best possible design for each site*—This requires a certain amount of time and hand-holding with homeowners, but we decided that county government was not the best place to place all that responsibility.

The county health department still maintains a great deal of authority and responsibility for on-site systems. We review designs, issue permits, do inspections and final approvals, manage records, handle enforcement and compliance, and take care of the licensing and certification. Designers are responsible for doing the actual design work, certifying the installations, maintaining their continuing education credits, and providing loan certification information to

lending institutions. Certain responsibilities are shared by the county and private sector. These include site reviews, as-builts, homeowner education, and the maintenance of on-site systems. We also share training responsibilities with the local chapter of the Washington On-Site Sewage Association.

The process for our certification program is composed of a three-phase exam which covers rules and regulations (including an emphasis on local policies and procedures), soils theory, and practical exercises. We also require county staff to take and pass the exam. Today we have about 10 certified designers, in addition to county staff, who are all knowledgeable and capable of offering good assistance and information to homeowners in Clallam County. This has allowed us to reduce field staff, improve turnaround times, focus on final inspections and as-builts, implement the revolving loan fund for failing systems, and carry out watershed studies.

There have also been some tough issues. The most noticeable has been an overall increase in the cost to the homeowner as the net cost of system design has risen. There has also been a certain amount of confusion about roles and responsibilities as more players are now involved at each site. This, in turn, has created some problems in ensuring accountability when mistakes occur. And finally, there has been some resistance from the private sector which, in some cases, has questioned the need for county oversight once professional competency has been sanctioned. This has required some ongoing role identification.

Looking ahead, we need to enhance land use and sewage planning; monitoring and maintenance programs; professional competency, performance, and trust; and public confidence in our work as public health professionals.

Jerry Stonebridge, Washington On-Site Sewage Association

There is a clear need for some type of certification program for the on-site sewage industry. On-site systems are here to stay, and they need to be properly operated and maintained in order to provide good treatment and disposal. Individuals in the industry are now realizing that we are putting secondary treatment plants in people's backyards, and we need some means to take care of these systems.

This is why the members of the Washington On-Site Sewage Association (WOSSA) took the lead in establishing the training center at WSU Puyallup. We invited a wide range of interests to participate in this project, including the academic institutions, local health departments, the state Department of Health, the Water and Wastewater Certification Board, manufacturers, suppliers, the Washington State Pumpers Association, Washington Environmental Health Association, Board of Registration for Sanitarians, professional engineers and soil scientists. This group has made the training center a reality, and now needs to continue working together to make it a success. The center can become the hub for a variety of on-site training programs, and will certainly become a significant part in certification programs.

In North Carolina, certification started with a state mandate to establish a certification program for on-site sewage operators. In Washington we do not have such a mandate, and in today's political climate we may not get one. So we have taken the initiative to make use of the existing infrastructure to better educate and train practitioners. If legislation is what we want and need, we will be much more successful if we work together as a unified group that shares a

common vision for professional training and certification. We've also talked with the American Board of Certification, who have said that they could possibly handle certification in conjunction with the state Department of Health. We have many options. Now we just have to make some decisions.

We believe that all individuals and entities, public or private, need to be educated and certified if they are going to operate, maintain, and monitor on-site sewage systems. Certification means that local regulators can be confident that practitioners are trained and competent in dealing with on-site sewage systems. Again, the key to progress is through the continued cooperation of the many individuals and agencies involved in these issues.

Mary Jo Adams, Green River Community College

Information that I have about the Water and Wastewater Certification Program at Green River Community College may serve as a possible model as you move forward with your certification programs for on-site sewage practitioners. In keeping with your focus on operation and maintenance, we essentially certify people who operate and maintain wastewater and drinking water facilities.

The state Department of Ecology assists us with our wastewater certification, and the state Department of Health assists us with the drinking water certification. Personnel involved in day-to-day operation of water or wastewater facilities are required to be certified. Many employers also use the program in determining minimum qualifications, salary levels, job titles, etc. The certification board oversees administration of the program, while the state agencies carry out the day-to-day business of the program. The certification board is composed of representatives from various certification levels, employers and the state agencies.

We also maintain a classification system for the water and wastewater utilities. This allows us to match certification levels with different types of systems, a concept that may have some applicability for on-site sewage systems and utilities.

Each certification level has minimum education and experience requirements, which are as follows:

Classification	Years of Education	Years of Experience
Operator in training	12 (high school diploma)	3 months
Level 1	12	1 year
Level 2	12	3 years
Level 3	14	4 years
Level 4	16	4 years

Operators are allowed to substitute their education and experience in different ways. Our goal is to ensure that operators have sufficient expertise to carry out their duties. If you go this route, you will have to decide whether you want this complex of a system.

The program is designed to be self-supporting. As such, the exam fees and annual renewal fees are based on the cost of the program. In order to qualify for renewal, operators must document professional growth through continuing training and education. When necessary, we can and

do revoke certifications in cases of negligence or unverified education and experience. We feel very strongly about this because of our obligations to protect the environment and public health.

Challenges for the program include the following: 1) the "catch-22" problem of having sufficient opportunities for operators who need experience before they can move up in certification; 2) the wastewater program is currently not self-supporting and Ecology is not prepared to approach the legislature to address the shortfall; 3) the program is prone to abuse by employers; and 4) the need to keep examinations current and practical.

UPGRADING EXISTING ON-SITE SEWAGE SYSTEMS

Panel

Linda Hofstad
Environmental Health Specialist, Thurston County Health Department

Laura Porter
Commissioner, Mason County

Howard Leibrand
Health Officer, Skagit County Health Department

Moderator

Tim McDonald
Health Director, Island County Health Department
President, Washington State Public Health Officials

Message

Public health and environmental protection require ongoing attention to the repair and replacement of failing on-site systems. It is an issue that is complicated by many social, economic, political and technical considerations. While our ability to detect failing systems has improved in recent years through the use of sanitary surveys and dye-test techniques, our ability to correct these problems continues to depend on strong local government and community leadership, flexible public funding, clear information and technical assistance, good education, timely enforcement, sound planning and design, and committed action by property owners.

Linda Hofstad, Thurston County Health Department

Thurston County has a comprehensive program for identifying and correcting failing on-site sewage systems. This program is composed of three primary components, two of which are reactive in nature (complaints and loan certifications) and a third which is more proactive (intensive sanitary surveys).

Complaints are handled on a prioritized basis through a single staff person devoted to complaint response and enforcement. Top priority is given to surfacing discharges followed by permit/code violations and other, less descriptive problems. When a problem is detected, owners have 30 days to submit a repair design and 60 days to complete the installation. For the loan certifications, health department staff are called upon to inspect individual on-site systems, then prepare a report for the lending institution.

The third component of our program is the intensive sanitary survey. We call it "intensive" because it takes between 4 and 8 hours to inspect each system in a targeted area using a dye-trace technique. We changed our approach in the late 1980s when it became apparent that we

were not succeeding in improving water quality and protecting shellfish beds by simply correcting the obvious on-site failures. We theorized that we were dealing with a more widespread nonpoint problem involving many more systems.

Our survey method is based on the following three key features:

- *All homes with on-site systems are surveyed*—We define the boundaries of the survey area and identify all properties based on information from the tax assessor's office.
- *Education is conducted throughout the survey process*—Letters are issued explaining the reason for the survey, neighborhood workshops are conducted on the care of septic systems, brochures are handed out during the actual survey, and videos are made available on the care of basic and alternative systems.
- *On-site systems are tested using a dye-trace technique*—The dye-trace technique allows us to identify failures that previously went undetected. We've now surveyed about 1200 systems, revealing an average failure rate of 13 to 14 percent. (Previous methods revealed failure rates of 4 to 6 percent.) We use a conservative testing approach which relies on both a positive dye result and a water sample that confirms the presence of fecal coliform. To improve quality control, we first determine background levels and have now introduced a second dye to avoid problems with cross-contamination. To date, our research has shown no correlation between failures and the age or type of system.

As part of the Shellfish Protection Initiative grant, one employee is designated to work half-time on community solutions in the project areas. For individual repairs, we have had great success using a "diagnostic approach" which gives the homeowner six to eight weeks to identify his or her own problem. The repairs often involve fixing only a component rather than the whole system, which can be handled relatively quickly and inexpensively. With this approach the homeowner develops more ownership and awareness about the problem.

With our enforcement actions, we now rely on the civil process only. The real objective, after all, is to fix the failing system and to protect public health and water quality. Having the ability to write tickets shows the public that these issues are important. If necessary, we also have the option of using default judgments or injunctive relief.

To assist homeowners, we provide low-interest loans for repairs and upgrades. We are currently looking at the criteria that we use in making these loans to see if we can make the program more useful.

We are currently conducting a dye-trace study to see if we can find a correlation between dye levels and bacteria levels, or to see if we can find a better indicator for identifying failing systems. Our goal, always, is to find better ways of carrying out this program.

Laura Porter, Mason County Commission

Mason County's experience can be portrayed through personal anecdotes which illustrate the difficulties facing rural, mostly poor areas of Puget Sound. On-site sewage systems are

expensive to repair and upgrade, and in many cases property owners are unwilling or unable to pay these costs.

I once visited a single, low-income mother who was participating in neighborhood discussions about failing on-site systems—a neighborhood with an on-site failure rate of about 55 percent. As I approached the home, her children, ages two and four, were in the yard making mudpies. This story is about what was in that mud. I had come to talk with this mother about serious health problems that had plagued the family. Although this person had been to meetings and had heard all the information about failing systems, pollution, and public health, she never connected the information with the mud pies and their family health problems. She finally asked me, after an hour of personal discussion, "Is it possible that our illness is related to the wet clay in the front yard?" Complicating the situation, this person was a renter, so it wasn't her system to fix. And the owner said he would simply evict the family if he had to fix the system. As such, the option for this family was to live in their car, which then presents the public policy question, "Where are they going to go to the bathroom if they are living in their car?"

How do we deal with these types of situations? How do we deal with low-income residents, renters and other needs? In Washington it's fine to spend public money on sewers, but it is not acceptable to spend money on on-site systems.

The next day the Mason County Board of Health heard an appeal pertaining to a new system being installed on a lot where the previous home had been destroyed by fire. The third-generation owners simply wanted to reconstruct their property. However, there wasn't enough room for both the new on-site system and the tennis court. Because reconstruction of the tennis court was a priority, the owners sued us. The case is now being appealed to superior court.

With our processes, judges and political leaders alike are called upon to interpret health regulations and to make decisions about failures and many other issues. These technical issues become political when dealing with constituents. At almost every juncture in the process, staff and commissioners are called upon to make decisions that come under tremendous scrutiny and pressure.

Another difficulty is finding qualified professionals who are willing to assist homeowners with repairs. Most designers and installers prefer to work on new systems. Because of this problem and other circumstances, the county often has no alternative but to extend deadlines for compliance.

We are finding fairly consistent failure rates of 10 to 15 percent along our shoreline areas. So why don't we just fix the problem? The simple answer is that there is nothing simple about these issues. For example, a homeowner who had given permission for staff to enter his property and conduct a dye test is now considering suing the county for "breaking and entering" because the sanitarian went under the house in performing the dye test.

In Mason County, a good 10 percent of the people "just say no"—no to government, no to regulations, no to public health. There is immense pressure on elected officials in dealing with the on-site sewage issues, from being sued, to losing elections, to making decisions that may involve matters of public health and possible eviction. Elected officials need to deal with a number of practical considerations in solving these problems.

From a local perspective there are glitches in state policy. Why can't the state provide better assistance when it is far cheaper to fix existing systems than it is to install sewers? There is a real need for education on land uses, densities, failure rates and water quality. We all have to continue working with citizens to help them better understand these issues and to focus attention on solving the problems.

Howard Leibrand, Skagit County Health Department

After many years of living with failing on-site systems, two small, bay-side communities in Skagit County are now working toward a solution. Both of the communities have high failure rates—60 percent in Edison and 45 percent in Blanchard. Edison has 65 homes on tiny lots, most of which are hooked into a common drainage system that goes directly to a tidal slough. Blanchard has 52 homes with gravity systems, many of which are discharging directly into the bay. For years people knew they should stay away from the waters, but because the problem wasn't too bad, no one took action. The residents didn't understand the threats to public health and nearby shellfish beds. When the health department found high coliform counts in 1990-1991, the county wanted to wait until the watershed planning process was completed before taking action. But efforts were initiated earlier after prompting from the state and a shellfish downgrade at the mouth of the Samish River.

The communities took the initiative and formed local sewage committees in January 1993. They are doing a great job working with a variety of interests and local, state and federal agencies to solve the problem. The Edison and Blanchard projects were selected by the Department of Ecology as pilot projects under their Small Towns Environment Program. Community leaders worked with Thurston and Mason counties to see how they had dealt with shellfish downgrades. The communities petitioned the state Department of Health in March 1993 for a severe public health hazard designation to qualify for grants. They also studied treatment options and funding sources, and were successful in obtaining both a $50,000 Centennial Clean Water Fund grant for designing a community sewage system in Edison and a $500,000 Community Development Block Grant for system repairs and upgrades. During this period, the county also established a $500,000 revolving loan fund to assist with repairs and upgrades.

Despite the effort, 15 people became ill last spring after eating shellfish from Samish Bay, which resulted in a downgrade for a portion of the bay. Overall, there has been success in identifying the problem, but failure in not addressing the problem soon enough.

In our work on these projects, a number of issues have surfaced. One issue is the obvious lack of monitoring and good information that we have in areas like this. If failures had been detected and addressed as they occurred, it would have prevented the dramatic problems that we have today. Health departments lack the basic capacity to be proactive. We spend most of our time and resources responding to emergencies.

Another issue has been one of inertia—the difficulty in changing course with a long-established situation. In addition to the 65 homes in Edison, a school is also involved. To fix the problem we had to wait for resolution on a school bond issue. However, having the school involved has also been positive in generating action because the school district has a timeline that will help force a solution.

Citizens initially thought the problem was from farms upstream, not from their septic systems. Leaders from the community have been instrumental in providing information to neighbors to help them understand that it is their problem. The county has also played an important role in educating the residents. The sanitary surveys we conducted were effective, educational, and well received.

A final problem has to do with "it's not my job." The role of a local health professional has evolved basically as that of a regulator—not an educator, not a facilitator, and certainly not an on-site designer. State law says that it is the homeowner's responsibility to make sure that the on-site system is functioning properly. But as we learn more about the breadth and depth of these problems across the region, we increasingly see that they require more from all interests, including local health departments.

LAND USE AND ON-SITE SEWAGE SYSTEMS

Panel

Dick Settle
Professor of Law, Seattle University School of Law

Louise Miller
Councilmember, Metropolitan King County Council

Mike Shelton
Commissioner, Island County

Joy Keniston-Longrie
Environmental Programs Division Manager, King County Department of Metropolitan Services

Craig Cogger
Extension Soil Scientist, Washington State University, Puyallup Research and Extension Center

Moderator

Steve Wells
Assistant Director for Growth Management Services, Washington State Department of Community, Trade and Economic Development

Message

Growth management planning influences the use of on-site sewage systems in the Puget Sound region. In rural areas, individual and community on-site systems will continue to be called upon as a long-term solution for sewage treatment. Existing systems in urban areas will likely remain in use as long as performance is good, due in part to limited capacity at municipal treatment facilities. In rural settings, particularly the island environments, GMA policies that concentrate growth are difficult to reconcile with other policies that support groundwater recharge and wastewater reuse. Increasing reliance on on-site systems raises unresolved questions about development densities and nitrate contamination of groundwater.

Dick Settle, Seattle University School of Law

The Growth Management Act (GMA) is stirring a revolution in Washington land use planning. Most GMA provisions relate to the county and city planning and regulatory processes. These include responsiveness of comprehensive plans to the 13 GMA goals, consistency and coordination through county-wide planning policies, identification of urban growth areas, and implementation of the comprehensive plan through consistent development regulations and the capital facilities plan. The GMA spells out three kinds of consistency—local policies and

regulations must be consistent between jurisdictions; they must be internally consistent; and zoning, other development regulations, and capital investments must be consistent with the comprehensive plans.

There are a few major substantive requirements in the GMA. One is that natural resource lands and critical areas must be placed off-limits to urban development. The second is that urban growth areas must be designated and sized to accommodate the 20-year growth projection and must contain most of the growth. The third substantive requirement is concurrency—new development will not be allowed unless certain services are available within six years of the time of development. Finally, locally undesirable but regionally essential land uses, such as prisons, must be accommodated.

The GMA has some general implications for on-site sewage treatment. For the most part, development will be concentrated in sewered areas. Development outside the urban growth areas will be at lower densities which are more compatible with on-site sewage treatment. Subdivisions will need facilities and services concurrent with development. This will require that sewage treatment, including individual and community on-site systems, be adequate or that sewers be made available when needed.

Louise Miller, Metropolitan King County Council

One of the drivers behind the Growth Management Act was that King County voters were concerned about sprawl. The challenge is to figure out how we can grow more gracefully and not get ahead of the capacity of our local infrastructure. In spite of the recent rise in opposition to growth management, people are still very concerned about the manner and cost of new growth. King County has about a half-million people in the rural area, a half-million in the suburban cities, and a half-million in Seattle. Financial constraints are strongly affecting the extension of infrastructure, especially to growth areas outside existing urban areas.

There is no great urgency for converting on-site systems to sewers. METRO is approaching capacity with its sewer system, and it will be expensive to add more. Also, on-site systems contribute significantly to groundwater recharge, which we are coming to see as an important benefit. The King County comprehensive plan has been revised to acknowledge that existing on-site systems in urban areas can remain, as long as they aren't polluting.

We need good maintenance and periodic inspection of on-site systems. Many people in the rural area are on public water and don't even know they have an on-site sewage system. More and more houses are built every day that are served by on-site systems and that have all the conveniences of homes in urban areas. We need to make sure that people know they have an on-site system, and that they know how to maintain it so they don't pollute their community water system. Once a community water supply goes bad, people look to the county to subsidize their connection to a regional water supply.

Statewide, the future of growth management is uncertain. Some counties now want to opt out and the Growth Management Hearings Board decisions are challenging local government authority. The urban counties certainly don't want out of growth management because they have made such an enormous investment of time and process, and have developed consensus

about how to deal with growth. It's a set of issues that we have to deal with in one form or another.

Mike Shelton, Island County Commission

Island County is growing quickly, and mostly in the unincorporated areas. There are no rivers in the county—our aquifers recharge from rainfall. Except for Oak Harbor, groundwater provides the water supply for everyone in the county. This has led us to recognize the importance of both protecting our groundwater supply and maintaining recharge via on-site sewage systems.

Our on-site program in Island County can serve as a model for other counties. County health has been a leader with standards that are just now being accepted as minimum requirements in the state regulations. Island County understands the importance of on-site systems as the permanent means for sewage treatment in rural areas.

On-site systems are important sources of aquifer recharge, both for drinking water and to prevent salt water intrusion. If all new development were required to go to sewers in urban growth areas, the lack of recharge would place tremendous strain on the aquifers.

I'm afraid the Growth Management Act doesn't recognize these needs. Standard GMA requirements that call for concentrated growth and centralized sewer service are contrary to what we believe are good water-management practices in Island County. The GMA needs to be changed to allow more flexibility for rural local governments to control their patterns of land use based on local situations and knowledge.

Joy Keniston-Longrie, King County Department of Metropolitan Services

METRO is a regional wholesaler of wastewater treatment. METRO is developing a Regional Wastewater Service Plan through the year 2020. Considerations in this process are coordination with GMA, state and federal regulations, demographics, and the fit with on-site sewage systems. The plan will look at regional alternatives for protecting water resources; reducing wastewater discharges, combined sewer overflows, and treatment of waste; wastewater reuse; and biosolids handling and reuse. METRO hopes that the plan will be forwarded from the King County Executive to the King County Council in 1995, and adopted by the Council in 1996.

This regional approach is needed because the population and sewage discharges continue to grow. A half-million more people and 83 million gallons per day (mgd) more wastewater will be added to the METRO service area by 2020. This translates into a 39 mgd additional need for treatment capacity. Treatment plants and pipes will be at capacity by 2008. New systems need to be designed for peak flows, and need to account for both sewage flows as well as inflow and infiltration.

Financing will be a major concern for the future. Charges to rate payers have increased dramatically over the past 30 years. Total investment to date for infrastructure is between $2 billion and $2.5 billion. In the future, costs will increase further. Poor management can result in public health problems and surface and groundwater contamination. These costs are hard to quantify.

Public sewers will be extended to serve growth in urban areas. Existing on-site systems may remain in those areas, but if densities increase then they will need to be replaced with sewers. On-site systems in rural areas serve valuable functions, such as aquifer recharge. However, they can cause pollution problems in areas with unprotected aquifers or if poorly installed or maintained.

King County is close to adopting the following policies for on-site systems:

- Septic systems are considered to be permanent in rural areas and on natural resource lands.
- Community systems may be allowed when they are needed to solve health problems in rural areas and when they are managed and accompanied by density limits.
- Failing systems in rural areas and on natural resource lands can be replaced with public systems only if health problems exist.

In urban areas, decisions on the types of systems allowed will be made by local jurisdictions. Sewers are usually required if they are within a certain proximity to development.

METRO is required to accept all the sewage that member jurisdictions generate. However, expansion of the system will be increasingly difficult and METRO is interested in working collaboratively throughout the jurisdiction to find creative ways to protect water resource quality and quantity. Important considerations are watershed management, fish and wildlife habitat protection, and wastewater reuse.

Craig Cogger, Washington State University

A properly functioning on-site system effectively reduces bacteria, biochemical oxygen demand, and phosphorus, but produces nitrates. The problem is how to limit the effects of nitrate leaching. Estimates of nitrate removal by different types of septic systems are limited, and are based on uncertain data. The impacts of nitrate discharges on human and environmental health may not be seen until a community is fully developed, when it is too late.

Short-term actions should leave room for long-term solutions. While one house per five acres may be an acceptable density for rural areas, it is unsuitable for urban areas and conflicts with growth management planning. We need to consider the cumulative impacts of development on the environment. In the long run, we need to find ways for on-site systems to limit nitrate discharges. The following are possible ways to deal with the problem of nitrate contamination:

- Estimate nitrogen loss from current systems and evaluate the benefits of converting to more efficient systems.
- Develop models to estimate the effects of dilution in groundwater. This has yielded limited success so far.
- Base lot sizes, in part, on the potential for landscapes to remove nitrates.
- Encourage the development, approval, and use of denitrification systems.

- Explore the use of systems that have increased seasonal plant uptake, such as shallow irrigation systems.
- Build dilution and denitrification goals and policies into land-use planning, such as clustering systems and using greenbelts for dilution.