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Helping America's Small Communities Meet Their Wastewater Needs

JURIED ARTICLE

A Private Market Approach to Onsite Wastewater Treatment System Maintenance

Mars Experiments with Wetlands and Water Reuse

Fall 2001 Volume 2, Number 4

NATIONAL SMALL FLOWS CLEARINGHOUSE

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JURIED ARTICLE

A Private Market Approach to Onsite Wastewater Treatment System Maintenance

John Herring, Ph.D.

30 Maintenance of existing onsite systems remains the weak link in many community wastewater management programs. This article discusses the limitations of traditional regulatory approaches to onsite system management. The author proposes an alternative private market approach using catastrophic onsite wastewater treatment system insurance.

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Mars Experiments with Wetlands and Water Reuse

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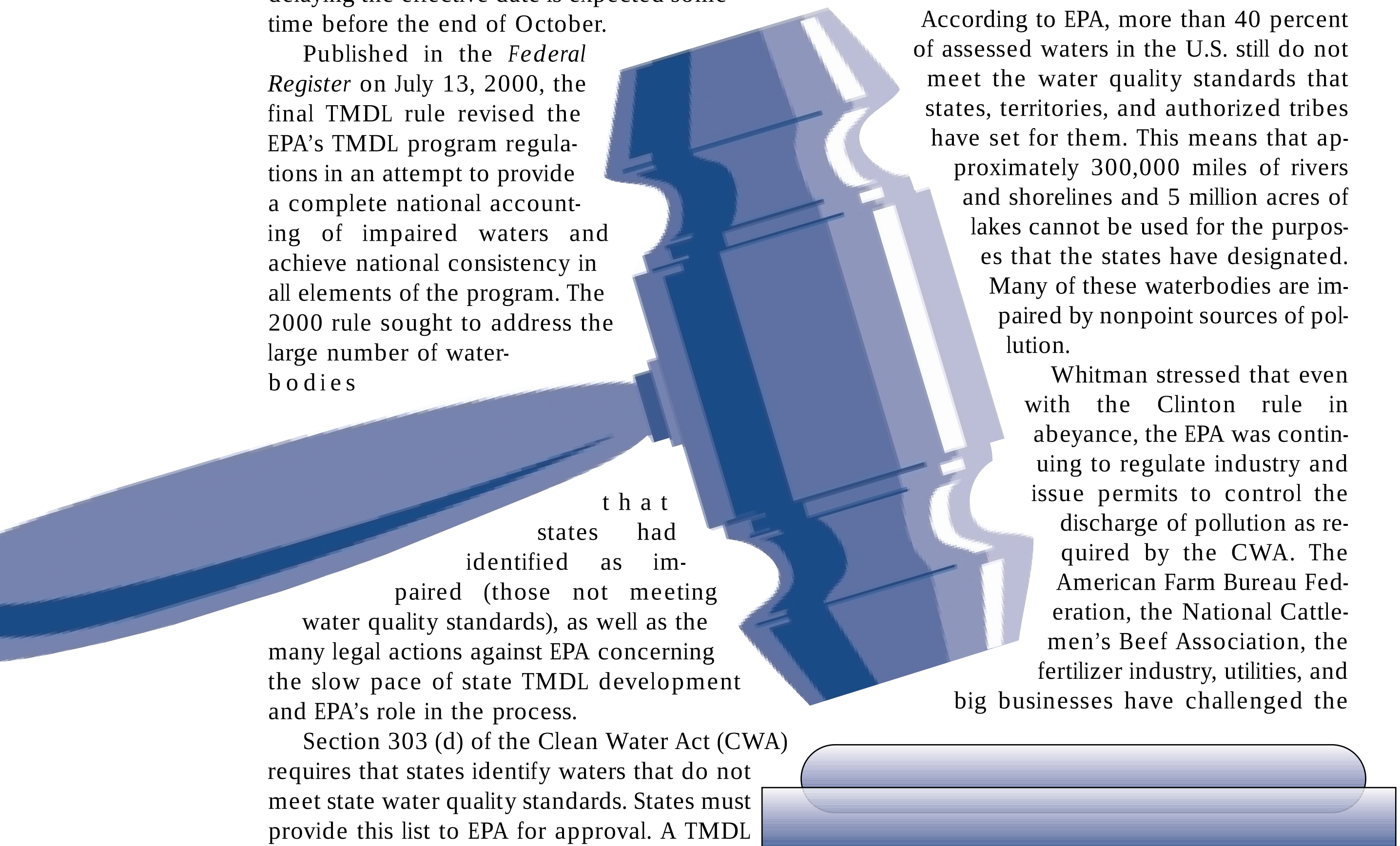
EPA To Review TMDL Rule

On July 16, 2001, the U.S. Environmental Protection Agency (EPA) and the Justice Department filed a motion asking the U.S. Court of Appeals for the D.C. Circuit to delay action on a legal challenge to the July 2000 Total Maximum Daily Load (TMDL) Rule. In a *Federal Register* notice on August 9, EPA proposed to delay the effective date of the rule for 18 months as it seeks more public input, reviews, and rewrites the rule. A final rule delaying the effective date is expected sometime before the end of October.

Published in the *Federal Register* on July 13, 2000, the final TMDL rule revised the EPA's TMDL program regulations in an attempt to provide a complete national accounting of impaired waters and achieve national consistency in all elements of the program. The 2000 rule sought to address the large number of waterbodies that states had identified as impaired (those not meeting water quality standards), as well as the many legal actions against EPA concerning the slow pace of state TMDL development and EPA's role in the process.



Section 303 (d) of the Clean Water Act (CWA) requires that states identify waters that do not meet state water quality standards. States must provide this list to EPA for approval. A TMDL is then required for that waterbody.

A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive while still meeting water quality standards, and is also a measure of the total amount of pollutant that sources are allowed to discharge into a waterbody. The TMDL program was designed to identify polluted waters and determine the necessary reduction in pollutants to meet water quality standards.

EPA Administrator Christie Whitman said that to ensure that the nation's bodies of water are cleaned up, an effective national program is needed that involves the active participation and support of all levels of government and local communities. But, she said, many feel the current program "falls short of achieving the goals." The regulation was among dozens of environmental rules issued by the previous administration that Bush officials have reviewed since taking office. This one could affect virtually every region and state in the country.

The rule would have required states to develop a TMDL, or clean-up plan, within 10 to 15 years of a waterbody being placed on a state's list of impaired waters. The rule also called for restoration actions to occur during the subsequent 10 to 15 years. In 1998, states identified approximately 21,000 waterbodies as impaired by approximately 37,000 pollutants.

According to EPA, more than 40 percent of assessed waters in the U.S. still do not meet the water quality standards that states, territories, and authorized tribes have set for them. This means that approximately 300,000 miles of rivers and shorelines and 5 million acres of lakes cannot be used for the purposes that the states have designated. Many of these waterbodies are impaired by nonpoint sources of pollution.

Whitman stressed that even with the Clinton rule in abeyance, the EPA was continuing to regulate industry and issue permits to control the discharge of pollution as required by the CWA. The American Farm Bureau Federation, the National Cattlemen's Beef Association, the fertilizer industry, utilities, and big businesses have challenged the rule as unlawful and, potentially, a devastating financial burden. But environmentalists said the administration's decision would undermine a program critical to cleaning up the nation's waterways.

In the face of mounting controversy, in July 2000, Congress attached a rider to an emergency appropriations bill that prohibited EPA from spending funds to implement the July 2000 rule. In October 2000, Congress ordered the National Academy of Sciences (NAS) to assess the scientific basis of the overall water cleanup program. An academy panel issued a report in June recommending a more science-based approach and suggesting that some of the rivers and streams be dropped from a cleanup list until better standards and monitoring are devised. The panel agreed that water pollution remains a serious problem and that the program forcing cleanup should be continued despite scientific uncertainties.

Whitman emphasized that the NAS recommendations will be studied at the same time there is a public process going forward to consult with all interested parties. Over the next several months the EPA will conduct a stakeholder process. It intends to propose necessary changes by spring 2002 and hopes to adopt such changes within the 18-month time frame.

For more information about the EPA's TMDL program, visit the TMDL Web site at **www.epa.gov/owow/tmdl/**.

For an overview of how TMDLs relate to local governments, including recent news, regulatory and legislative updates, and online publications, visit the Local Government Environmental Assistance Network (LGEAN) Web site (TMDL Hot Topic Web page) at **www.lgean.org/html/hottopics.cfm**.

With contributions from Water Technology Online, 7/17/2001 SF

EPA Releases New Collection of Nonbinding Guidance Documents

The U.S. Environmental Protection Agency (EPA) has posted a new collection of nonbinding guidance materials online at the EPA Web site. Called the Interpretive Documents Collection, the site contains documents issued to regions, states, and/or the regulated community that explain and interpret environmental regulations and statutory requirements. The collection presently contains only nonbinding guidance materials issued by EPA headquarters offices since January 1, 1999, and does not include materials released by EPA regional offices. The collection may not include all guidance documents issued during this period. If EPA identifies additional guidance documents, they will be added to the collection. You can search through the collection at **www.epa.gov/guidance/**. SF

To the Editor

Not unlike many others, the article by Bennette Burks and Michael Price (Spring 2001 *Small Flows Quarterly*) seems to miss the point about the concerns related to the use of onsite wastewater treatment technologies. There is nothing that is new in the world of onsite wastewater treatment except the lack of concern about prevention when it comes to utilizing these systems. I found the comparison of sampling for private wastewater treatment systems to that of municipal systems to be particularly illustrative of this point.

Municipal wastewater treatment systems discharge into surface waters, while typical onsite systems discharge below grade and ultimately into groundwater. No one expects to be able to use surface water without pretreatment, whereas virtually everyone expects to be able to use groundwater without pretreatment. Therefore, the same averaging that is perfectly acceptable for municipal treatment cannot be equally applied to onsite treatment if protection of public health and groundwater quality is the goal. It is hard for me to believe that anyone concerned about public health or groundwater quality would imply that it is acceptable for a system discharging into sensitive areas to exceed acceptable limits on any number of days as long as the 7- or 30-day average is OK.

Additionally, as several articles in the Spring issue point out, no matter how well the treatment system is designed and installed, the system cannot meet the design standards if the necessary maintenance is not performed. Thus, the more we rely on technology to treat domestic wastewater, the greater the risk to public health and groundwater. It is typical for authors of these articles to emphasize the need for proper maintenance and operation, but suggestions for effective ways to achieve that goal are noticeably absent.

The few ideas that are offered include an operating license, ongoing servicing agreements, etc. These "solutions" look good on paper, but are not very effective in reality. Regulatory agencies cannot realistically be expected to be the enforcers of servicing contracts or operator's licenses unless they have the luxury of a large staff and enjoy playing cat-and-mouse. Even when a system is brought back into compliance, the environment has lost while the system was improperly operated. These solutions rely heavily on penalties for after-the-fact violations—they do not work as true preventive mechanisms.

I look forward to the day when the cheerleaders for these not new, but higher risk technologies step forward with the hard and fast truth that if prevention is a goal of wastewater treatment, the payment for the servicing and maintenance of these systems must be assured in the same manner that funding for municipal treatment systems is assured; namely, through a special assessment or other assessed fee. If people are eager to use the technology, receiving the bill for the annual operating costs up front will not discourage them. The real benefit of this mechanism is that the public health assurance will be there, and potential malfunction will be related to mechanical, not human, frailties. At least mechanical devices can be equipped with alarm systems to warn us when they don't do what we expect.

Sincerely,
James P. Clark, R.S., Director
Environmental Health Section
Public Health Division
Department of Human Services
Dane County, WI

Calendar of Events

NOVEMBER

Realtors Conference and Expo
The National Association of Realtors
November 2–5
Chicago, Illinois
(800) 628-6338—Peter Cumming
www.narconference.org

BATIMAT International Building Exhibition 2001
National Association of Homebuilders
November 5–10
Paris, France
(800) 368-5242 ext. 109

Restoring Native Ecosystems National Conference
The National Arbor Day Foundation
November 6–7
Nebraska City, Nebraska
(888) 448-7337

Up Front Solutions to Backyard Problems/17th Annual Onsite Wastewater Treatment Conference
North Carolina State University
November 7–9
Raleigh, North Carolina
(919) 513-1678—Joni Tanner
www.soil.ncsu.edu/training/

Municipal Waste Management Association Fall Summit
Municipal Waste Management Association
November 7–9
Austin, Texas
(202) 861-6760—Susan Jarvis
www.usmayors.org/mwma

Pretreatment Coordinator's Workshop
Association of Metropolitan Sewerage Agencies (AMSA)
November 7–9
Nashville, Tennessee
(202) 833-AMSA
Fax: (202) 833-4657
info@amsa-cleanwater.org

WWEMA 93rd Annual Meeting
Water and Wastewater Equipment Manufacturers Association (WWEMA)
November 8–10
Destin, Florida
(703) 444-1777
Fax: (703) 444-1779
wwema@erols.com

WEFTEC Latin America 2001
Water Environment Federation
November 11–14
San Juan, Puerto Rico
confinfo@wef.org

Water Quality Technology Conference
American Water Works Association
November 11–15
Nashville, Tennessee
(303) 347-6194
chaas@awwa.org

Annual Water Resources Conference
American Water Resources Association
November 12–15
Albuquerque, New Mexico
(540) 687-8390

Virginia Water Research Symposium 2001
Virginia Water Resources Research Center
November 14–16
Charlottesville, Virginia
jupoff@vt.edu

2001 Groundwater Foundation Annual Conference and Groundwater Guardian Designation Ceremony
The Groundwater Foundation, Pennsylvania Water Resources Education Network, and Pennsylvania Rural Water Association
November 14–16
Pittsburgh, Pennsylvania
(724) 465-4978
Fax: (724) 465-4953
sherenehess@yourinter.net

Competitiveness for Municipal Water and Wastewater Enterprises
Urban Water Institute
November 14–16
San Francisco, California
(949) 760-6071
Fax: 949-760-6073
urbanwater1@aol.com

EMECS 2001: 5th International Conference on the Environmental Management of Enclosed Coastal Seas (EMECS)
EMECS
November 19–22
Kobe, Japan
81-78-252-0234
2001@emecs.or.jp

2001 ACWA Fall Conference
Association of California Water Agencies (ACWA)
November 28–30,
San Diego, California
(888) 666-2292
Fax: (916) 325-2316
mmdepartment@acwanet.com

DECEMBER

The Remediation Course
Princeton Groundwater, Inc.
December 3–7
Orlando, Florida
(813) 964-0800
Fax: (813) 964-0900
info@Princeton-Groundwater.com

Kentucky Onsite Wastewater Association 7th Annual Conference and Exhibit
Kentucky Onsite Wastewater Association
December 4–6
Louisville, Kentucky
(270) 358-8665—Kate Peake
thepeake@msn.com

Triple Play 2001 Realtors Convention and Trade Expo
The New Jersey, New York, and Pennsylvania Association of Realtors
December 4–6
Atlantic City, New Jersey
(732) 494-4720—Cheryl Kindon
www.realtorstripleplay.com

Journal of Light Construction (JLC) Live Training Show
Journal of Light Construction
December 7–8
Portland, Oregon
(802) 244-6257—Edward Brennan

JANUARY

NGWA's 2001 Groundwater Expo
National Groundwater Association
December 7–9
Nashville, Tennessee
(800) 551-7379

The InspectionWorld 2002 American Society of Home Inspectors
January 14–16
New Orleans, Louisiana
(847) 759-2820

FEBRUARY

USEPA SWMM, and PCSWMM 2002, Stormwater Modeling Workshops
Computational Hydraulics Int.
February 18–20
Toronto, Ontario
(519)-767 0197—Lyn James
Fax: (519) 767-2770
info@chi.on.ca
www.chi.on.ca

Conference on Stormwater and Urban Water Systems Modeling
Computational Hydraulics Int.
February 21–22
Toronto, Ontario
(519) 767-0197—Lyn James
Fax: (519) 767-2770
info@chi.on.ca
www.chi.on.ca

APRIL

NSF International Symposium on HPC Bacteria in Drinking Water: Public Health Implications
NSF International
April 22–24
Geneva, Switzerland
(734) 827-6818—Keri Broughton
www.nsf.org/conference/hpc

If your organization is sponsoring an event that you would like us to promote in this calendar, please send information to the *Small Flows Quarterly*, Attn. Tim Suhrer, National Small Flows Clearinghouse, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064. Or you may contact Mr. Suhrer at (800) 624-8301 or (304) 293-4191, ext. 5587, or via e-mail at **tsuhrer@wvu.edu**.

Wastewater on the web...

Drinking Water and Wastewater Operator Information Center

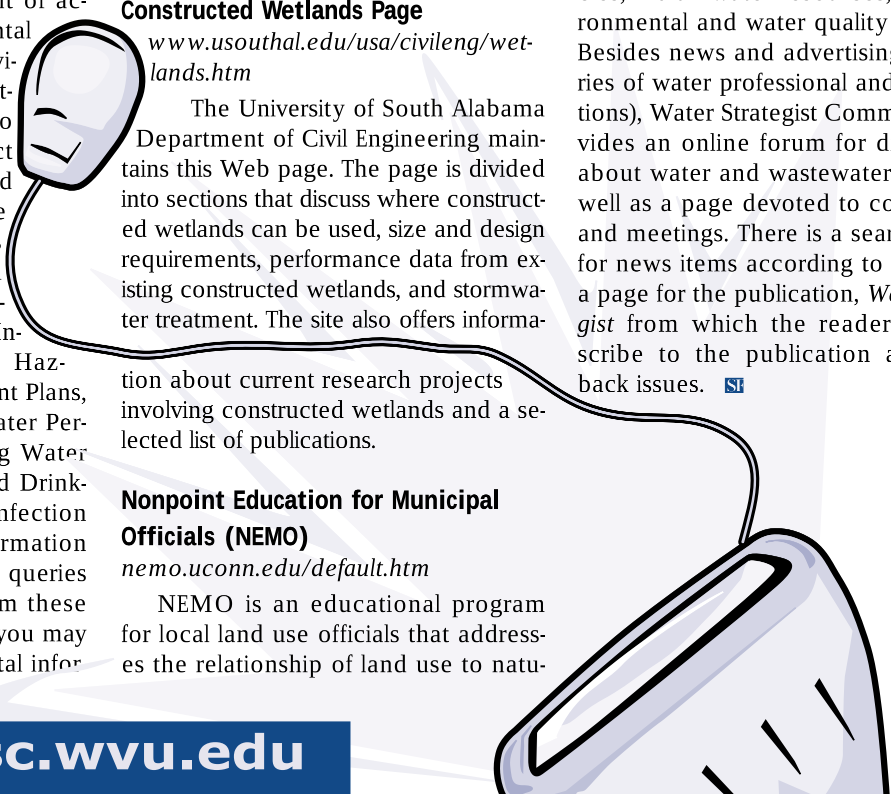
www.dep.state.pa.us/dep/deputate/waterops/redesign/indexgoodflash.htm

This site, maintained by the Pennsylvania Department of Environmental Protection (DEP), provides weekly updates of state environmental and regulatory news. There are also pages devoted to biosolids, wastewater operator certification review quizzes, free online technical assistance for wastewater operators, the Penn-Step Community Self-Help Program, and links to the Web sites of Pennsylvania DEP regional offices. The reader can access online forms for wastewater permits. There is also a page that announces DEP-sponsored training sessions and one that guides applicants through the wastewater operator certification process. The site offers classified pages where announcements about employment, sales, and events can be posted.

Envirofacts: Data Warehouse and Applications

www.epa.gov/enviro/index_java.html

Envirofacts is a single point of access to select U.S. Environmental Protection Agency (EPA) environmental data. The EPA created the Envirofacts Warehouse to provide the public with direct access to information contained in several of its databases. The Envirofacts Warehouse allows you to retrieve environmental information from EPA databases on Air, Chemicals, Facility Information, Grants/Funding, Hazardous Waste, Risk Management Plans, Superfund, Toxic Releases, Water Permits, Drinking Water, Drinking Water Contaminant Occurrence, and Drinking Water Microbial and Disinfection Byproduct Information (Information Collection Rule [ICR]). Online queries allow you to retrieve data from these sources and create reports, or you may generate maps of environmental information by selecting from several mapping applications available through EPA's Maps On Demand.



Florida Water and Pollution Control Operator's Association (FWPCOA)

www.fwpcoa.org/main.html

The FWPCOA is an organization of members who are engaged in producing, treating, and distributing drinking water; collecting, treating, and disposing of wastewater; and/or collecting and treating stormwater. It seeks to protect public health and preserve natural resources by advancing the professional status of water and wastewater operators, providing a licensing system, and arranging training programs. Their Web site has a job board, a message board, and pages containing information about continuing education. The training section lists FWPCOA-approved continuing education courses, state short courses given in cooperation with the Florida Department of Environmental Protection, and regional training schedules. It also offers access to training manuals.

Constructed Wetlands Page

www.usouthal.edu/usa/civileng/wetlands.htm

The University of South Alabama Department of Civil Engineering maintains this Web page. The page is divided into sections that discuss where constructed wetlands can be used, size and design requirements, performance data from existing constructed wetlands, and stormwater treatment. The site also offers information about current research projects involving constructed wetlands and a selected list of publications.

Nonpoint Education for Municipal Officials (NEMO)

nemo.uconn.edu/default.htm

NEMO is an educational program for local land use officials that addresses the relationship of land use to natural resource protection. The original stimulus for NEMO was the creation of a land cover database for the state of Connecticut, for the purposes of estimating nonpoint source loadings of nitrogen to Long Island Sound. NEMO was created in 1991–1992 as a collaboration between three branches of the University of Connecticut: the Cooperative Extension System, the Natural Resources Management and Engineering Department, and the Connecticut Sea Grant College Program. The Web site describes NEMO's statewide workshops and regional educational programs. Results of NEMO research in landscape effects on the environment also are presented.

Water Strategist Community

www.waterchat.com/

Water Strategist Community is the online version of *Water Strategist*, a monthly publication that offers news and in-depth analysis of marketing, legislation, litigation, and financial information about water resources. Reporting covers 17 western states, federal agencies, Indian water resources, and environmental and water quality concerns. Besides news and advertising (directories of water professional and organizations), Water Strategist Community provides an online forum for discussions about water and wastewater issues, as well as a page devoted to conferences and meetings. There is a search engine for news items according to topic, and a page for the publication, *Water Strategist* from which the reader can subscribe to the publication and order back issues. SF

Perspectives on the Science and Engineering of Onsite Wastewater Systems

CONTRIBUTING WRITER

Robert L. Siegrist, Ph.D., P.E.

Wastewater infrastructure includes a continuum of approaches that range from highly centralized systems serving densely populated urban areas to decentralized onsite systems serving sparsely populated rural areas.

Centralized systems serve approximately 75 percent of the population and generally include gravity piping networks that convey wastewaters from remote generation to centralized treatment plants. There, engineered, tank-based biological processes are supported by physicochemical processes, and the effluent is disinfected and discharged to a receiving surface water near the plant location.

Onsite and decentralized systems serve approximately 25 percent of the U.S. population and are characterized by collection distances that are short or negligible. Tank-based pretreatment followed by natural systems for advanced treatment before discharge to the land with recharge to groundwater. In the past, onsite systems have often been viewed as a temporary approach to wastewater management and acceptable for use only until a centralized approach could be implemented. Yet there are many situations within the U.S. (and more so in developing countries) where centralized systems are neither cost-effective nor sustainable due to a variety of factors (e.g., low-density development, rugged topography, limited water and energy supplies, and lack of skilled labor). In these situations, decentralized systems can and should be considered as long-term solutions (EPA, 1997).

Decentralized approaches to wastewater infrastructure are based on the use of onsite wastewater systems (OWS). These have evolved greatly during the 20th century from early cesspool and seepage pit designs that were focused simply on waste disposal to contemporary OWS designs that include unit operations to achieve advanced treatment as well as disposal and, in some cases, beneficial reuse. OWS can now be designed from a rapidly increasing array of options. These include engineered tank and packed-bed reactors, as well as natural system treatment operations that can be tailored for a given application to yield high treatment efficiencies over a long service life at low cost while protecting public health and environmental quality (Crites and Tchobanoglous 1998, Siegrist et al. 2001).

Today, there is a considerable knowledge base regarding OWS design, implementation, and performance that enables experienced practitioners to effectively implement most commonly used systems. While much is known through research and field experiences, the current state-of-knowledge does not fully support rational system design to predictably and reliably achieve specific performance goals.

It is often difficult for someone unfamiliar with the field of OWS to understand how systems are identified, evaluated, designed, and implemented for a service life that often is expected to be 10 to 20 years or more. Moreover, it is often difficult, if not impossible, to discriminate between optional OWS approaches in order to make decisions that will lead to a cost-effective approach for reducing wastewater related risks to an acceptable level. Two possible outcomes of the current state of OWS science and engineering are that (1) current onsite system technology is not being exploited fully and effectively and that innovations are being stymied and not being rapidly deployed, or (2) inappropriate and even harmful applications may occur.

Advancing the science and engineering of onsite wastewater systems involves at its core, fundamental and applied research and testing to increase the understanding of a given wastewater system or its components, as well as the translation of that understanding into decision aids and modeling tools that enable a rational design and implementation practice. In addition, advancing the science and engineering of this field involves gaining acceptance for a given OWS practice and thereby encouraging its widespread use.

Current State of OWS Science and Engineering

Scientific understanding of OWS has been gained through fundamental and applied research, field testing, and practical experiences. The knowledge base has been documented and disseminated through student theses and dissertations, technical reports, conference proceedings papers, peer-reviewed journal articles, and in guidance documents and manuals (e.g., SSWMP, 1978; Siegrist et al., 2000; Van Cuyk et al., 2001; EPRI, 2001; Siegrist et al., 2001; EPA, 1980). Unfortunately, too much of the scientific understanding of OWS process function and performance has not been fully and clearly documented. Rather, there are ubiquitous studies and observations published in the gray literature while other knowledge is not published at all, but simply retained in (or worse yet, lost from) the memory of researchers and practitioners. Also, observations made during research or field applications have not been used to develop mathematical models to represent processes and enable extrapolation and prediction. As a result there have been, and continue to be, controversial and unresolved views of OWS science and engineering, which unavoidably leads to highly varied practices.

To the uninformed but intelligent scientist or engineer new to the OWS field, who might consider applying OWS, the absence of more fundamental understanding embodied in mathematical models and employed as part of a rational design practice would almost certainly suggest that OWS are not well understood nor predictable in their application and performance. How does one informed and knowledgeable about conventional or alternative OWS explain the wide variability in practices today?

For example, it is difficult to document the basis for how small differences from a highly imprecise hydraulic test of a soil horizon (e.g., 10 vs. 15 minute per inch percolation rate) can provide adequate insight into soil properties to enable selection of 2.4 centimeters per day (cm/d) rather than 2.2 cm/d for septic tank effluent (STE) loading rates to an OWS using soil infiltration. Similarly, it is difficult to state why in some areas, 1.2 meters of unsaturated soil to groundwater or seasonal saturation is required, while in others, as little as 0.3 meters is all that is needed. It is also difficult to show what the basis with respect to purification is for allowing hydraulic loading rates for aerobic treatment unit effluent discharged to an OWS in sandy soils to be increased by 10-fold or the depth of unsaturated soil to be reduced by 50 percent.

In years past, without sound scientific understanding, practices evolved somewhat blindly and resulted in widespread performance failures. Examples include (1) the upscaling of soil-based OWS whereby the design practice and experiences from small, single-family home applications were used for large, multifamily or commercial applications and (2) OWS to serve restaurants and other commercial facilities with higher strength STE being designed with hydraulic loading rates similar to those used for household STE.

While much is known about the science and engineering of OWS, there are gaps in the current knowledge base. Ideally we would understand how and why processes functioned in a certain way and be able to account for all the relevant influences on performance, including system design, siting, usage, installation/operation, and environmental factors. However, we do not have this understanding at present, and thus we lack the ability to describe in quantitative terms how a system of a given design functions and what can be done to modify design or operation factors to achieve a given performance goal.

To illustrate the breadth and depth of perceived science and engineering needs, the outcome of a recent national research needs conference is insightful. This 2-day conference, funded by the

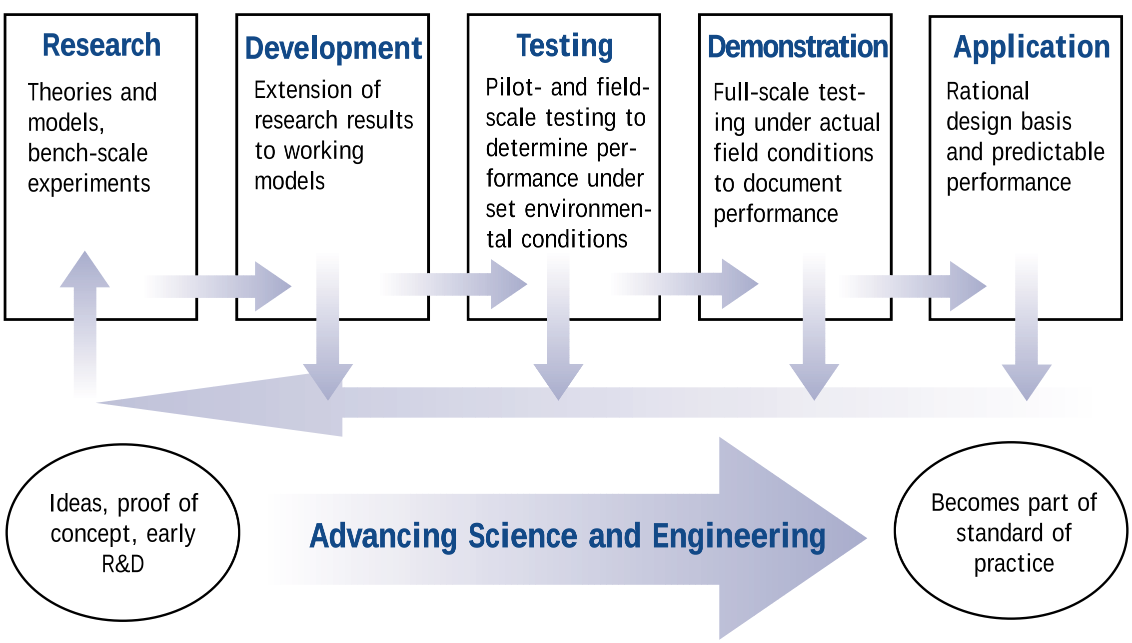


Figure 1

Stages in technology development and application.

Table 1

Example research needs presented at the 2000 National Research Needs Conference[1]

Area	Example Research Needs
"Design and Performance of Soil Absorption Systems . . ." by R.L. Siegrist, E.J. Tyler, & P.D. Jenssen (21 needs listed)	• What is the effect of pretreatment on soil clogging, OWS purification, and hydraulic performance? • How is treatment efficiency affected by transient/extreme environmental conditions? • What models are appropriate for predicting performance as a function of siting, design, and operation? • What methods can be used to estimate the contribution of new or existing OWS to pollutant loads in a watershed? • What are the time-varying characteristics of emerging tank-based treatment units? • What short-term tests can be used to predict long-term performance?
"Fate and Transport of Pathogens . . ." by D.O. Cliver (16 needs listed)	• What are the basic methods by which pathogens are contained or inactivated by basic septic systems? • What are the effects of biomat development on pathogen retention in the soil and on alternative engineered infiltrative surfaces? • Quantify the survival and transport of pathogens in saturated soil. • How does pathogen discharge result from the abrupt failure of an innovative system? • How will catastrophic events impact cluster systems, and how long will it take for adequate performance to be re-established?
"Fate and Transport of Nutrients . . ." by A.J. Gold and J.T. Sims (12 needs listed)	• What micro-scale site features affect the long-term performance of nutrient removal? • How does aerobic pretreatment impact long-term denitrification and hydraulics? • What conditions and designs promote denitrification in different alternative OWS? • What is the long-term removal expected from plant uptake and microbial immobilization in root zone and wetlands systems? • What are the site factors and management practices that impact the capacity of streamside areas to remove nutrients from groundwater flow?
"Economics . . ." by C. Etnier, V. Nelson, and R. Pinkham (12 needs listed)	• Can national performance standards increase OWS acceptance? • What are the actual lifespans and failure rates of onsite and decentralized systems? • When are management and remote monitoring systems cost effective? • How can decentralized treatment be used in the service of smart growth goals? • How can decision-making models used by communities to evaluate wastewater management choices be improved?

[1]Research needs developed at the EPA-funded national conference in St. Louis, Missouri, during May 2000.

U.S. Environmental Protection Agency (EPA), was convened in May 2000 in St. Louis, Missouri, and invited experts were asked to review the state-of-knowledge and make recommendations regarding areas of research needs (EPRI 2001). The research needs presented totaled 61 needs, some of which are illustrated in Table 1.

So, as the future is upon us, we are in the midst of a dilemma of sorts. There is a clear and recognized need for continued, if not expanded, use of OWS as a component of a sustainable wastewater system infrastructure in the U.S. Yet, to enable effective and sustainable use of OWS, there is a current and continuing need for understanding. External forces, such as groundwater disinfection concerns, source water protection initiatives, and watershed total maximum daily loads (TMDLs) are intensifying the scrutiny of OWS and the demands for scientific understanding and rational engineering practice.

Advancing OWS Science and Engineering

Advancing OWS science and engineering depends fundamentally on a logical strategy, as illustrated in Figure 1. This is a classic approach for technology advancement proceeding from the initial bright idea through research and development, technology testing and demonstration, until it evolves into broad use in a standard of practice. As illustrated in Figure 1, advancement requires a logical process of inquiry leading to sufficient understanding that performance can be reliably de-

Table 2

Contrasting approaches to testing and evaluation of OWS function and performance

Type/ Description	Pros	Cons
I. Controlled laboratory experimentation employing: (A) 1-D columns (B) 2-D tanks (C) 3-D tanks	• Can control variables to be studied and can replicate conditions such that small differences can be determined. • Can be designed to elucidate mechanisms and process behavior. • Can be implemented relatively quickly and at lower cost. • Monitoring and measurements can be readily accomplished. • Tracer and viral surrogate studies can be done without concern over environmental release. • Avoids travel to field sites and adverse weather or seasonal constraints. • Does not require physical access to private property.	• Difficult to use for structured soils such as silt loams. • If operated at ambient lab climate conditions, it does not embody diurnal or seasonal patterns in temperature, moisture regime, etc. • Have to transport effluent from a source to the lab. • There can be scale effects on flow and transport in small diameter columns, though these can be offset in larger columns (e.g., 15-cm diameter or larger).
II. Semi-controlled field testing employing: (A) Pilot-scale (B) Full-scale	• Can isolate variables of interest to some extent. • Can be used with structured soils and situations difficult to mimic in the laboratory. • Can be designed to embody soil and climatic conditions that may affect performance. • Transport of effluent from the source to the lab is not required. • Can be viewed by some as more representative of true performance.	• Environmental variations can mask real differences. • Can be more costly and time consuming to complete. • Requires accessible field sites with adequate effluent flow, which does not change too much during the period of study. • Due to cost, test cell or site replication can be difficult. • Can be more difficult to monitor and make measurements.
III. Uncontrolled studies of existing systems by: (A) Records review and walk-over observations (B) Hands-on probing, sampling, and monitoring and measurements	• OWS implemented in practice embody all contributing factors to performance such as design, siting, installation, usage, O&M. • Can be viewed by some as most representative of true performance.	• Cannot control most factors that influence performance, so performance observed cannot be linked to a specific factor. • Ability to discriminate small, but important, differences can be masked by inherent variations. • Due to the sample size required based on inherent variability, sampling and monitoring can be difficult and costly. • Can be difficult to locate adequate numbers of suitable sites to yield required sample sizes. • Changes in effluent flow can confound interpretation of results. • Atypical weather can impact results (e.g., hurricane). • Use of some tracers/surrogates may not be possible.

signed for and predicted. Consistent with this, we need to increase the depth and breadth of our scientific understanding and enable development of mathematical relationships and modeling tools at the micro- to macro-scales.

It must be acknowledged by technology developers, designers, regulators, and others that application of the process illustrated in Figure 1 to OWS can be extremely challenging for varied reasons, including: (1) performance can be affected by numerous design and environmental conditions, (2) certain aspects of performance can be difficult to rigorously monitor and measure, and (3) the system service life and time frame for evaluation can be exceedingly long (e.g., up to 20 years for a soil treatment system), and (4) management is a variable to be considered in performance studies.

Research into natural systems whose performance can be affected by environmental factors is especially difficult, time-consuming, and costly. Unlike accelerated testing schemes that can be

Table 3

Example activities that support the advancement of OWS science and engineering[1,2]

Organization/Activity	Description
Consortium of Institutes for Decentralized Wastewater Treatment	• Information exchange and strategic planning • Education and training initiatives • Research and development activities
National Decentralized Wastewater Water Resources Capacity Development Project	• EPA-funded project to advance the state of management, technology, and practice of decentralized wastewater • Grants and contracts are provided to support training, research, and development efforts
Research and Development Projects	• There are numerous research and development projects recently completed or ongoing that are funded by states, regional EPA offices, federal agencies, private industry, and other sources
National Onsite Demonstration Program (NODP)	• Encourages use of alternative, decentralized technologies in small and rural communities • Seven phases have been funded since 1993
U.S. EPA Environmental Technology Verification (ETV)	• ETV Source Water Protection program addresses verification of decentralized wastewater treatment technologies including nutrient reduction, high strength waste treatment units, and disinfection units.
U.S. EPA *Design Manual for Onsite Systems*	• The 1980 manual has been in the process of revision for more than five years and should be finalized and released during 2001
National Small Flows Clearinghouse (NSFC)	• Databases and information sources
U.S. EPA Management Guidelines	• Voluntary national guidelines on management of decentralized wastewater systems
Training Centers for Onsite & Small Community Wastewater	• Exist nationwide often associated with the Consortium • Some coordination of activities through the NSFC and NETCSC
Workshops and Conferences	• Routinely convened at the local, state, regional, and national level • Events can include onsite system facets within larger programs (e.g., WEFTEC) or are dedicated to onsite systems (e.g., ASAE, NOWRA)

Many organizations have committees that focus on onsite and small community issues (e.g., WEF, ASAE, NOWRA)

[1]The information provided in this table is intended to illustrate the range of organizations and activities ongoing and is not intended to be comprehensive nor to provide any endorsements.

[2]NSFC = National Small Flows Clearinghouse; NETCSC = National Environmental Training Center for Small Communities, WEFTEC = Water Environment Federation Technical Exhibition and Conference; ASAE = American Soc. of Agricultural Eng.; NOWRA = National Onsite Wastewater Recycling Association.

used to evaluate the structural integrity of an object due to physical and chemical forces, OWS involve biological processes and aging phenomena, and they may be subject to upset by usage fluctuations or operational dysfunctions. As a result, they may not be amenable to rapid, yet insightful testing. For example, testing and evaluation of soil-based OWS (and many other types of OWS as well) can be generally categorized to include: (1) controlled laboratory experimentation, (2) semi-controlled field testing, and (3) relatively uncontrolled field surveys and investigations (Table 2). As outlined herein, these approaches have pros and cons and the best approach is dependent on the question(s) to be answered, the breadth and extent of extrapolation needed, and what level of confidence is desired in the conclusions drawn from the work. Depending on the question, one or more testing and evaluation approaches may be most appropriate. In any event, however, the quest for knowledge and certitude is fraught with time and cost that must be offset by the value of information to be gained by the research and testing undertaken.

Mathematical models provide a powerful tool for understanding wastewater treatment processes and describing the performance of OWS as a function of design, operational, and environmental factors. Proper and careful use of single-site process models can enable optimization of system design and operation, as well as provide a quantitative understanding of how design, operational, and environmental factors affect pollutant treatment. Site-scale models include simple spreadsheet-based equations as well as complex numerical models that can simulate unsaturated flow and reactive transport. At the other end of the spectrum of spatial scales are calibrated watershed models that can allow prediction of the impacts of OWS on water quality as well as assist in determining TMDLs for a watershed and regulating population growth in the watershed. Watershed models range from simple mass-balance methods, to geographic information system (GIS) mapping methods, to complex numerical models that attempt to account for many different treatment processes.

Apart from a solid scientific foundation and the engineering ability derived there from, there are factors that could and often do impact and constrain realization of the OWS advancements, such as:

- absence of peer-reviewed publications documenting research and investigative findings with widespread dissemination;
- absence of explicit performance goals for which generic or site-specific technologies or designs can be developed and tested against;
- current difficulty of cost-effectively monitoring OWS for process control and performance assessment;
- absence of effective and reliable management to ensure system function occurs as specified;
- prescriptive and normally conservative local regulatory codes enforced in a restrictive manner through regulators and stakeholders;
- lack of systems analysis methods for evaluating cost-effectiveness of OWS;
- perception that OWS should be simple, require no maintenance, last forever, and be cheap;
- assuming that results derived from investigations of, or experiences with, older disposal-based OWS as representative of contemporary OWS that have been and are designed to achieve advanced treatment;
- perception that centralized systems are not subject to performance dysfunctions while widely scattered and intermittent OWS dysfunctions and repair are a negative reflection on the OWS technology;
- inability or unwillingness to recognize the value of wastewater and the beneficial reuse that can be realized through OWS; and
- lack of education among current and future system users, scientists/engineers, and regulator/policy makers.

Fortunately, none of the above factors are insurmountable constraints, and most are being addressed in one manner or another as illustrated in Table 3.

Conclusions

Onsite wastewater systems have been and will remain a necessary and appropriate component of sustainable wastewater infrastructure in the U.S. While much is known about OWS process principles, design, and performance, gaps remain in OWS science and engineering that must be filled to fully exploit the potential of OWS while preventing inappropriate and even harmful applications from occurring. These gaps have been identified, in part, and efforts are ongoing to advance the science and engineering of OWS. SF

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Mars Experiments with Wetlands and Water Reuse

NSFC STAFF WRITER
Marilyn Noah

"Sometimes it's blue, sometimes it's red, and sometimes it smells like chocolate and even has peanuts in it," Dean Hill, wastewater technician, laughs as he describes the processing water as it comes from the M&M/Mars candy factory in Waco, Texas. Dealing with this extremely high-strength wastewater is an ongoing project at the plant.

To help reduce disposal and energy costs, engineers have designed and constructed an experimental wetland project to test its capabilities of purifying the factory's effluent for reuse. In addition, a separate section is designed to dewater biosolids, leaving the solids to compost in place. As Norman Burgess, engineer, explained, "The thought was to avoid sewer and water purchases by further cleaning of the water. Other sites within the Mars corporation have also experimented with wetland concepts because of the advantages of low energy and their natural cleaning ability. We piggybacked on their experiences and developed this design for our application here in Waco."

Mars saw wetland technology as a cost-effective and environmentally sound way to purify the candy factory effluent for secondary use onsite, such as irrigating lawns and grounds or as replacement water for cooling towers. The pilot facility was built to test these ideas and to verify full-scale design parameters.

The Mainstream Treatment Plant

The high-strength wastewater that results from cleaning manufacturing equipment for a factory that produces SNICKERS®, SKITTLES®, STARBURST®, and MILKYWAY® candies is first sent to an activated sludge pretreatment plant.

Depending on the candy being manufactured that day, the wastewater stream may contain high levels of sugar, milk, or chocolate, Hill explained. "It is very similar to dirty dishwater with a high grease content and a large proportion of food particles."

To remove the floating fats, the wastewater is passed through a grease trap and then through a rotary screen to remove coarse particles, such as peanuts or even screws or washers picked up from equipment in the plant. A dissolved air flotation unit removes the more stable oils and grease, such as peanut oil, hydrogenated soybean oil, and cocoa butter.

While the peanuts and fats are carbonaceous items and technically could be handled by the remaining processes, Hill explains that, with a flow rate of 150,000 gallons per day (gpd) of effluent, there simply isn't enough time for such coarse items to break down. The current detention time—from start to finish—for one gallon of wastewater through the complete system is seven to eight days.

From the dissolved air flotation unit, the wastewater flows into the equalization basins. At this point, the nutrients, and pH are equalized for maximum bacterial growth. The water is aerated and nutrients, such as ammonia and phosphate, essential for maximum bacteria growth, are added. Wastewater is tested twice a day to keep track of nutrient levels, temperature, pH, and dissolved oxygen uptake rate. Technicians also test for suspended solids and conduct settling tests.

Hill explained that the chemical oxygen demand test determines how the bacteria are working. They usually test for nutrients in order to keep them at optimum levels. A pH of 7.5 is preferred. The temperature of the wastewater is 90 degrees F as it comes from the plant; effluent of between 80 and 90 degrees F is optimal for the growth of the preferred mesophillic bacteria. During the winter, Hill has seen basin temperatures drop down to 63 degrees F, even with the use of steam sparging and heat gain from diffused aeration. While biological activity slows a good bit, some digestion still occurs.

The dissolved oxygen uptake rate is another factor that reveals to the technicians that the bacteria are successfully treating the wastewater. On days when the wastewater has a high sugar content, bacteria need increased amounts of oxygen to do their work.

Technicians use the settling test to keep track of the "good bacteria." Hill explained that they must cultivate bacteria forms that settle out rather than the filamentous type that are more buoyant and float on the surface of the water.

Burgess reported that loading rates for this system are relatively high. Peak loads during manufacturing plant shutdowns reach 20 thousand pounds of chemical oxygen demand (COD) per day, with flows reaching 300,000 gallons of water. That, he said, is 40 times the strength of the typical load the local sewage treatment plant treats.

From the equalization basin, the water is sent to the activated sludge aeration basin. At this point, 98 to 99 percent of the waste has been broken down, and there is very little for the bacteria to feed on. A small amount of untreated water is added to the waste stream to stimulate growth.

The clarifier is the next step. There, the remaining biosolids are mechanically pushed into a hopper area located at the bottom of the clarifier, from which they are then pumped out. Some of this is sent back to the equalization basin to reseed the water there. The remaining majority goes to an aerobic digester, where the water is decanted off. The sludge is hauled away by tanker truck for land application at a state-permitted site two or three times a week. The effluent from this process is discharged to Brazos River Authority's Waco Metropolitan Area Regional Sewerage System.

"Treatment plant operators work hard to create a biosolid that is concentrated past two percent, since one of the major operating costs is biosolids disposal," said Burgess. "Under optimal conditions, concentrations up to four percent can routinely be achieved. Savings in disposal costs due to these higher concentrations are substantial."

Reuse at the Pilot Facility

To address the possibility of biosolids disposal on the site, a vertical-flow, reed bed pilot facility has been built to test an alternative method for dewatering the material.

The reed bed consists of a lined, 4-foot deep gravel bed planted with Phragmites reeds. As technician Mike Everett explained, "Biosolids are flooded over the surface of the bed every couple of days, where the water is allowed to filter down through the gravel media. The bottom of the gravel bed is contoured to collect the filtrate in a collection well, where it is pumped back into the front end of the activated sludge treatment plant, where the nutrients are recycled by the bacteria. More than 99 percent of the solids are removed through this filtering action."

Photo courtesy of Norman Burgess.

Dean Hill, wastewater technician at the Waco, Texas, Mars plant, shows decomposed biosolids in the reed bed.

"The solids are left on the surface of the gravel bed," Everett continued. "The reeds aerate them as they sway in the wind, drawing oxygen from the air, and the plants' roots keep it permeable. This material breaks down to rich compost, reducing its volume by 92 percent. All of this occurs without any objectionable odors and a minimum energy requirement."

Little or no work is necessary to maintain these reed beds. Hill explained that when the top growth dies down in winter, it is cut and hauled away to a composting area, where it decomposes

The Mars company's reed bed at Waco, Texas, under construction: (left) shaping the sand and (below) pulling the liner into position.

Photos courtesy of Norman Burgess.

naturally. The finished composted product is used as mulch for the ornamental flowerbeds around the buildings.

A portion of the water from the activated sludge pretreatment plant's daily effluent is sent to the constructed wetland facility. As Everett explained, "About 5,000 gallons of the 150,000 gallons of total daily effluent flows in the 'water garden.' After moving through a living clarifier section covered by floating vegetation, the water runs through a series of recirculating tanks called 'ecological fluidized beds' where the bacteria reduces nitrates to nitrogen gas. The water then passes through a horizontal flow, subsurface wetland planted with reeds, cattails, and bulrushes."

The water takes about two days to travel through this bed, where it comes into contact with naturally occurring bacteria that live among the roots and gravel. Approximately 94 percent of organic materials are removed from the waste stream by using absorption, microbiological activity of the bacteria, and other chemical and biochemical reactions. Weak electrical charges on the plant root hairs also help to attract and hold solid particles. At this point, the wastewater is cleaned well enough to meet requirements for surface discharge.

The water then enters a display pond for storage and eventual reuse. The display pond is the delight of the many visiting school children that visit the factory and the treatment system. This pond is stocked with Japanese Koi fish that love to lunge at food tossed their way. In addition to aesthetic and entertainment value, the fish help balance the miniature ecosystem by eating algae. The several hundred brilliantly colored Koi are thriving in this water although as Hill points out, the water isn't very clear because the large fish population keeps the bottom stirred up. The Texas Natural Resource Conservation Commission has issued a permit to allow reuse of this water for irrigation on factory grounds. Mars has not yet implemented that process.

The ultimate plan is to expand the scale of this 5,000-gpd plant to accept the entire 150,000 gpd produced. Burgess said that he doesn't foresee any fundamental design changes, except for using more robust and permanent piping systems, controls, and monitoring instrumentation.

The wetland and reed beds have met the expectations of reducing waste disposal and energy costs for the company. Everett said, "This project allowed Mars to learn what works and what doesn't in this type of process and has proved that the system does work. Not only is it an attractive approach from an environmental standpoint, it also makes good business sense. At Mars, waste isn't a problem–it's an opportunity." SF

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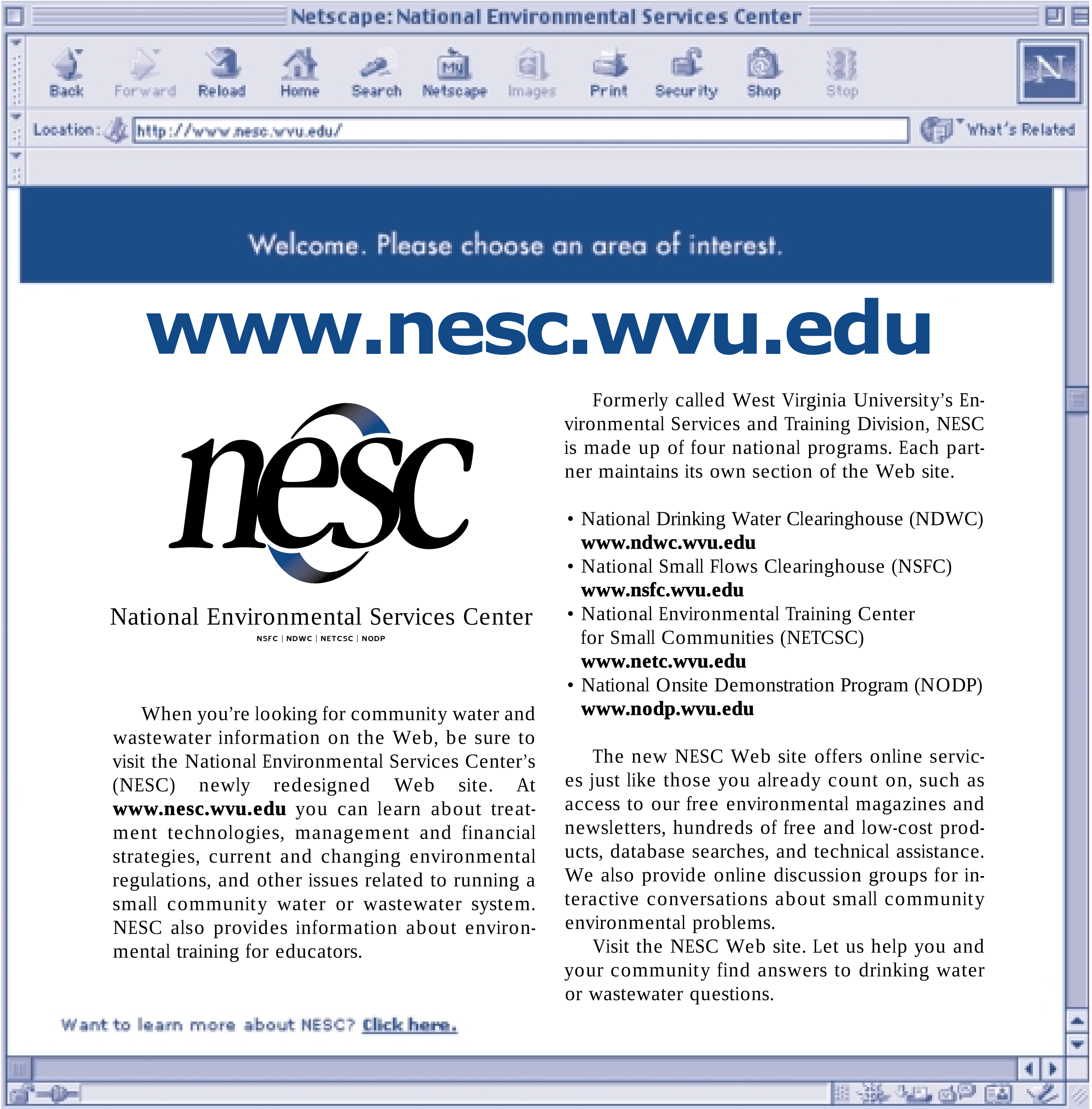
For more information about this project, contact Hill or Everett at (254) 751-5684 or Burgess at (254) 751-5656.



www.nesc.wvu.edu

National Environmental Services Center

NSFC | NDWC | NETCSC | NODP

When you're looking for community water and wastewater information on the Web, be sure to visit the National Environmental Services Center's (NESC) newly redesigned Web site. At **www.nesc.wvu.edu** you can learn about treatment technologies, management and financial strategies, current and changing environmental regulations, and other issues related to running a small community water or wastewater system. NESC also provides information about environmental training for educators.

Formerly called West Virginia University's Environmental Services and Training Division, NESC is made up of four national programs. Each partner maintains its own section of the Web site.

- National Drinking Water Clearinghouse (NDWC) **www.ndwc.wvu.edu**
- National Small Flows Clearinghouse (NSFC) **www.nsfc.wvu.edu**
- National Environmental Training Center for Small Communities (NETCSC) **www.netc.wvu.edu**
- National Onsite Demonstration Program (NODP) **www.nodp.wvu.edu**

The new NESC Web site offers online services just like those you already count on, such as access to our free environmental magazines and newsletters, hundreds of free and low-cost products, database searches, and technical assistance. We also provide online discussion groups for interactive conversations about small community environmental problems.

Visit the NESC Web site. Let us help you and your community find answers to drinking water or wastewater questions.

New Interactive NPDES Web Site Available

The U.S. Environmental Protection Agency (EPA) has launched a new Web site to provide easy access to information about its national permitting program, the National Pollutant Discharge Elimination System (NPDES). Local governments who own and operate wastewater treatment plants are required to apply for and obtain an NPDES permit. These permits contain a variety of required elements, including discharge limits; monitoring, reporting, and record keeping requirements; and requirements for managing residuals.

The site uses state-of-the-art database technology to manage documents, regulations, and contact information. Users are able to select a variety of ways to enter and view the Web site. These include a general interests format and a detailed topics list for those more familiar with the NPDES program. The site also allows users to create and sort specialized lists of publications, guidance materials, and regulations.

This Web site can be accessed at **cfpub1.epa.gov/npdes/?program_id=6**. For any further questions or comments, contact Ross Brennan at **brennan.ross@epa.gov**. SF

Making Money Onsite– A Manufacturer Advises Contractors

NSFC STAFF WRITER
Natalie Eddy

Ed Festa, a general contractor in Connecticut for 20 years and an onsite wastewater treatment manufacturer in Florida for the past 15 years, knows business and is making the onsite industry his business.

He may not have a best selling "how to" book on the *New York Times* list, but he has been riding the onsite wastewater treatment lecture circuit for the past five years, teaching the virtues of good business, education, and bottom-line common sense.

Festa owns Eco-Pure Wastewater Systems of Fort Myers, Florida, (a company that manufactures a peat moss biofilter), and he has been lecturing for various conferences and organizations including the National Onsite Wastewater Recycling Association (NOWRA), Florida Environmental Health Association, Florida Onsite Wastewater Association, American Society of Agricultural Engineers, and Alabama Onsite Wastewater Association.

In addition, Festa has spoken at training centers from Florida to New York about the steps a newcomer needs to take to make it in the onsite wastewater treatment industry today.

"In our industry, I find that there isn't much emphasis on knowledge," said Festa. "Most contractors just decide one day to buy equipment and start a business. And consequently, most contractors do not make money because they don't know how to run a business, and they don't know the technology."

In his presentations, Festa's main emphasis is on teaching contractors how to make money in the business. "There is a good reason for that," he said. "If a contractor goes out and performs a service and can't make money doing it, a couple of things are going to happen. First, the job will be of poor quality because the guy is losing money. Second, the contractor is not doing what he is supposed to do, which is protecting the environment and working in the best interest of his client."

"In our industry, I find that there isn't much emphasis on knowledge," said Festa. "Most contractors just decide one day to buy equipment and start a business. And consequently, most contractors do not make money because they don't know how to run a business, and they don't know the technology."

– Ed Festa

Do's and Don'ts

The first step in business should be creating a business plan that includes long- and short-term goals with a detailed target marketing strategy outlining competition and what prices need to be charged to cover costs.

Festa lectures about the need to closely integrate marketing and sales efforts with a consistent image of the company. Along with that, he points out the importance of advertising that will specifically reach the target audience, whether it's through trade magazines or local means, such as newspapers and radio.

Financing is also an important element of success, according to Festa. Before borrowing money for startup costs, future contractors should research low-interest, small business loans rather than settling for a bank's or equipment dealer's high-interest loan.

Inflation also should be taken into consideration. Festa said inflation rates need to be calculated into bids, adding that many contractors are still charging the same fees they applied 10 years ago.

The average annual income of a system installer today is $25,000. "That's tough for a guy who has intensive capital costs. These people should be making $50,000 to $60,000 per year, but they don't. The reason is they charge $2,000 for a job that costs them $1,800 to do," he added.

Festa adds that computers are extremely important to properly run a business, particularly in regard to record keeping. Written contracts that are signed and dated protect both contractors and customers. "Nothing should be done on a hand shake or negotiated verbally," he added.

The contract proposals should list specifically what the contractor will be doing, size of the tank, depth of the digout, size of the drainfield, size of the pump chamber, type of soil replacement, and whether it is a new system or a repair. It also should state what the contractor will not do—such as sodding, backfilling, hand raking, or grading.

In addition, the contract should state if charges are included for permits, reinspections, engineering costs, rock removal, and excessive dewatering.

The contract also needs to state who will pay if the site conditions are different from the plan and if there are delays. And it should contain a liability clause exempting the contractor from blame for broken water, electrical, telephone, and cable lines, and damage caused to sidewalks, driveways, and landscaping due to heavy equipment.

Also to protect the contractor, the agreement should specifically state that the septic system remains the property of the company until paid in full.

He also recommends that contractors use work sheets to ensure proper bidding.

"When bidding, you have to ask yourself what it costs to run your business," Festa added. "You have to look at the useful life of your equipment and what the cost is to run your equipment without overhead and profit."

In making bids, contractors also should consider their machinery costs, such as insurance, equipment storage, taxes, and interest.

He added that many contractors make the mistake of thinking they should keep their employees busy. "You're not going to get every job, and you shouldn't worry about being the lowest bidder," he added.

Assigning Blame

Festa has been researching the industry for several years. He believes a mutual relationship exists between the manufacturer and contractor. "If a manufacturer's product is as good as he says it is, and the contractor doesn't understand how to make money, then the manufacturer's product is worthless," he said.

When the joint relationship fails, Festa believes it is everyone's fault — not just the manufacturer and the contractor. "It is an overall lack of education that trickles down from unlicensed state regulators to just general misinformation," he added.

Engineers share in the blame, too. Festa noted that many engineers today design systems with outdated codes in mind.

"Everyone needs more understanding about how important education is to the survival of this industry. The manufacturer needs to educate the installer about the product. In turn, state health offices need to place more emphasis on the training of installers. And the public needs to be educated."

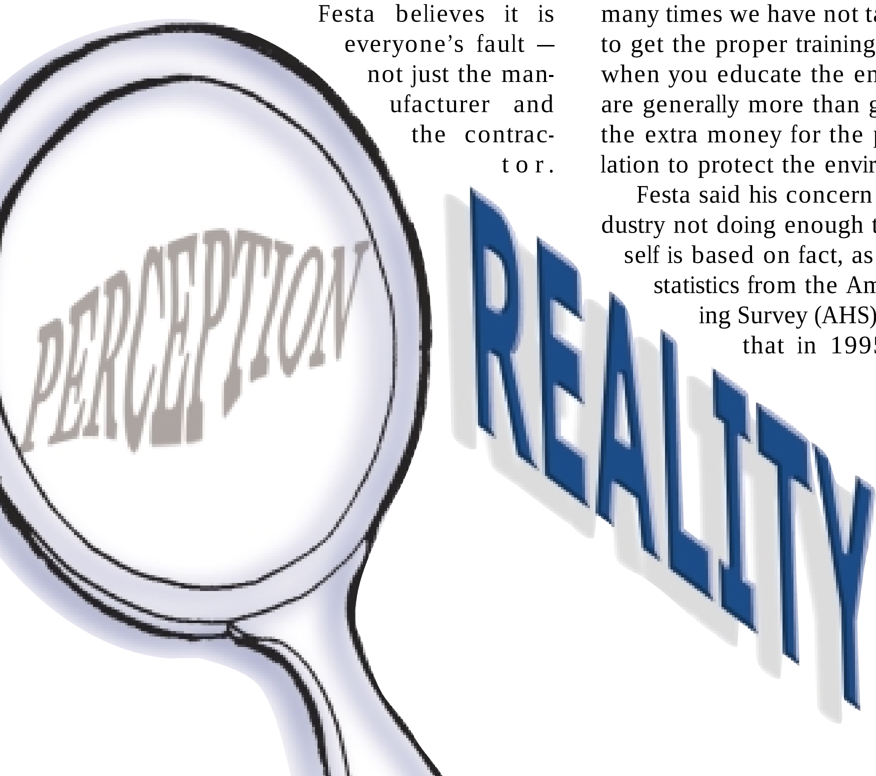
Self-Image Problem

Part of the public education process should be aimed at improving the industry's image. Once considered a temporary fix until big sewers could come along, Festa said that now the U.S. Environmental Protection Agency (EPA) asserts that with proper management, onsite systems can be a permanent alternative to sewers.

He added that the industry's image problem is inherent to the type of services it provides. "The general public looks at people in the wastewater industry as the lowest form of service provider because of what we do. Nobody likes to admit that they go to the bathroom. When you are dealing with this type of commodity, it is difficult to maintain a high self-image," he said.

"People look down on our industry and consider it less than professional. That being said, it's our fault because we don't educate the public about how valuable our profession is, and many times we have not taken the time to get the proper training. I found that when you educate the end users, they are generally more than glad to spend the extra money for the proper installation to protect the environment."

Festa said his concern about the industry not doing enough to promote itself is based on fact, as illustrated by statistics from the American Housing Survey (AHS), which states that in 1995 more than 2.5 million septic systems were reported as malfunctioning or having completely broken down. The AHS is conducted by the U.S. Commerce Department's Census Bureau and sponsored by the U.S. Department of Housing and Urban Development (HUD).



Festa added, "Most states don't even know where their systems are located, and 30 percent are more than 30 years old. Yet the EPA estimates that 38 to 40 percent of all new wastewater treatment construction is going to be onsite systems. That is a huge number. And we continue to dump 4 billion gallons of wastewater into the ground a year."

With numbers like that, Festa said it is imperative that people in the industry know what they are doing. "The regulatory body needs to work more closely with the industry, and the manufacturers need to work much closer with installers," he said.

"Installers are the key. They are the people in the field working hard and trying to ensure a safer environment, but because of a lack of training, most of them aren't accomplishing that task."

Another problem is the "misinformation" that is given to the public about the wastewater industry as a whole. Festa said the only information the public receives about onsite systems comes from two commercials from Rid-X and toilet paper advertisements. "It's a huge failure on everyone's part that the actual end user has no information as to how these systems function," he added.

Festa plans to put a presentation together to balance the misinformation presented in these commercials and ads.

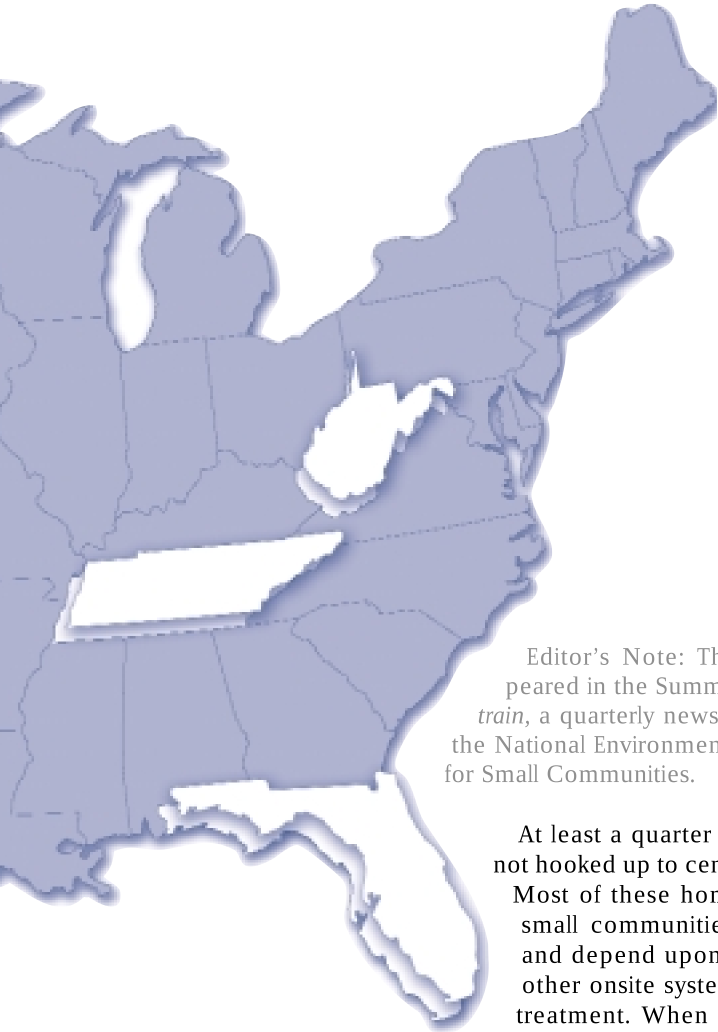
The End Result

If the industry doesn't fix itself, Festa believes the end result will be severe consequences for the nation's drinking water in the years ahead. "The industry is still trying to utilize the same systems from 30 years ago at the same cost. It's time to move ahead with the times," he said.

"The bottom line is you can't put a price on the public's health or the environment. People need to wake up and realize what an important service those in the wastewater treatment industry provide. And we, in the industry, need to realize that we are professionals performing a vital job to protect the public's health."

For more information, contact Festa at Eco-Pure Wastewater Systems, 17305 Pine Ridge Road, Fort Myers, FL 33931 or call (888) 999-0936. SF

Three States Build New Onsite Wastewater Training Centers



NSFC WRITER/EDITOR

Cathleen Falvey

Editor's Note: This article first appeared in the Summer 2001 issue of *E-train*, a quarterly newsletter published by the National Environmental Training Center for Small Communities.

At least a quarter of U.S. homes are not hooked up to central sewer systems. Most of these homes are located in small communities and rural areas and depend upon septic systems or other onsite systems for wastewater treatment. When onsite wastewater systems malfunction, raw wastewater can pond in backyards and seep into ground and surface waters, potentially exposing family, neighbors, and pets to dangerous pathogens, threatening public health and the environment.

Although onsite systems often are the most economical and environmentally sound wastewater treatment options for small communities, like all treatment systems, they must be properly designed, constructed, installed, and maintained to function properly. The success of onsite wastewater systems begins with well-trained and educated professionals.

With prompting from local wastewater professionals, three states—Florida, Tennessee, and West Virginia—have established or are working to establish new onsite wastewater training centers. All of these centers will offer courses and demonstration sites featuring different onsite wastewater technologies for hands-on training.

Florida Onsite Wastewater Training Center—Polk City

In response to Florida's increasing demand for onsite wastewater technologies and skilled professionals to install, maintain, and repair them, the Florida Onsite Wastewater Association (FOWA) and the Florida Department of Health's Bureau of Onsite Sewage Programs teamed up to establish a new training center. The Florida Onsite Wastewater Training Center officially opened in April 2000 and is located midway between Tampa and Orlando in Polk City, conveniently only one mile from Interstate 4.

According to Kevin Sherman, FOWA's executive director, the association's members were instrumental in planning the center and bringing the project to fruition.

"The center is partially funded through a $5 repair permit fee, which is collected from onsite wastewater permits in the state," said Sherman. "The state allowed the FOWA to take a lead role in developing the center and designing the hands-on instruction. This type of hands-on learning is perfect for onsite industry professionals—most of whom agree that even a bad day in the field is better than a good day in the office."

In Florida, onsite system contractors have several options for obtaining continuing education credits needed to renew their licenses, and the training center has become a popular choice because of the field instruction. The center operates, in part, on fees generated from workshops and seminars offered to registered septic tank contractors, master septic tank contractors, and the public. In addition, all the certified environmental health professionals Florida's health departments employ are required to receive orientation training at the center, and advanced training and certification courses are provided four times per year.

Sonia Cruz of the Florida Department of Health says that, during the first contract year, 186 state employees participated in all the courses offered at the center's Accelerated Certification Training Program, and 196 participated in advanced training and certification courses.

"One important aspect of the center for communities is that it promotes technologies that have lower construction costs and consume less energy," said Cruz.

The center leases its 18-acre site from the state for $1 per year. An additional 2.5 acres of adjacent land was purchased to serve as the site of an administrative center, called the parsonage, which houses FOWA headquarters and other center activities. Sherman lives full-time at the parsonage and provides around-the-clock services and security.

"All the systems at the site were donated by manufacturers," said Sherman. "We called every manufacturer we knew so we didn't have to pay for any systems." In addition, local contractors and wastewater professionals played a key role by donating time and assisting in constructing the site

Sherman said that the systems are charged with plain drinking water, rather than wastewater, for instructional purposes. He is especially proud of the center's curriculum.

"We developed well-defined training scripts for each of the systems," said Sherman. "This ensures that everyone who comes to the center receives consistent information and that all the major points about the systems are covered regardless of who teaches the course."

For more information about the Florida Onsite Wastewater Training Center, e-mail **Sonia_Cruz@doh.state.fl.us** or call her at (407) 317-7325. Sherman can be contacted by e-mail at **osmc2001@yahoo.com**, or by phone at (863) 956-5540.

Onsite Wastewater System Training Center—Tennessee Agricultural Experiment Station, Spring Hill

Tennessee's new onsite wastewater training center is currently only in the planning stages and has not been officially named. But according to Bob Pickney of the Tennessee Onsite Wastewater Association (TOWA), a state chapter of the National Onsite Recycling Association (NOWRA), his organization is committed to making certain the center soon becomes a reality.

"Our members have supported the idea for a training center from the start," said Pickney. "In Tennessee, we don't have any requirements for training installers and other onsite system professionals. We want to raise the level of training in onsite wastewater professionals in the state."

The group is working closely with C. Roland Mote, Assistant Dean of the University of Tennessee's Agricultural Experiment Station, who has been involved with onsite and decentralized wastewater systems since 1974. Mote is spearheading the planning and funding of the center, which he says is much needed.

"Our center will be much more than just a facility," said Mote. "It will be a comprehensive education and research program of the University of Tennessee (UT). We will be constructing training facilities and experimental systems as needed both to educate and learn more about different onsite technologies."

A primary training facility of the center will be located at the Middle Tennessee Agricultural Experiment Station in Spring Hill. Land and other resources of UT's 11 branch experiment stations distributed across the state are available to support the center. There will be a permanent faculty, and the center will provide traditional classes as well as hands-on instruction. The faculty also will travel to different areas in the state and the region to provide training.

Residences on the site that house the agricultural experiment station employees who take care of the crops and do the harvesting will generate the wastewater for the demonstration systems. Mote is working with TOWA members to encourage manufacturers to donate their systems, equipment, sweat, and expertise to the project.

Mote has applied to the U.S. Environmental Protection Agency for a $500,000-319 Clean Water Grant. He also is working with Kent Taylor and Greg Upham of the Tennessee Department of Environment and Conservation's Division of Groundwater Protection and James Watson of the Tennessee Valley Authority. Both of these organizations have pledged funds to match the 319 Grant funds when approved.

For more information about Tennessee's Onsite Training Center, contact Mote at (865) 974-7105 or e-mail **cmote@utk.edu** or TOWA's secretary, Brian Corwin, at (615) 790-5751.

West Virginia Onsite Wastewater Training Center—Morgantown

Regular *Small Flows Quarterly* readers are no doubt aware that Morgantown, West Virginia, is home to the National Small Flows Clearinghouse and its partner organizations, the National Environmental Training Center for Small Communities, the National Drinking Water Clearinghouse, and the National Onsite Demonstration Program (NODP). They may also know that the NODP has installed several demonstration onsite wastewater systems at nearby Chestnut Ridge State Park. But what they may not realize is that during the past two years, the NODP has been working hard to establish a comprehensive onsite wastewater training center in West Virginia to serve the state and the region.


Photo by Kevin Sherman

Bill Rawlins gives instruction on suspended growth aerobic systems to students at the Florida Onsite Wastewater Training Center.

According to NODP Phase III Program Coordinator Mike Aiton, the planning for the training center began two years ago, and the center started preliminary site development last summer.

"The first curriculum we developed was to train West Virginia Class II designers and installers, utilizing both classroom and hands-on exercises," said Aiton. (Class II systems in West Virginia refer to alternative onsite wastewater system designs.) "The first offering took place four days in December 2000. A second offering was

CONTINUED ON PAGE 49

Sussex County, New Jersey—

A Case Study in Onsite Management

NSFC STAFF WRITER

Caigan M. McKenzie

Eighty-five percent of the homes in Sussex County, New Jersey, relied on onsite systems for wastewater disposal. Many of these systems were old, poorly designed, and installed in soil unsuitable for onsite systems. Converting summer residences to year-round use compounded the problem by overloading systems.

Failing onsite systems in this northwest corner of New Jersey posed a variety of potential problems for residents. Pollution of wells, streams, and lakes could cause health problems. Contamination of water sources would cause property values to drop and require residents to pay high costs to replace systems that might have been saved had failures been detected in time.

To resolve these potential problems, the New Jersey Department of Environmental Protection (NJDEP) awarded Sussex County a $450,000 grant in 1986 to fund a pilot demonstration program to learn about septic system management.

Selecting Pilot Areas

In 1988, the Sussex County Planning Department invited all municipalities to apply for participation in the pilot program. Communities would be chosen based on their understanding of the issues; level of support for the program from local government and the community; and contribution of administrative, technical, and legal resources.

The Sussex County Planning Department chose four sites that represented typical situations in which septic management would be helpful:

- lake communities and communities with groundwater concerns (Sparta Township/Byram Township/Cranberry Lake),
- a community with a local health department (Hoptacong),
- a community with an active homeowner's association (Frankfort Township/Culver Lake), and
- areas in which housing development varies from dense (Sparta Township/Cranberry Lake) to widely scattered (Byram Township/Cranberry Lake).

Agreement Between Pilot Areas and the County

Pilot areas agreed to set up a steering committee, provide septic system information to residents, pass necessary ordinances to support the program, and assist the county's project team with public education efforts. In return, the county agreed to develop and implement a septic system management program for one year, formulate ordinances, and provide a qualified consultant for guidance.

The NJDEP grant would pay for technical assistance, engineering help, and the services of onsite inspectors in the pilot areas.

Culver Lake (Frankfort Township) Pilot

Years before the pilot program began, Culver Lake residents conducted a water pollution study that confirmed their fears about the lake's deteriorating quality.

The area had originally been developed as a summer resort, with 800 individual lots, some very small, surrounding the freshwater lake. Now, most homes have been converted to year-round use, overloading the old, under-designed septic systems located in poor soils.

Steering Committee Sets Goals

The local board of health appointed its president and three community representatives to the steering committee because of their extensive knowledge about Culver Lake's water quality issues.

The committee focused on developing a process to detect, correct, and prevent septic malfunctions in the pilot area for existing septic systems and to educate the public about septic system maintenance and operation. New septic systems would be regulated through an amendment to the Realty Improvement Sewage Facilities Act (N.J.A.C. 7:9A, effective January 1, 1990), which mandates statewide management of new septic systems.

Septic System Management Program Presented to Homeowners

Homeowners supported the idea of a septic system management program but opposed being charged an annual fee to administer the program. They also rallied against licensing existing septic systems, fearing that the township would require them to replace all existing systems.

Ordinance Backs Management Program

The steering committee and its attorney asked the board of health to pass an ordinance to enforce the septic system management program. The adopted ordinance (July 16, 1990) required residents to submit a plot sketch of their system to the board of health within 90 days of enacting the ordinance; to pump, inspect, and repair systems on a property prior to sale; and to follow the N.J.A.C. 7:9A regulations for new septic system designs, construction, operation, and maintenance. In addition, the ordinance created the Septic Waste Management Program (SWMP) committee to distribute educational materials, maintain a computerized database, and oversee septic systems inspections. The SWMP committee included members of the original steering committee and two part-time employees.

Community Education

Over the course of a year, public education covered a wide range of septic system information. A variety of methods were used to educate the public, including seminars, manuals, brochures, reports, and reference cards. Education also helped dispel misconceptions some residents harbored about the program's goals and objectives.

Results

The program continued beyond its planned ending date, using funds left over from other pilot projects. By the end of the three-year pilot, Culver Lake had 42 inspections at point of sale and nine voluntary inspections. The failure rate in 1991 was 37 percent, and it reached 41 percent in 1992 and 1993. No project funds were available for remediation, which homeowners had to pay for themselves. However, the township was able to help some residents with this cost by applying jointly with them for low-income grants from the state's small communities grant program.

In its report, the consulting group recommended the following steps:

- Continue the SWMP project in order to see a positive effect on water quality.
- Upgrade a significant number of septic systems.
- Continue both the volunteer and realty transfer inspection programs.
- Regularly pump out systems to prevent additional system failures.
- Continue educational efforts to keep residents aware of septic system operation and maintenance.

In looking back over the pilot program, steering committee member Peter Trachtenberg pointed out that the steering committee focused entirely on establishing the validity of the program and not on implementing it once the evidence was clear.

"We should have started to prepare for implementation when we began Phase II and not relied on the results to speak for themselves," said Trachtenberg.

Phase II extended from January 1, 1993 to December 1993. It added realty inspections and continued the homeowner education work done in Phase I.

Hopatcong Pilot

In the late 1960s, Hopatcong experienced a building boom because a new interstate connected Hopatcong to the major urban centers to the east. The increased population caused summer homes to be used year round and small lots to be used for constructing new homes. The small lots, poor soils, and undersized systems caused many septic systems to fail, accounting for more than 40 percent of the incoming pollution to Lake Hopatcong.

In 1980, the Lake Hopatcong Regional Planning Board conducted a lake diagnostic and management study. The study found that a septic system management district was needed to protect the lake and groundwater.

Steering Committee Looks at Options

Hopatcong appointed a 30-member steering committee. Committee members included the health department administrator, the mayor (who was both an environmental attorney and former member of the local board of health), borough council members, and a member of the environmental commission.

Program Obstacles

Problems began when the borough and county computer systems were unable to handle data because the computer systems were incompatible. The board of health refused to spend money on a different computer, fearing funds to support it would be exhausted once the pilot program concluded.

The board of health and the steering committee disagreed about specific points to be included in the ordinance that would enforce the management program. The committee wanted the ordinance to require homeowners and homebuilders to become licensed system operators, to pump out systems before renewing their licenses, and to submit an inspection report to the board of health.

The board of health branded the ordinance the committee drafted as burdensome. Citing a lack of manpower to enforce the ordinance, the board of health rewrote the ordinance. The committee didn't feel the board made the ordinance tough enough to support the management program. Neither side would budge, causing the SWMP to come to a halt.

Management Program Doesn't Get Off the Ground

Onsite system management did not occur under the pilot program. Reasons for its failure included a lack of commitment on the part of some members of the steering committee, difficulty in continuing project financing at the local level, and discouraging legislative battles at the state level.

Hopatcong expects sewers to be the answer to their problem and has received an offer of $8.6 million from federal sources and $5 million from the state to be applied to the match required by the locality. The project is likely to be built by 2003.

Byram and Sparta Townships (Cranberry Lake) Pilot

Cranberry Lake relies solely on onsite, subsurface disposal systems for wastewater treatment. Failing systems, small lot sizes, conversion of summer homes to year-round residences, soil limitations, and lack of management are some of the reasons for Cranberry Lake's wastewater problems.

The steering committee for Byram Township was composed of the town manager, the board of health president, and representatives from the Cranberry Lake Association and Byram Environmental Commission.

Key points the committee pushed were residents' need for financial assistance to repair or replace systems, guidance in choosing appropriate and cost-effective technologies for the area, and educating the public about septic system operation and maintenance.

As in the other pilot sites, rumors spread that the county was going to demand that all septic systems be replaced. To counter this fear, the committee held several public meetings to explain the program's objectives, to answer questions about inspections and costs, and to allay fears of replacing all existing systems.

The ordinance that was passed August 28, 1990, to support the management program stated that

- all homeowners within the pilot area must obtain a three-year septic system operator's permit from the board of health,
- educational materials would be given to homeowners when a permit was issued,
- renewing the initial operator's permit would require the homeowner to submit a plot plan showing the location of the septic system and well on the property and to provide proof that the septic system had been pumped out, and
- homeowners must submit proof for subsequent permit renewals that the septic system had either been pumped out or inspected by a licensed professional.

Public education about septic system operation and maintenance was accomplished through a variety of seminars, manuals, brochures, reports, and reference cards.

"It took people time to come to the realization that it was in their own self-interest to do this. After we provided a great deal of information and patience, they came to see the management program was not so much out to penalize the bad guys as it was to protect the good ones," said Ronald F. Gatti, Byram Township manager. "In the beginning, people asked, 'Why me?' Now that they see they are getting better service from the township, others in surrounding areas are asking, 'Why not me?'"

Of all the pilot communities, Cranberry Lake was the only one to successfully operate a septic system wastewater management district.

Lake Mohawk

Lake Mohawk is a private Sussex County lake community of 8,000 people in 2,600 homes. Since only property owners have access to the lake, enforcement is much easier than it is in communities that are open to the public.

Lake Mohawk wasn't a part of the pilot programs. But the residents could see for themselves that something needed to be done to protect the 770-acre lake from turning green in the summer because of alga growth. In the 1980s, Frances Smith, manager of the Lake Mohawk Country Club, spearheaded a movement to establish a management program.

"It took nearly 10 years of educating our people before we felt they were ready for an ordinance," said Smith. She took a gentle approach in moving people toward behavioral changes, such as using dishwashing and laundry detergent that didn't contain phosphorus and being careful not to spill fuel into the lake when filling fuel tanks on boats.

Lake Mohawk Country Club, the governing body of the community, used a variety of methods to educate its residents. They copied relevant information from publications, put together their own materials, published discussions members of the country club had with township officials, health departments and private pumpers, and brought in speakers.

Lake Mohawk developed a data system to list and track septic systems. During this time, Smith worked to educate the public and met with local governments to review their ordinances. Developing an ordinance took months of hard work but was overwhelmingly accepted by the residents in January 1999.

Key provisions of the ordinance included requiring that systems be pumped every three years and prohibiting fertilizers containing phosphorus.

Sussex County, New Jersey, Selected for Inclusion in NODP IV Database

Phase IV of the National Onsite Demonstration Program (NODP), funded by the U.S. Environmental Protection Agency (EPA), and has been tracking Sussex County's efforts.

Their management techniques have been entered into NODP IV's database as management models from which other communities can draw to create their own wastewater management systems.

NODP IV's mission is to promote, develop, and demonstrate management strategies for onsite wastewater treatment in small communities in the U.S. The focus is on integrating technology and management to assist communities in funding, installing, monitoring, and effectively managing onsite wastewater systems as cost-effective viable alternatives to full centralized sewage systems.

For more information about the Sussex County project from the NODP IV database, call Project Coordinator Graham Knowles at (800) 624-8301 or (304) 293-4191. SF

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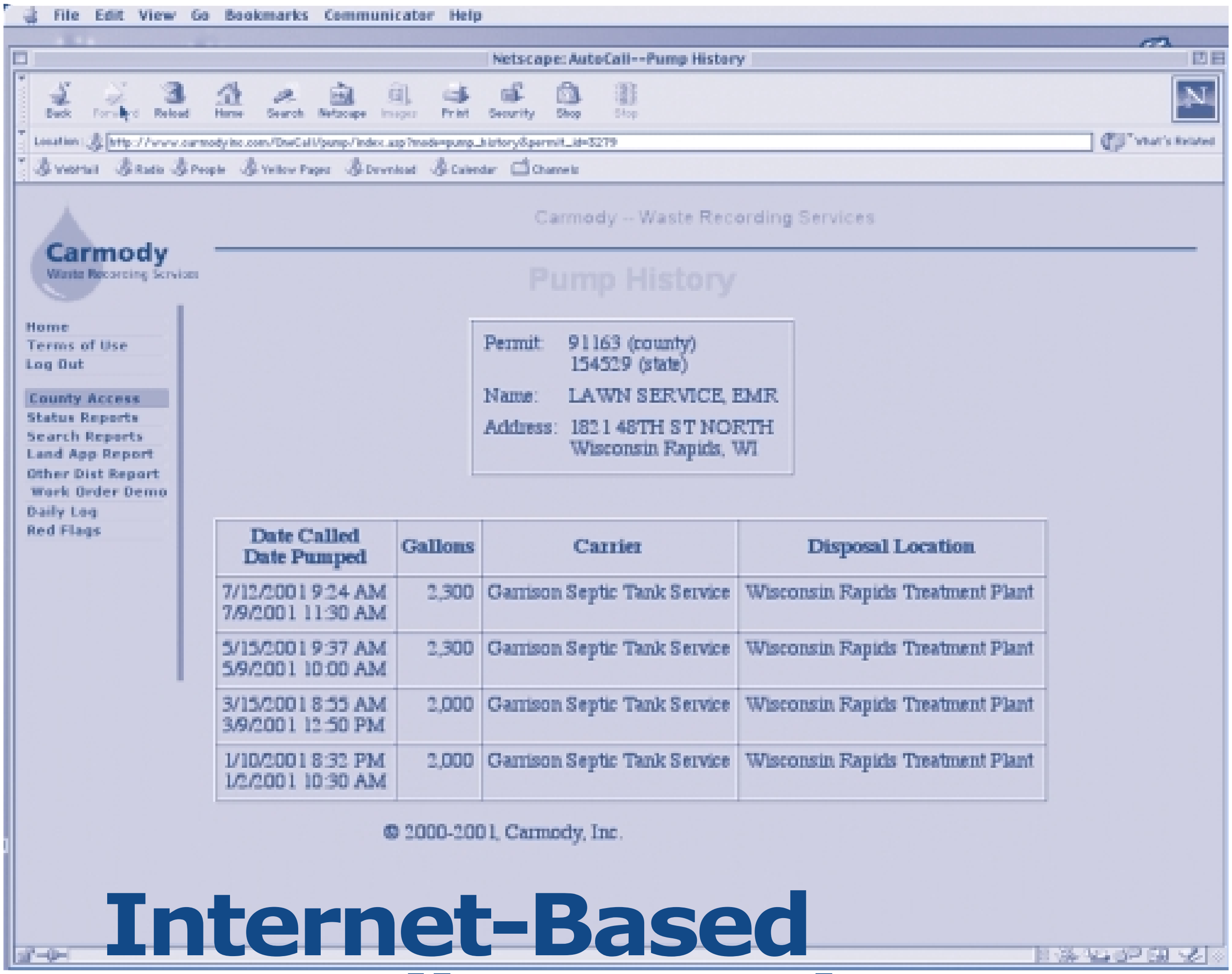
NSFC Resources

The Spring 1996, Volume 7, Number 2 issue of *Pipeline* offers strategies for developing centralized programs for operating, maintaining, or monitoring decentralized systems. This issue explains how management programs help communities protect public health and the environment by giving communities more control over wastewater treatment. Included are tools and strategies that are helpful in setting up and maintaining a management program, as well as two examples of established management programs. The price of this NSFC newsletter is 25 cents. Additional shipping charges apply. Request Item #SFPLN05.

The Fall 1999, Volume 10, Number 4 issue of *Pipeline* is dedicated to helping small communities locate funding for important wastewater treatment projects. This issue outlines the most commonly used sources of funding from the EPA and other federal agencies. It also provides information about lesser-known avenues of funding, such as regional programs and nonprofit organizations. It even includes information about funding sources for homeowners who want to install or repair onsite wastewater treatment systems. The price of this NSFC newsletter is 25 cents. Additional shipping charges apply. Request Item #SFPLNL19.



Internet-Based Recording Service

Solves Maintenance Reporting Problems

NSFC STAFF WRITER

Marilyn Noah

Wood County, Wisconsin, is using a unique data and reporting system to track liquid waste from the collection point to the disposal location. The Carmody Waste Recording Service is an Internet-based system that documents the maintenance history of each registered wastewater system.

Located in the central portion of the state, Wood County is a mostly rural county, ranging over 812 square miles, with an estimated population of 74,000. A majority of the onsite wastewater treatment systems in this part of Wisconsin are either adjacent to floodplains, wetlands, or the shorelines of one of many streams. Regular system maintenance is vital to ensuring the purity of the ground and surface water.

Illegal disposal is common practice

Liquid holding tanks are the predominant handling systems for wastewater. These tanks are designed to be emptied by professional waste haulers and the waste disposed of properly. However, to evade this service cost, property owners often dispose of the waste onto the surface of the ground.

"Even though the cost of waste removal is not exceptionally expensive ($70 to pump and $150 to treat), homeowners often choose to save their money by illegal disposal, often conducted at night or on weekends," explained Duane Greuel, environmental specialist with the Wood County Department of Planning and Zoning.

Illegal wastewater disposal has been identified as a major cause of the unusual number of viral diarrhea cases in the county, especially among children. When health professionals at the Marshfield Clinic in Marshfield, Wisconsin, could reliably predict a major jump in cases of intestinal infections after periods of heavy rain, they decided to investigate. Their research has produced data indicating that for each holding tank added to a 40-acre parcel, there is a 22 percent increase in viral diarrhea cases in children as they are exposed to the untreated wastewater.

New reporting system tracks liquid waste

In response to this health threat, and in an attempt to have accurate, timely records of waste management practices to protect water resources, the Wood County Board of Supervisors approved an ordinance amendment on February 15, 2000, allowing the Planning and Zoning Department to regulate all holding tanks in the county under a unified reporting system. Prior to this action, holding tanks had been administered nine different ways.

"Prior to our system, the various records of maintenance, pumping, installation, etc., were all kept by different agencies, between the Department of Natural Resources, county health officials, and the Department of Commerce," said Scott Carmody, president of Carmody Data Systems, Inc. "Problems arose because there was no cross-referencing of this data. When wells became polluted from illegal discharge or overflowing tanks, county regulatory officials were caught in the middle without the proper records to track the problems."

The Carmody Waste Recording Service is a uniquely designed data and reporting system that records the pickup and disposal of waste, detects overdue maintenance, and maintains required documentation for the state Department of Natural Resources (DNR), the Department of Commerce, and the counties.

Carmody's system reduces paper handling. Liquid waste carriers were required to fill out three of four cards of information that then had to be sent to the various agencies involved. Now, under the new system, when carriers return to their office, they just log on, enter the secure area, and fill in the pertinent information.

"They just fill in the blanks and hit 'Process,'" Carmody said. "Carriers can also register new clients, and licensed installers can enter all service events so there is a running maintenance record of the system."

County regulatory officials, as well as state DNR representatives, can log on and see the entire database with its daily entries. This ability for all the agencies to have access to all the data has been very helpful.

Photo courtesy of Scott Carmody.

Wood County Environment Specialist Duane Greuel (right) explains the Carmody system to Wood County Code Administrator Marv Krzykowski (left) and Wood County Planning and Zoning Director Gary Popelka (center).

In the past, when improper dumping or failing systems were found to be affecting nearby water sources, the records were kept by so many agencies in different locations, that by the time the source could be tracked down, it was often too late to prosecute. The timeliness of this system and the centralization of records helps regulatory officials and DNR agents do their job.

"Since October of 2000, two thousand homes using holding tanks have been brought into this system, and all new holding tanks are registered as they are permitted," Greuel said. "Sixty-three thousand gallons per day are recorded daily. We expect this to rise to 100,000 by the end of the year. We are working in partnership with 100 percent of the major liquid waste carriers operating in the county to create a check-and-balance system for waste discharge and treatment."

Initially, the seven-year contract with Carmody included placing automatic sensors in every holding tank. And even though the major proponents of the system held special informational meetings countywide, and the hearing process went smoothly, the suggestion of these sensors really stirred up the opposition.

"Because these sensors would have automatically sent tank levels to our office, the homeowners who are inclined to dump their own tanks illegally would have been caught. Residents thought it just went too far, so the department backed down from incorporating the hardware portion of the system at this time," said Greuel.

When the program was first introduced, the liquid waste industry was also reluctant to take part, concerned that this close monitoring system would catch them doing something wrong; but their fears have proved unwarranted. Overall, the waste haulers have been pleased by the reduction of paperwork and by the easy design of the data-entry site.

Accurate record keeping helps homeowners

As pumping records are kept this accurate and current, it makes it an easy job to send out reminders for homeowners when it's time to have their system pumped. "We can be proactive in helping our residents rather than having to respond to an unpleasant emergency," Greul said. "In addition, we are encouraging the installation of pretreatment systems instead of holding tanks. These pretreatment setups require routine maintenance. This recording system helps us generate the maintenance reminders to keep the systems working safely and properly." He added that aerobic treatment units and sand filter systems are gradually reducing the number of holding tank permits as onsite waste installers become familiar with their use.

In addition, wastewater system maintenance records for the past 40 years or so have been entered into the system. "This review of old records has helped us verify the accuracy of ownership and the accuracy of property locations." Gruel said. "Pumpers are often unclear about where the county lines fall, and some residents have been incorrectly identified as residents of Wood County."

And now, to the bottom line. The cost to the county for the program was $36,000, because the county board of supervisors chose to pay for the initial data entry fee instead of passing the cost on to the holding tank owner. All new holding tank owners are required to pay an additional $20 entry fee. A $36 annual fee, or $3 monthly fee billed to each participating homeowner, is being used to fund the program. Regulators and service providers are not charged to use or access the program, and Carmody expects the cost of service to drop as the business grows.

While it is still in the early stages, everyone seems quite pleased with how the online system is operating. Carmody explained that they are developing software that will create reports from the pumpers accounting program. This will allow the pumper to complete their pumping reports and accounting at the same time. Presently the only county in the state using such a coordinated system, everyone is watching for their success.

Overall, Carmody has been happy with how well the system was accepted and how well it has worked. The system has only been online since October 2000, but he is confident that as regulators and health department administrators become familiar with the setup, they will appreciate the advantages of being able to access real-time data.

Greuel noted that sharing this maintenance information between all the involved entities should reduce illegal disposal and failing or poorly maintained systems. "Cleaner groundwater means a healthier population, and this state-of-the-art system helps to ensure that," he said.

For more information, contact Duane Greuel, environmental specialist, Wood County Department of Planning and Zoning at (715) 421-8471 or e-mail **dgreuel@co.wood.wi.us**. You can also call Scott Carmody, president, Carmody Data Systms Inc., at (608) 846-0267 or e-mail **scottcarmody@carmodydata.com**. SF

Call for Papers: Fractured-Rock Aquifers 2002

March 13–15, 2002—Adams Mark Hotel–Denver, Colorado

Sponsored by U.S. Geological Survey, U.S. Environmental Protection Agency, National Ground Water Association, and Jefferson County, Colorado

Conference Goal and Motivation

The goal of Fractured-Rock Aquifers 2002 is to foster communication between policy makers, land-use planners, and groundwater scientists to promote the sustainable use of vulnerable natural resources. This conference is an opportunity for researchers and planners to discuss meaningful issues related to groundwater in fractured-rock settings.

Abstracts are solicited for the following conference topics:

Water management policy in fractured-rock settings

- Land-use planning
- Water use and sustainability
- Completion of Source Water Assessment Programs and transition to source water protection
- Water quality issues—naturally occurring and anthropogenic contaminant issues
- Individual sewage disposal systems (ISDS)
  - Performance and suitability in fractured-rock settings
  - Innovative technologies, designs, and remediation

Characterization of fractured-rock aquifers from borehole to watershed scales

- Geophysical and remote sensing techniques
- Field-based geologic framework and visualization
- Hydrologic data collection, monitoring, and simulation
- Recharge rates
- Geochemical characterization and ground-water dating
- Computer simulation of watershed and aquifer dynamics

Case studies

Electronic Abstract Submission and Guidelines

Abstracts and manuscripts must be submitted in electronic format (disk or e-mail as an attached file). Word 7.0 documents are preferred. Please submit abstracts by e-mail as an attached file to **dguth@ngwa.org**. If sending the abstract on a disk via regular mail, a hard copy should also be mailed with the submittal form. Please indicate the topic and subcategory (by letter designation) for which the abstract is being submitted and include full mailing addresses, phone, fax, and e-mail addresses of contributing authors. Additional instructions will be provided upon notification of acceptance.

USGS contact: Suzanne Paschke, Hydrologist, USGS, P.O. Box 25046, MS 415, Denver Federal Center, Lakewood, CO 80225. Phone: (303) 236-4882 x258, Fax: (303) 236-4912, **fracrock@usgs.gov** For questions and sponsorship information, call Bob Masters at NGWA (800) 551-7379, **rmaste@ngwa.org.** SF

What on Earth is GASB 34, and why should you care?

New Accounting System Will Impact Small Systems

CONTRIBUTING WRITERS

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Reprinted from Summer 2001 *On Tap*

All public government agencies, which include public water systems, will experience a significant change in accounting over the next several years. The change is called Governmental Accounting Standards Board Statement No. 34, Basic Financial Statements and Management's Discussion and Analysis for State and Local Governments—or "GASB 34" as it's more commonly known. And this statement may cause public water system accountants, financial advisors, and auditors to scramble for new technical and accounting information so that they can understand the differences between these two terms:

- "cash-based accounting" (currently used in government agencies and municipalities) and
- "accrual-based accounting" (commonly used in the private sector).

Accounting changes may happen faster for some public water systems than others, but it will depend upon their size. (See the table on page 29 for more information about when systems must adopt GASB 34 standards.) Regardless of the size of your water system, now is the time to prepare: proper planning and implementation of the GASB 34 system are the keys to keeping pace with public water systems of the future.

What is GASB?

GASB is a private, nonprofit organization formed in 1984 to develop and improve accounting and financial standards for state and local governments.

The board has seven members and is supported by a full-time staff. The board's members include users, preparers, and auditors of state and local government financial statements, as well as an academic advisor. The board is the government equivalent of the Financial Accounting Standards Board (FASB), which sets accounting standards for the private sector.

GASB is responsible for setting generally accepted accounting principles (GAAP) for both state and local governments. These GAAP set the criteria that the government must follow—or in this case public water system—when obtaining "clean opinions" from their auditors. A clean opinion means you have good credit and is very important when a state or local government wants to issue bonds, procure financing for long-term construction projects, and obtain performance bonds.

In June 1999, GASB approved GASB 34, the latest in a series of standards that the board has issued. This proclamation requires that state and local governments begin to report on the value of their infrastructure assets—including roads, bridges, dams, and water and sewer facilities—and to develop procedures and methods for asset management systems.

While the future requirements will still contain some original accounting information, GASB 34 mandates a more comprehensive approach to financial statement preparation. GASB 34's main goal is to make financial statements reflect the financial health of government offices. An informed user should be able to review this new statement format and determine the overall condition of a government or a public water system, especially concerning its progress toward infrastructure repair or replacement.

How will GASB 34 be implemented?

Under the current reporting method, revenue and expenditures are recorded in the fiscal year in which they are received or paid (cash-basis accounting). Under the GASB 34 method, governments must account for revenues and expenditures for the period in which they are earned or incurred (accrual-basis accounting). In addition, all current and long-term assets and liabilities, such as infrastructure and general obligation debts, need to be reported within the balance sheet.

GASB defines infrastructure assets as long-lived capital assets associated with governmental activities that are permanent in nature and have a longer useful life than most capital assets. Water systems are one example of infrastructure assets. Buildings are not included unless they are an ancillary part of the infrastructure network.

Implementation Requirements for GASB 34

Phase	Government Revenue	Implementation Dates
Phase 1	$100 million or greater	Beginning after June 15, 2001
Phase 2	Between $10 million and $100 million	Beginning after June 15, 2002
Phase 3	Less than $10 million	Beginning after June 15, 2003

Retroactive Implementation Requirements for GASB 34

Phase	Revenue	Implementation Dates
Phase 1	$100 million or greater	Beginning after June 15, 2005
Phase 2	Between $10 million and $100 million	Beginning after June 15, 2006
Phase 3	Less than $10 million	N/A

Agencies with less than $10 million in annual revenues are not required to report infrastructure values retroactively. While not required, the state and local governments are encouraged to conform.

GASB 34 is designed to help inform the general public as to how well the government maintains infrastructure assets using preventive maintenance verses replacement. GASB 34's reporting requirements are designed to provide more information about the government's ability to repay its debts and care for the infrastructure asset once built.

The effective GASB 34 compliance date depends upon the size of the government, measured by the government's total annual revenues in the first fiscal year ending after June 15, 1999. Larger systems need to begin using GASB 34 this year, while medium-sized and smaller systems will start in subsequent years.

In the first year that agencies are required to report the value of infrastructure assets, they only need to report the value of newly acquired or recently built infrastructure assets. This is called GASB 34's prospective reporting requirement.

Once the appropriate initial phase is determined, governments must retroactively capitalize and report all general infrastructure assets acquired, renovated, or improved since 1980. (See the table on this page for implementation dates.)

The 1996 Amendments to the Safe Drinking Water Act require capacity development programs to be in place for all states. Capacity development means that a state helps its drinking water systems improve their finances, management, infrastructure, and operations so they can provide safe drinking water consistently, reliably, and cost-effectively. (See the Fall 1998 issue of *Water Sense*, for more information about capacity development.) State agencies implementing capacity development programs should be able to help with GASB 34 requirements, and also help determine the cost and depreciation of systems. State agencies responsible for capacity development programs will need to become sufficiently knowledgeable about GASB 34 in order to help provide assistance.

Why is it important for a municipal or public water system to comply?

Under the U.S. Environmental Protection Agency's drinking water state revolving fund (DWSRF), where funds are allotted to the states in order to provide drinking water loans, one eligibility criteria is that each water project undergo financial analysis to ensure the ability to repay the loans. The financial analysis will give a more complete picture of the overall financial stability of the state and local governments once the GASB 34 conversion is completed. This analysis will give auditors the necessary information to decide whether current-year revenues were sufficient to cover the costs of current-year services. This information also will allow the analyst to determine whether the rates currently charged are adequate to meet the future needs for loan repayments.

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Local governments and small water systems can explore a number of sources to learn more about GASB 34 requirements.

Here are three:
GASB offers an *Implementation Guide* that further discusses issues, provides additional illustrations, and presents nearly 300 questions and answers that have arisen about GASB 34. Go to the GASB Web site at **accounting.rutgers.edu/raw/gasb/,** or call (203) 847-0700 to learn more.

In December 2000, GASB issued an Exposure Draft: *Basic Financial Statements—and Management's Discussion and Analysis—for State and Local Governments: Omnibus, an Amendment of GASB Statements No. 21 and No. 34*. This amendment clarifies provisions that are not clear enough to be consistently applied. The GASB intends to release it soon as GASB Statement No. 37.

The American Institute of Certified Public Accountants (AICPA), offers guidance via *Understanding and Implementing GASB's New Financial Reporting Model*. This publication may be ordered online at the AICPA Web site at **www.aicpa.org/index.htm** or by calling AICPA toll-free at (888) 777-7077.

Other authoritative guidance may be found with the Government Finance Officer's Association (GFOA). The GFOA, a professional association of state, provincial, and local finance officers in the U.S. and Canada, recently issued an updated book, *Governmental Accounting, Auditing, and Financial Reporting*. This book is commonly referred to as *The Blue Book* or *GAAFR*. It has been revised to include instruction about the new reporting model. In addition, the GFOA offers technical bulletins and services, and other information on their Web site at **www.gfoa.org**. SF

A Private Market Approach to Onsite Wastewater Treatment System Maintenance

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ABSTRACT: Malfunctioning or failing onsite wastewater treatment systems (OWTS) are a significant source of pollutants, adversely affecting hundreds of waterbodies nationwide. Currently, system design, siting, and construction are fairly well-managed, with maintenance of existing systems the remaining weak link. In this article, some limitations of traditional regulatory approaches to OWTS management are discussed, and an alternative approach using private-market catastrophic OWTS insurance is proposed and developed. Possible advantages of an OWTS insurance approach include improved water quality, risk reduction for homeowners and lending institutions, increased incentives for additional research regarding OWTS management practices, and reduction in the need for publicly funded regulatory programs.

Editor's Note: This article was first published in the winter 1996 issue of the *Small Flows Journal*, the National Small Flows Clearinghouse's (NSFC) peer-reviewed publication which preceded the *Small Flows Quarterly*. The article and its subject, using insurance as a tool for onsite wastewater system management, has sparked renewed interest among many in the field. The NSFC would like to note that this article presents only one of many possible private-market approaches to managing onsite systems. Communities interested in learning about more options should contact National Onsite Demonstration Program Phase IV Coordinator Graham Knowles at (304) 293-4191 or (800) 624-8301.

In the U.S., approximately 25 million private residences rely on onsite wastewater treatment systems (OWTS), such as septic tanks with leachfields (Bureau of the Census, 1993,165, Table 12). When properly designed, sited, constructed, and maintained, such systems can provide an excellent, low-cost means of treating waste with little risk to human health or environmental quality. However, inadequate system care can result in system failure, with consequent environmental and public health risks.

Virtually all jurisdictions in the U.S. have regulations or programs to assure proper OWTS siting, design, and construction—but maintenance, the final step in OWTS management, is much more troublesome to control and is the most frequent source of system decay and failure.

In response to problems with failing systems, some communities regulate and control OWTS maintenance through management districts and other community programs. While these programs can be very effective, their successful implementation often depends on widespread community support.

In this article, some of the advantages and limitations of current OWTS management programs in the U.S. and Canada are discussed, and an idea for an alternative, insurance-based strategy for managing OWTS maintenance is offered. The proposed strategy allows for individual participation by homeowners living in communities where management districts are impractical or unpopular.

OWTS MANAGEMENT PROGRAMS

Regulating Maintenance

Typically, state or local health departments promulgate standards for OWTS design and siting criteria. Sound OWTS construction is usually achieved through onsite inspection during the construction phase by health department personnel, local building inspectors, watershed inspectors, or some other regulatory authority. In many instances, backfill over a system is prohibited until such an inspection occurs.

However, direct regulatory programs aimed at managing OWTS maintenance are rare and usually focus on remediation of a direct threat to public health or property values, or the protection of a specific highly-valued waterbody.

An example of a preventive management program aimed at protecting a highly valued waterbody is an intermunicipal agreement among six towns and two villages sharing frontage on Keuka Lake, one of the New York Finger Lakes. The agreement requires inspections for systems within 200 feet (61 meters) of the shoreline at least once every five years as a means of protecting the high quality of this extraordinarily valuable resource (KWIC, 1993). Shoreline properties in this watershed are economically critical. For several of the municipalities, shoreline properties constituting only a few percent of total land area contribute more than half of all property tax revenues. Keuka Lake OWTS inspections, performed by municipal officers, include verification of adequacy of baffles, checks for holes or cracks, and a determination of whether pumping is needed. Funding for these inspections is provided by fees for services and by municipal support.

Many of the other successful OWTS management programs discussed in the literature were developed precisely because of real or perceived threats to public health or economic well-being. For example, the Stinson Beach Water District in Stinson Beach, California, is the result of direct threats to public health in an area heavily dependent on water-based recreation (Richardson, 1989). Groundwater sampling and testing of the residences in the Stinson Beach area indicated 10 percent of the systems were malfunctioning.

Other examples include the onsite management program in Fountain Run, in south central Kentucky, where there was greater than a 30 percent failure rate for existing systems, with many additional systems undersized by current standards and "expected to fail in the near future" (Otis, Robertson, and Kleinschmidt, 1981). The Westboro, Wisconsin, district was developed to deal with a situation in which more than 80 percent of all systems discharged directly into a small stream (Otis, Robertson, and Kleinschmidt, 1981). And in Virginia, the Arlington County Chesapeake Bay Preservation Ordinance, which requires five-year pumping cycles for onsite systems (EPA, 1993, 4.116), clearly bases its legitimacy on the issue of protecting the highly significant Chesapeake Bay.

Other examples of OWTS management programs show the same general trend. Mooers and Waller (1994), in their survey of Nova Scotia's OWTS management districts, noted only three successful districts since the 1982 legislation authorizing their formation. In each case, significant problems led to formation of the districts. In Port Maitland problems included failed systems and direct discharge to ditches. In Guysborough a survey found that only 10 percent of the systems did not drain to ditches or surface water. In Woods Harbour many systems were determined to be malfunctioning.

Limitations of Current Programs

While the aforementioned examples of managed OWTS maintenance have largely been successful, expansion of such direct regulatory programs to cover all onsite systems is highly unlikely. One reason is that, in many areas, the immense cost associated with such an expansion would require a significant increase in public funds.

New York State, for example, has approximately 1.5 million residential OWTS, with Suffolk County accounting for more than 20 percent of that total (Bureau of the Census, 1993, 224–230, Table 66). Straightforward calculations assuming four inspections per person per day, or 1000 per year, mean that New York would need 1,500 new inspectors if annual inspections were implemented. Even inspection on a three-year cycle, as is recommended under the Management Measures Guidance for the Coastal Nonpoint Pollution Control Program (EPA, 1993, 4.114), would require 500 inspectors. Adding salary and benefits to other program costs, such as office space, staff support, materials, etc., leads to a cost estimate of at least $15 to $20 million per year. Whether generated through fees for required services, as part of a community's general

Economically critical shoreline properties on Keuka Lake, New York, are protected by an intermunicipal onsite wastewater treatment maintenance agreement.

Photo courtesy of the Finger Lakes Association, Inc.

Table1

hypothetical example of levels of OWTS insurance coverage

Policy	Services Included	Deductible	Coverage provided
Low–Cost	none	High	Repair and replacement costs up to $2,500
Standard	Inspection of system at three-to five-year intervals	Medium	Repair or replacement of existing system up to $5,000
Deluxe	Annual inspection of system Annual household plumbing and water-use audit Pumping of tanks as needed	None	Repair and replacement costs up to $10,000. Up to $1,000 design permitting costs for alternative onsite or special systems.

budget, or through some form of special tax, these costs would be borne by the public.

Assigning responsibility to existing agencies, such as watershed inspectors or local health departments, would simply mean an increase in workload such that significant staff additions would be necessary. It also should be noted that these estimated costs merely focus on inspections and do not include the potential costs of remediating inadequate systems.

In the absence of significant perceived benefits, such a program is unlikely to gain widespread community support, especially because its successes (early detection of OWTS problems) imply an additional cost, sometimes substantial, to affected homeowners. Mooers and Waller (1994) note that in some communities in Nova Scotia, the lack of a public perception that OWTS problems even exist has resulted in the failure to adopt onsite management programs. Therefore, while the concept of a district or other public utility as a mechanism for onsite system maintenance has obvious advantages, it is not a panacea. It appears to be an attractive alternative only if at least one of the following conditions can be met:

- there is a serious threat to health or property values that a district might reduce at less expense than central sewers,
- there is a widespread perception of a threat to public health or the environment and a perception that central sewers would be more expensive, or
- the area is undergoing significant new development, so that district formation is a part of an overall development package.

In a few instances, however, it appears that districts can be developed and supported by a community in the absence of a real or perceived immediate threat, given a population that is exceptionally committed to minimizing environmental impacts.

ADVANTAGES OF EFFECTIVE OWTS MAINTENANCE

Despite the costs and limitations of a public management district or utility approach, the concept of controlling OWTS maintenance is attractive from both individual and societal perspectives. Societally, the pollution avoided through routine inspection and maintenance will improve water quality in hundreds of waterbodies nationwide. In New York State alone, it is estimated that OWTS pollution is the primary cause for over 180 waterbodies failing to meet designated use standards. OWTS failures are a secondary cause of pollution for an additional several hundred waterbodies (DEC, 1993).

For the individual system owner, routine inspections also can provide significant benefits. Early detection of many malfunctions, such as loss of in-tank baffles, allows early and inexpensive maintenance. In addition, inspection normally includes tank pumping, itself an important factor extending a system's useful life.

For a variety of reasons, it seems that most homeowners do not perform appropriate routine OWTS maintenance despite such benefits. The author has been unable to locate any formal studies showing voluntary high levels of homeowner OWTS maintenance in the absence of the same preexisting conditions listed earlier as being important in management district formation.

In a survey conducted at the beginning of the process leading to the Keuka Lake intermunicipal agreement, a systematic random sample of the records of 839 systems in the watershed showed that fewer than 40 percent of systems had been inspected in the previous 10 years. Nearly 22 percent of systems in the watershed had not been inspected in more than 20 years (Powell, Herring, and Anderson, 1988). These findings, together with those of colleagues (Lemley, 1995) and anecdotal information from pumpers, regulators, and others working in the field, lead to the conclusion that it is not uncommon for homeowners to ignore OWTS maintenance until after gross failures occur.

Because properly designed and sited systems do not require maintenance often, homeowners are unlikely to incorporate system maintenance as routine. Also, when faced with the choice between the certainty of spending a small amount of money now versus the possibility of having to spend a large amount in the future, time preferences for money reinforce the desire to avoid spending money when there is no immediate benefit.

The fact that OWTS maintenance can often be delayed without immediate repercussions can also lead to neglect. Also, homeowners are sometimes unaware that OWTS maintenance is necessary, or even that they rely on onsite treatment.

Education programs regarding OWTS maintenance are sponsored by many political jurisdictions, educational associations, and other groups (see Mancl and Magette, 1991). While such programs can address some of the homeowner maintenance issues discussed previously and are virtually always a component of OWTS management programs, education programs are, at best, rarely completely effective in changing behavior. Education and outreach efforts are necessary but are not usually sufficient in preventing neglect, just as the posting of speed limit signs does not obviate the need for enforcement.

Preventing OWTS Failure

For the reasons above, it is not uncommon for homeowners to focus on OWTS maintenance only after gross failures occur. When a system fails noticeably (for example, with surface discharge), owner inconvenience from such factors as odor is usually sufficient to assure relatively prompt remediation. Unfortunately, remediation by owners is often predicated on a clear and inconvenient failure, and corrective measures can be significantly more expensive than preventive ones.

The first problem with preventing OWTS failure is related to the difficulty of clearly defining "failure." Reliance on owner action tends to imply a definition based on obvious inconvenience, such as odor problems, surface discharge, etc. Even obvious symptoms of incipient failure, such as transient surface ponding directly over leach lines, may well be missed or ignored by the homeowner. Symptoms recognized by the homeowner usually appear well after more subtle symptoms of failure. Water quality impacts, threats to public health, and costly system damage can occur well before the more obvious symptoms of failure.

Implications of the increased OWTS remediation costs include overall increased expenses for the homeowner (public funds for the remediation of failing private onsite systems are small and are likely to remain so) and the problem that some individuals will not be able to remediate at all. Regulatory officials are thus placed in the position of enforcing against individuals who already perceive themselves as victims and who cannot afford to remediate.

Given such undesirable alternative solutions as property condemnation, regulatory agencies are faced with simply attempting to ameliorate problems. While the creative use of alternative onsite systems can resolve problems in many instances, cases still remain in which the results are unsatisfactory from both environmental and public health perspectives.

A Private Market Alternative

One approach that could offer a workable OWTS maintenance alternative for individual homeowners would be the development of a private market in catastrophic OWTS failure insurance. Private insurers could offer policies, perhaps as riders to existing homeowner policies, that would cover the cost of OWTS repair or replacement. Clearly, insurers would have an incentive to develop expertise to assess and reduce risks of system failure in order to maximize their profits. An obvious approach to doing so is to establish minimum maintenance standards that void the policy when not met. Systems maintained according to these minimums would, in fact, have a reduced likelihood of failure, protecting environmental and public health, as well as reducing overall costs to homeowners.

The concept of using insurance programs to reduce pollution potential from private homes is already being considered in New York. In response to concern over pollution potential in the New York City watershed system, New York State has announced that legislation will be introduced authorizing the creation of ". . . a voluntary program of homeowner insurance for underground home heating oil tanks. Such insurance would cover the cost of necessary soil and groundwater remediation and thereby encourage homeowners to investigate and report on the conditions of their underground tanks, and remediate identified problems" (New York State, 1995, 10). The impetus for this program is concern over public health—the New York City water supply system provides drinking water to more than nine million people. Similar logic could be used to extend the program to address OWTS maintenance issues.

Insurers of onsite systems might offer a range of options with policies, such as varying deductibles. Thus, a very low-priced policy with a high deductible would not cover routine costs such as periodic pumping, while a more expensive policy could (for a hypothetical example of OWTS coverage, see table 1). Such policies would be, from the homeowner's perspective, analogous to a utility district, allowing the homeowner to trade a lower regular payment for protection from larger unexpected costs. For example, the Georgetown Divide Public Utility in California includes inspections for onsite systems in a large subdivision among its services. Homeowners are charged $12.50 per month for the management of single-family systems (Dix, 1992).

To compare the private market plan to that of public districts or utilities, first consider a situation in which all homeowners participate. The systems would have equal beneficial impacts, in that maintenance would be uniformly addressed. In each case, the homeowner would pay a relatively low fee to avoid the possibility of a much larger cost should the system fail. The only difference under the full participation scenario is that the fee would be paid to a private insurer in one case and a public utility in the other.

However, if support for OWTS maintenance is not universal, the two systems would differ. With the insurance approach, there is a direct correlation between those supporting OWTS maintenance and participation. Under the district plan, those supporting maintenance can, if sufficiently numerous and vocal, force a maintenance program on those reluctant to participate. The result under the district plan would be high participation, assuming adequate enforcement of the regulatory program is included. If, however, those supporting OWTS maintenance are not sufficiently numerous or well-organized, their desire for a district will be frustrated. In such a case, the only maintenance that will occur is that which can be attained through voluntary means, such as education.

The above comparison assumes, for both options, that each OWTS contributes equally to pollution problems, or that the relationship between likelihood of polluting and support for OWTS management is random. In most instances, a relatively small portion of systems constitute the majority of pollution potential. This serves to increase the difference between the two approaches. If we assume that those owners most likely to pollute are also most likely to oppose required maintenance (because of the repair costs it would impose), the insurance strategy would provide some benefits but not adequately deal with the highest-risk cases.

On the other hand, the district approach could be expected to have one of two results. If a sufficient majority of homeowners were interested in required maintenance (i.e., the proportion of high-risk systems were low), they could force the creation of a program that would address the high-risk situations. If, however, those opposing the district were capable of blocking formation, there would be no required maintenance for anyone. In this sense, the district strategy may be seen as a high-risk, high-payoff strategy.

Advantages of OWTS Insurance

The following are several points of interest and possible benefits of the private insurance approach to OWTS maintenance:

- **An insurance plan may allow for the application of market forces to minimize the costs associated with OWTS management**.

  Just as individuals frequently compare costs and services for autos or homes, a private market system will offer the opportunity for competition to improve prices and service to the homeowner. Estimates of the cost of such insurance are, of course, heavily dependent on assumptions regarding such issues as system life cycle and the extension to be expected through routine maintenance, definitions of system failure, and so on.

  Observed OWTS failure rates usually range between one and five percent per year (EPA, 1993, 4.114). Assuming a catastrophic failure rate of one percent per year with remediation costs averaging $4,000, a fee of $40 per year should cover claims. Premiums must be higher to allow for overhead costs and profit. In addition, at least in the initial stages of such a program, a significant margin for error would be needed. This margin would presumably be reduced as expertise accumulated. It thus seems that a premium of $100 per year, competitive with costs of some existing governmental districts, is feasible. If policies were incorporated as riders on existing homeowner policies, administrative costs would be minimized. With 25 million such systems in the U.S., the potential market is significant.

- **Private insurers can be expected to set maintenance standards for OWTS policies in order to reduce their costs.**

  Just as an insurer may encourage proper maintenance for a home in order to avoid later claims, OWTS insurance would provide an incentive for insurers to work with their customers to improve routine maintenance. Examples of approaches include offering differential premiums, distributing educational pamphlets, and establishing minimum maintenance requirements. Again, as with traditional homeowner policies, the insurer may reject or limit claims if reasonable and customary maintenance is not performed by the owner (e.g., if the OWTS is never pumped or inspected). Both insurer and insured thus have strong incentives to improve maintenance and reduce the likelihood of failure.

- **Private insurance holds the promise of allowing tailoring to site-specific conditions, always an important factor in OWTS management.**

  Insurers might consider site conditions such as soil porosity and proximity to water supplies (which affect the risk an individual OWTS poses) in determining premium rates, the frequency of appropriate inspections, and action levels for remediation. Insurers might elect to require that inspections be performed by their staff or by individuals with specified credentials, such as registered sanitarians.

- **Individual insurers would have the burden of determining at what point a system can be considered in failure.**

  One major difficulty facing any traditional OWTS regulatory inspection program is the determination of failure, because OWTS failure is most often a continuum rather than a single catastrophic event. This problem would be much less important under an insurance plan, as individual insurers might establish their own systems of evaluation. Insurers would thus balance the increased protection from setting high standards (very early warning of possible problems) with the increased costs associated with the risk reduction. It is to be expected that, over time, some standardization would occur. At a minimum, certain failure "trigger points" would be set so as to meet relevant public health and environmental standards, so that the insurance would actually protect the homeowner. Clear trigger points would probably include those currently applicable in regulation, such as surface discharge, and other possible criteria, such as the physical integrity of tanks and lines (avoiding cracks), evidence of solids flow into leach lines, etc.

- **An insurance approach may encourage and generate funding for further OWTS research.**

  Because of the direct economic implications of setting specific points of failure, insurers would have a significant incentive to improve knowledge of such factors as efficiency and life span of differing types of systems under differing conditions and the effectiveness of various best management practices. As a further parallel to existing insurance mechanisms, such information might be generated in many ways. For critical questions, insurers might themselves fund research. The Insurance Institute for Property Loss Reduction, for example, funds research aimed at reducing property losses due to natural disasters, such as hurricanes and earthquakes (McLean, 1995). In other instances, research done under other auspices could be used. The incentive to improve understanding of OWTS operation should improve both the insurance market and OWTS maintenance over time.

Benefits of OWTS failure insurance to the environment and insurers are clear. The chief advantage for homeowners is in terms of risk reduction. As such, acceptance of the plan will depend on homeowner perceptions of risk. An insurance program would provide additional opportunities for education programs. Also, because insurance premiums are predictable, there would be an increased recognition that OWTS management is needed and can have direct economic impact. Therefore, the insurance strategy should not be considered a replacement or substitute for educational programs. Instead, they are complementary.

OWTS Mortgage Insurance

Perceived risk reduction as a driving force is not limited to the homeowner. Approximately two-thirds of the owner-occupied, one-family housing units in the United States are currently covered by a mortgage or other lien (Bureau of the Census, 1993, 224–230, Table 66). Financial institutions may be expected to recognize the risk reduction potential of such an insurance plan and take steps to encourage participation. Just as most lending institutions require insurance to protect against other value-reducing problems such as fire, they might require OWTS insurance.

Because OWTS management has not historically been a major issue for such institutions, an education program for lending institutions would probably be necessary. Such a targeted program might be developed by water quality experts as a long-term means of improving water quality. Alternatively, private groups, whether they be environmental interest groups or associations focusing on the insurance industry, might also assume the role of educating lenders.

Adoption of OWTS insurance requirements by such federal lenders as the Department of Housing and Urban Development (HUD) and Rural Development would both introduce the concept to the private sector and establish a market, justifying private insurers in taking action to develop their offerings. Alternatively, having OWTS insurance might translate into a small rebate on mortgage costs, reflecting the risk reduction. This possibility is unlikely, however, unless a similar reduction were applied to mortgages for homes served by public sewerage.

One factor affecting lending institution acceptance of OWTS insurance is the recent growth of the secondary mortgage market. This has led to pressure to standardize mortgage terms and conditions, so that groups of mortgages may more readily be "bundled" for resale. This will initially act to discourage lender requirements for OWTS insurance. However, if the insurance provides adequate risk reduction, some institutions are likely to require it. Other factors, such as proximity to potable water supplies, may be important in the determination of risk reduction. Once OWTS insurance is required for some mortgages, the same tendancy toward standardization should act rapidly to increase the number of institutions requiring the insurance.

CONCLUSION

Existing regulations to ensure appropriate OWTS maintenance are inadequate, and public support for expansion of regulatory authority through mechanisms, such as wastewater management districts or utilities, is limited except in specialized circumstances. Voluntary programs, such as education programs developed by cooperative extension offices, cannot be completely effective. Voluntary programs also must overcome inherent disincentives for establishing routine maintenance or remediating failed systems, because it is less expensive in the short-term for unconcerned system owners to do nothing. What is needed to ensure OWTS maintenance in areas without community programs, then, is an institutional mechanism that internalizes the cost of OWTS maintenance, thus reducing failure rates and consequent public health and environmental problems.

In summary, a private market system for catastrophic OWTS failure insurance could provide an alternative approach to improving OWTS maintenance, the major problem in overall OWTS management. The insurance approach would offer risk reduction for the homeowner, avoid the need for a large and expensive governmental entity, and internalize costs which are currently external. This strategy could create new incentives for the development and refinement of better OWTS maintenance practices, and may also affect siting and design practices. Improved environmental quality and reduced threats to public health are possible benefits of such a system. Risk reduction aspects of the proposal may also trigger support from lending institutions, despite recent pressure for standardization of mortgage provisions. SF

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The Role of Biomats in Wastewater Treatment

What is a "biomat" and how is it formed? Does the biomat have an effect on the treatment of septic tank effluent?

Editor's Note: This column is based on calls received over the National Small Flows Clearinghouse (NSFC) technical assistance hotline. If you have further questions concerning biomat formation or soil clogging in general, call (800) 624-8301 or (304) 293-4191 and ask to speak with a technical assistant.

Although the septic tank settles out, and in fact, digests a large portion of the solids from household wastewater, the effluent from the septic tank still has a high biochemical oxygen demand (BOD) because of the presence of biodegradable organics and high bacterial content that may include pathogens.

Therefore, septic tank effluent (STE) is not suitable for direct discharge into surface waters or onto land surfaces. Further treatment is needed to remove these harmful pathogens and reduce the BOD. The most common way to accomplish this and dispose of the treated wastewater is through subsurface soil absorption.

Effluent flowing out of the septic tank enters a subsurface disposal area through a distribution network of perforated pipe that can be pressurized or gravity fed. Final treatment of the STE occurs as it percolates through the soil. The effluent is purified mainly by three processes: absorption, filtration, and microbiological decomposition.

As the effluent is discharged into the soil absorption system (SAS), a restrictive layer, the biomat, develops beneath the distribution lines of the SAS at the gravel-soil or bed-soil interface. Several terms refer to this phenomena: clogging mat, clogging zone, biocrust, and biomat are the most common. There are two phases of biomat formation: 1) accumulation of suspended solids, and 2) bridging of the solids and soil particles by the bio-produced material that slowly accumulates over time.

Characterized as a "black slimy layer" in the infiltrative surface and anaerobic in nature, the biomat is composed of accumulated suspended solids, minerals, bacterial cells, microorganism fragments, polysaccharides, and polyuronides. Most matter found in the biomat is organic and biodegradable; however, only partial decomposition of the organic matter occurs because of the environment of the biomat.

Ranging from less than 1 centimeter to several centimeters thick, the biomat acts as an active biological site for treatment of STE. The biomat helps ensure the conditions for optimal treatment of the effluent by restricting the infiltration rate into the soil, inducing unsaturated soil conditions, and reducing the chances of rapid dispersion below the system.

Because the biomat is very active biologically, it is responsible for removing a larger portion of the BOD from the STE. The constantly changing microorganism population uses the dissolved and suspended organic matter (including other microorganisms) as a food source, resulting in the effluent plume having a relatively low BOD. However, the plume will contain nitrates and possibly ammonia.

Biomats are also highly effective in removing bacteria and pathogens from the STE. Biodegradation and filtration combine to limit the travel of pathogens. Microflora present in the biomat trap the pathogens until they are either consumed or die. A study conducted at the Technical University of Nova Scotia showed no trace of fecal coliform 4 inches from the gravel-soil interface under optimum conditions, although under adverse conditions, travel of contaminants can be much greater.

Mature biomats can also detain viruses that can be present in the effluent. Biomats are said to be the most important part of the treatment process and the main line of defense for human protection against the bacteria and pathogens present in STE.

The biomat controls infiltration of the wastewater into the soils. The clogging reduces the soil pore-volume and reduces the hydraulic capacity of the soil absorption field. Water still flows through the clogging zone but at a considerably lower rate than in the natural soils beneath the field.

Loading of the soil absorption field dictates the method of the biomat formation. Two general methods of biomat maturation exist: creeping (or progressive) and pressure distributed. In the creeping method, biological growth starts near the perforations where effluent is discharged. As the system ages and the soil "clogs," the maturation surface progresses down-slope along the distribution lines. This movement progresses until the bottom of the soil absorption area is clogged or crusted, effluent becomes ponded in the bed, and unsaturated conditions occur below the crust or clogged layer.

In the pressurized system, the effluent is distributed evenly throughout the soil absorption area; thus, biological growth occurs uniformly near each perforation and will eventually mature along the entire bottom of the soil absorption field. The biocrust layer restricts liquid flow, inducing unsaturated conditions, and, therefore, aeration in the underlying soil. Contact between the pollutant present in the effluent and the mineral particles will be increased with increased clogging, resulting in a better renovation ability of the soil.

Flow through this clogging layer improves effluent filtration and purification, provided that adequate infiltration into and percolation through the soil is maintained. However, a clogging mat is not necessary for successful wastewater treatment because the soil moisture regime can be controlled by wastewater distribution methods. SF

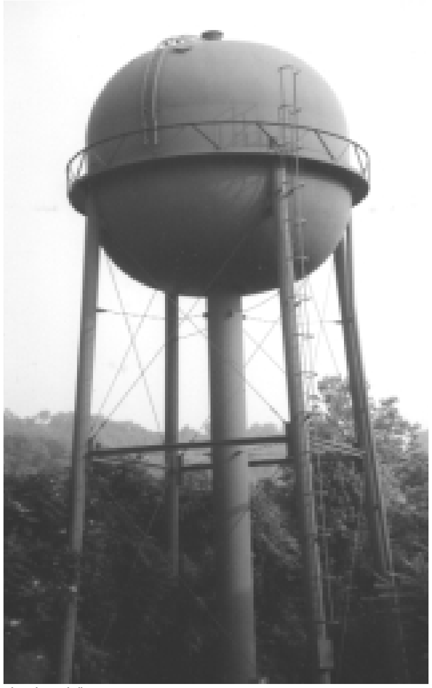


Photo by Michelle Moore

Protecting Small Systems

The National Drinking Water Clearinghouse Has Important Information for Communities

In the face of the recent terrorist attacks against the U.S., the National Drinking Water Clearinghouse (NDWC) has assembled important information about protecting small drinking water systems against potential threats. The NDWC's intent is to educate and inform water system personnel, community officials, and governing boards, and to help them prepare emergency plans.

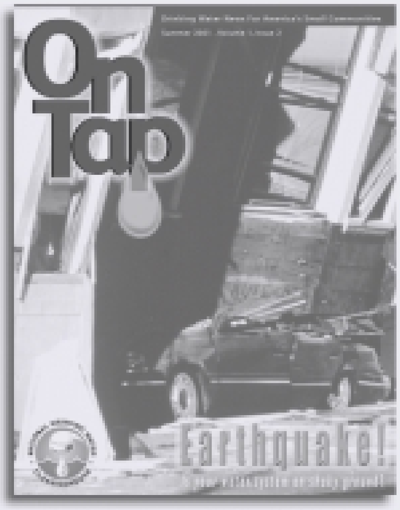
Although the NDWC's information focuses specifically on drinking water systems, prudent wastewater system managers and operators will find much of the information useful for securing their own systems.

On Tap

The upcoming Winter issue of the NDWC's free magazine, *On Tap,* will focus on areas of concern for drinking water systems and how communities can protect drinking water personnel, facilities, and public health. If you know of drinking water system officials, operators, or others in your community who would benefit from the information in this issue, urge them to contact the NDWC at (304) 293-4191 or (800) 624-8301 to obtain a free subscription. Also, refer to the ad below for information about ordering the recently published *On Tap* issue about natural disasters.

www.ndwc.wvu.edu

The NDWC's Web site is updated regularly and features the latest news and information about safeguarding small drinking water systems. It includes a list of water protection links and resources, a calendar of events, and past issues of *On Tap, Tech Brief, Water Sense,* and other NDWC publications. Visit NDWC online at **www.ndwc.wvu.edu**. SF



Drinking Water Magazine Discusses Natural Disasters

Natural disasters can strike all parts of the country at any time of the year. Communities need to prepare for flooding, earthquakes, and droughts to lessen the potential effects of these crises. The National Drinking Water Clearinghouse's (NDWC) Summer 2001 *On Tap* is a theme issue that deals with disasters that may affect water systems and gives suggestions to help mitigate the consequences when emergencies occur.

Summer 2001 *On Tap* also evaluates progress on the Source Water Assessment Program around the country. Identifying potential contamination in a drinking water system's source water must be completed in most states by 2003. Read about the program and how states are working toward their deadline.

The *Tech Brief,* an in-depth review of treatment technologies for drinking water professionals, discusses diatomaceous earth (DE) filtration. This process uses diatoms—the skeletal remains of small, single-celled organisms—as the filter medium. DE filtration is effective and simple to operate and is one of the U.S. Environmental Protection Agency's approved technologies for meeting Surface Water Treatment Rule requirements.

Subscribe to *On Tap* by contacting the NDWC at (800) 624-8301, (304) 293-4191, e-mail to **ndwc_orders@mail.nesc.wvu.edu**, or write to P.O. Box 6064, West Virginia University, Morgantown, WV 26506-6064. Visit the NDWC Web site at **www.ndwc.wvu.edu**. SF

New NSFC Products Are Available

Constructed Wetlands in East Texas: Design, Permitting, Construction & Operations

The Pineywoods Resource Conservation and Development Council, cooperating with the Stephen F. Austin State University College of Forestry, received a grant to construct and monitor five treatment wetlands of various-sizes in order to demonstrate to East Texans an alternative treatment technology. This three-year grant was under section 319(h) of the Clean Water Act through the Texas Natural Resource Conservation Commission. Systems were monitored for one year following construction, and results showed systems performed better than expected. Lessons gained from the project are shared through the manuals listed below so that others can benefit from the project when building similar systems. Each volume contains detailed information about design feasibility, permitting, construction, operation and maintenance, plus numerous photographs and diagrams, an appendix, and reference sources. Although the manuals were prepared with East Texas in mind, any wastewater professional or homeowner interested in constructed wetlands should find the information useful.

Volume 1: The first of four manuals in the series, this relates to single-family wetland or rock filter systems with flows up to 500 gallons per day (gpd). The cost for this 24-page manual is $8. Request Item #WWBLDM93.

Volume 2: The second of four manuals in the series covers onsite collection systems with flows from 500 to 5,000 gpd. The cost for this 40-page manual is $8. Request Item #WWBLDM94.

Volume 3: The third of four manuals in the series deals with municipal systems with flows from 5,000 to 50,000 gpd. The cost for this 28-page manual is $8. Request Item #WWBLDM95.

Volume 4: The last of four manuals in the series, this is a plant identification guide with detailed information about single-family, medium-sized, and municipal systems. Both plant and weed photo galleries supplement the manual. The cost for this 44-page manual is $9.50. Request Item #WWBLDM96.

Mound/Pressure Distribution On-Site Sewage Disposal System

This 10-minute video introduces the onsite system and explains what it is and how it works. The pressure-dosed bed, or mound system, is examined as an adjunct to the conventional septic tank. Wastewater professionals are interviewed in the video, and computer graphics provide cross-sections of the system, illustrating how wastewater goes through the system and how it is treated by the different components. The importance of maintenance and monitoring is stressed throughout the video, with general recommendations, signs of system failure, and caveats provided. The video produced by the Anne Arundel County Department of Health provides information of particular interest to homeowners.

The cost for this video is $15. Request Item #WWVTPE64.

Watershed Management: A Policy-Making Primer

This booklet is a primer to prepare the way for a formal watershed management plan. It provides a basic sense of watershed management policy making in which responsibilities are shared in a cooperative context. The booklet highlights questions that policy makers must deal with, such as:

- How can conflicts be resolved or mediated?
- Why is an educational program needed?
- What management tools or methods may be applied?
- What are common obstacles?

Developed by the Cornell Cooperative Extension, New York State Water Resources Institute, Center for the Environment, Cornell University, this 11-page booklet may be helpful to local and public health officials, managers, planners, and the general public. The cost is $2.30. Request Item #WWBLMG12.

NODP II Final Reports Are in

Established in 1993, the National Onsite Demonstration Program (NODP) supports demonstrations of innovative and alternative onsite wastewater technologies to protect public health and the environment in small and rural communities. The NODP's primary objective is to help adopt proven innovative technologies and management systems in communities located in selected states that are receptive, but may not currently permit, the use of these systems.

The reports described below summarize the activities of six communities that participated in NODP II, one of six NODP phases. Each system summary discusses the site, system installation, key treatment objectives, operation and maintenance, monitoring, and cost, and includes a diagram of the system. The report also describes public education efforts and offers a list of the lessons learned from the program. The ordinances that were passed are also summarized.

Local and public health officials will be expecially interested in this information, and it may also be of use to wastewater professionals, such as regulators, managers, and finance officers, as well as the general public.

Education, Technology, and Management System Demonstrations in Rural Vermont

This report outlines the activities in five rural Vermont communities participating in NODP II: Addison County, Town of Jericho, Windham County, Warren Village, and Town of Hinesburg. Site conditions such as clay, shallow bedrock, or steep slopes limit the effectiveness of conventional onsite systems in Vermont. While some of the communities focused on developing management plans for onsite systems, educational activities were a key component of all the communities' activities and are discussed in specific sections of this report.

This 24-page report costs $3.50. Request Item #DPBLGN01.

Demonstration of Innovative Onsite Wastewater Systems in the Green Hill Pond Watershed of Rhode Island

This report outlines the activities in Green Hill Pond Watershed. With a grant from the NODP II and other partners, seven failing systems were retrofitted with alternative wastewater technologies, including:

- septic tank with recirculating trickling filter and sand filter;
- septic tank with recirculating trickling filter;
- septic tank with drip irrigation system and sand-lined trenches;
- septic tank with single-pass sand filter and shallow, narrow drainfield;
- septic tank with recirculating textile filter and shallow, narrow drainfield;
- septic tank with single-pass peat filter, ultraviolet disinfection unit, and shallow; narrow drainfield; and
- fixed-film bioreactor treatment unit with shallow, narrow drainfield.

This 14-page report costs $2.25. Request Item #DPBLGN02.

Innovative Technology and Management District Demonstration in an Impaired Watershed in Southern Pennsylvania

This report outlines the activities of a Centerville, Pennsylvania, project, funded by a grant from the NODP II. Originally intended to demonstrate one alternative cluster system, this project evolved into a comprehensive wastewater treatment and management plan for the entire town. It included three major activities:

- installing a contour trench system for multiple households,
- constructing a wetland to polish wastewater from the recirculating sand filter, and
- developing relevant ordinances and plans for the formation of a management district for the entire township with stakeholder assistance.

This 10-page report costs $1.95. Request Item #DPBLGN03.

Demonstration of Innovative Treatment and Disposal Systems in the Former Coal-Mining Town of Burnett, Washington

This report outlines the activities of Burnett, Washington. With a grant from the NODP II, Washington State Department of Health, as well as substantial volunteer efforts and donations, 14 malfunctioning systems were rebuilt using alternative wastewater technologies, including:

- septic tank with recirculating gravel filter and drip irrigation;
- submerged, fixed-film bioreactor treatment unit with drip disposal;
- aerobic treatment unit with raised media bed disposal;
- septic tank with aerobic biofilter and gravity soil absorption field;
- septic tank with submerged fixed-media activated bioreactor, peat biofilter, and gravity soil absorption field;
- septic tank with modified mound;
- septic tank with recirculating textile filter and absorption field;
- septic tank with dose/equalization tank and drip disposal;
- septic tank with gravity at-grade absorption field;
- septic tank with pressure distribution soil absorption field;
- septic tank with constructed wetlands and gravity soil absorption field;
- septic tank with stratified sand filter; and
- septic tank with an upflow biofilter.

This 18-page report costs $2.65. Request Item #DPBLGN06.

Demonstration of Innovative Treatment and Disposal Technologies in Environmentally Sensitive Karst Terrain Near Rock Bridge Memorial State Park, Missouri

This report outlines the activities of Rock Bridge, Missouri. With a grant from the NODP II, five failing conventional systems in the area were retrofitted with alternative technologies based on site limitations and needs, including:

- septic tank with drip irrigation system,
- aerobic treatment unit with drip irrigation system, and
- septic tank with low-pressure pipe system.

This 10-page report costs $1.95. Request Item #DPBLGN04.

Monongalia Management and Maintenance Partnership Project (3MP), Monongalia County, West Virginia

This report outlines the activities of Monongalia County, West Virginia. With a NODP II grant, the Monongalia County Health Department set these objectives:

- identify the most appropriate, usable wastewater management model to address Monongalia County's needs;
- establish a countywide revolving fund to offer homeowners low-interest loans to replace or install onsite wastewater systems; and
- provide education and training about properly installed and maintained onsite wastewater systems as a viable alternative to conventional systems.

The report also discusses how an onsite wastewater management district was established, the revolving loan program, education, and training.

This 10-page report costs $1.95. Request Item #DPBLGN05.

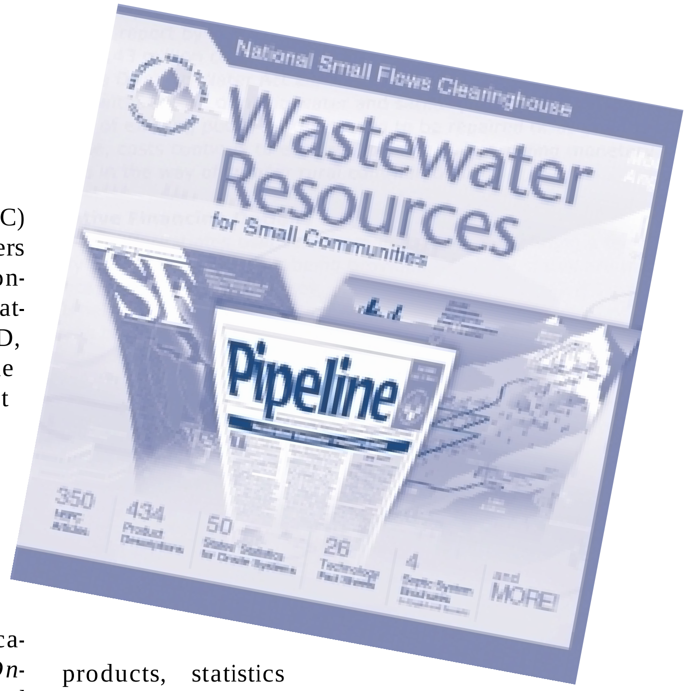
CALL FOR PAPERS

Small Flows Quarterly

Papers are now being accepted for the juried article section of the *Small Flows Quarterly*, the only magazine/journal devoted to onsite and small community wastewater issues (i.e., communities with populations under 10,000 or communities handling less than one million gallons of wastewater flows per day).

For additional information about the *Small Flows Quarterly*, manuscript submission guidelines, and publication deadlines, please contact Cathleen Falvey at **cfalvey@wvu.edu**, or phone 800-624-8301, ext. 5526, or write to Editor, *Small Flows Quarterly*, National Small Flows Clearinghouse, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064.

Give Feedback Online About NSFC's CD-ROM



The National Small Flows Clearinghouse (NSFC) recently released its first-ever CD-ROM, which offers a comprehensive collection of resources about onsite systems and small community wastewater treatment. After you've had a chance to use the CD, please let us know what you think by filling out the "Online Feedback Form" on our Web site at **www.nesc.wvu.edu/nsfc/cdfeedbackform.html**

Titled *Wastewater Resources for Small Communities*, this CD-ROM puts a wealth of information at the user's fingertips. The CD-ROM contains 350 articles from the NSFC's publications since 1989, including information from the *Small Flows* newsletter, the *Small Flows Quarterly* magazine, and the *Pipeline* newsletter. An educational information section includes the poster, *Onsite Wastewater Treatment for Small Communities and Rural Areas*, which describes 23 different wastewater treatment technologies. It also provides a series of brochures about septic systems in both English and Spanish.

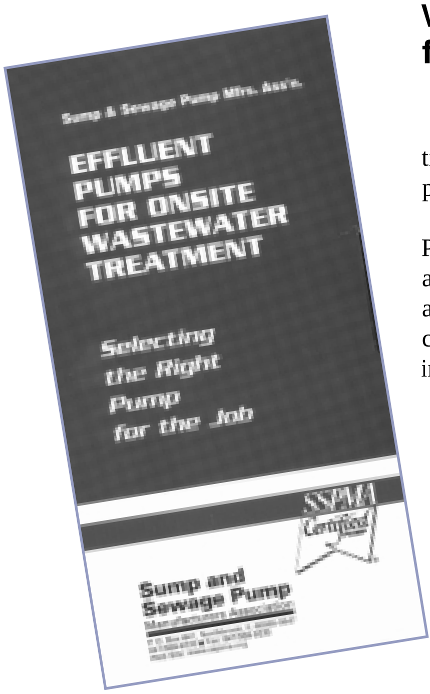
The CD-ROM also features a series of fact sheets the NSFC developed under the U.S. Environmental Protection Agency's (EPA) Environmental Technology Initiative. The fact sheets detail 13 different wastewater treatment technologies with both technical and general fact sheets for each topic.

Other resources available on the CD-ROM include information about the NSFC's vast selection of products, statistics on the status of septic systems in the U.S. detailed by state, and the full text of EPA's *Response to Congress on Decentralized Wastewater Treatment Systems*.

The CD-ROM is PC-compatible and requires a 486 or Pentium® processor and Microsoft Windows® 95 or later. The software needed to read the files (Adobe Acrobat Reader and Internet Explorer) also is provided on the CD-ROM.

Wastewater Resources for Small Communities (Item #WWCDGN162) costs $14.95, plus shipping. To order, call the NSFC at (800) 624-8301 or (304) 293-4191 or e-mail **nsfc_orders@mail.nesc.wvu.edu**. SF

Video Demonstrates Sizing and Selecting Pumps for STEP and LPP Systems



A new, 28-minute video by the Sump and Sewage Pump Manufacturers Association details how to size and select a pump for an enhanced flow septic tank effluent pump system and low-pressure pipe distribution system.

Titled "Effluent Pumps for Onsite Wastewater Treatment: Selecting the Right Pump for the Job," the video describes and defines the components of each system and basic terminology. The four different impeller designs (open, semi-open, closed, and vortex) are discussed, along with applications of each design. Viewers are encouraged to always check with the local governing regulations or codes before starting any project.

Example calculations are given for sizing and selecting pumps for an LPP system and STEP system. The video states that the same pump selection principle for these systems will also apply to sand, peat, and mound systems. The video shows how to plot the flow rate and total dynamic head needed on manufacturers' performance curves to select the pump. The video recommends that the system be checked at least once a year, or more if required. Fact sheets supplement the video with frequently asked questions and tables to help calculate flow rates, pump capacity and pump control differential.

This video can be a helpful resource for contractors/developers, engineers, managers, state regulatory agency personnel, and public health officials. The cost is $45.

To order the "Effluent Pumps for Onsite Wastewater Treatment: Selecting the Right Pump for the Job" video, call the NSFC at (800) 624-8301 or (304) 293-4191 and request Item #WWPKDM97. Orders may also be placed via e-mail at **nsfc_orders@mail.nesc.wvu.edu** SF

Products List

Item Number Breakdown

First two characters of item number: (Major Product Category)
WW Wastewater
FM Finance and Mangement
GN General Information
SF Small Flows
DP Demonstration Program

Second two characters of item number: (Document Type)
BK Book, greater than 50 pages
BL Booklet, less than 50 pages
BR Brochure
CD Computer Disk/ROM
FS Fact Sheet
PC Customized Search
PL Pipeline
PK Packet
PS Poster
QU Quarterly
SW Software
VT Video Tape

Third two characters of item number: (Content Type)
CM Computer search
CS Case Study
DM Design
FN Finance
GN General Information
IN Index
MG Management
NL Newsletter
OM Operation and Maintenance
PE Public Education
PP Public-Private Partnerships (P3)
RE Research
RG Regulations
TR Training

Last two characters of item number: Uniquely identifies product within major category

☐ Highlighted products are new

* Indicates changes in title, item number, and/or price

To place an order…

To place an order, call the NSFC at (800) 624-8301 or (304) 293-4191, or use the order form on page 63 and fax your request to (304) 293-3161. You also may send e-mail to **nsfc_orders@mail.nesc.wvu.edu**. Be prepared to give the item number and title of the product you wish to order. Shipping charges apply to all orders.

Abstracts of many products are provided in the NSFC's *Products Guide*. The guide may be downloaded via the NSFC's Web site at **www.nesc.wvu.edu**.

Case Studies

WWBLCS04	Alternating Bed Soil Absorption Systems (Crystal Lakes, Colorado)	$2.80*
WWBLCS13	Minimum Grade Effluent Sewers (Dexter, Oregon)	$2.00*
WWBLCS14	Free Access Intermittent Sand Filter (New York)	$3.40*
WWBLCS18	Septic Tank Effluent Collection and Sand Filter Treatment (New York)	$3.00*
WWBLCS21	Pollution Prevention at POTW's	$0.00
WWBKCS22	Combined Sewer Overflows and the Multimetric Evaluation of Their Biological Effects: Case Studies in Ohio and New York	$0.00
GNBKCS23*	Top 10 Watershed Lessons Learned	$0.00

Computer Searches

WWBKCM01	Constructed Wetlands, February 2001	$40.20*
WWBLCM02	Composting Toilets, February 2001	$8.60*
WWBKCM03	Failing Systems, February 2001	$24.40*
WWBKCM04	Greywater, February 2001	$13.60*
WWBKCM05	Onsite Management, February 2001	$14.00*
WWBKCM06	Mound Systems, February 2001	$16.20*
WWBKCM07	Pressure Sewers, February 2001	$12.80*
WWBKCM08	Sand Filters, February 2001	$31.80*
WWBKCM09	Septage, February 2001	$12.80*
WWBKCM10	Wastewater Characteristics, February 2001	$24.00*
WWBKCM11	Water Conservation, February 2001	$21.20*
WWPCCM12	Customized Bibliographic Database Search	Varies
WWPCCM15	Facilities Database Search	Varies
WWPCCM16	Manufacturers and Consultants Database Search	Varies
WWBKCM17	Lagoons, February 2001	$30.20*
WWBLCM18	Drip Irrigation, February 2001	$5.60*
WWBKCM19	Spray Systems, February 2001	$11.40*
WWBLCM20	Additives, February 2001	$3.40*
WWBLCM21	Low-Flush Toilets, February 2001	$4.40*
WWBLCM22	Operator Health and Safety, February 2001	$2.60*
WWBKCM23	Disinfection, February 2001	$26.40*
WWBKCM24	Site Evaluation, February 2001	$14.20*

Computer Software

WWSWDM39	Airvac Version 3.2 and User's Guide	$7.60
WWSWDM55	Station Version 3.0 and User's Guide	$7.10
WWSWDM58	User Documentation: POTW Expert Version 1.0	$33.75
WWSWDM77	Gravity Sewer Design Version 3.1M and User's Guide	$6.70
WWSWDM79	Variable Grade Effluent Sewers Version 2.2M and User's Guide	$10.15
WWSWDM91	User's Guide & Software Pregrav.xls Version 1.2E	$6.50
WWSWDM92	User's Guide & Software Pregrav.WQ1, Version 1.3	$6.20

Design

WWBLDM01	Subsurface Soil Absorption of Wastewater: Artificially Drained Systems	$5.10*
WWBLDM03	Onsite Wastewater Disposal: Distribution Networks for Subsurface Soil Absorption Systems	$13.80*
WWBLDM04	Onsite Wastewater Disposal: Evapotranspiration and Evapotranspiration/Absorption Systems	$4.80*

WWBLDM08	Management Plans and Implementation Issues: Small Alternative Wastewater Systems Workshops	$6.30*
WWBKDM09	Design Modules: Wisconsin Mound Soil Absorption System Siting, Design, and Construction Manual and Pressure Distribution Network	$15.90*
WWBLDM12	Site Evaluation for Onsite Treatment and Disposal Systems	$11.70*
WWBLDM13	Design Workbook for Small-Diameter, Variable-Grade, Gravity Sewers	$13.80*
WWBLDM14	Subsurface Soil Absorption of Wastewater: Trenches and Beds	$7.50*
WWBLDM16	Subsurface Soil Absorption System Design Work Session: New Development—Stump Creek Subdivision	$6.85
WWBLDM18	Onsite Wastewater Treatment: Septic Tanks	$4.50*
WWBKDM31	Planning Wastewater Management Facilities for Small Communities	$47.10*
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WWBKDM35	Onsite Wastewater Treatment and Disposal Systems	$123.00*
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WWBKDM47	Fine Pore Aeration Systems	$0.00
WWBKDM53	Alternative Wastewater Collection Systems	$0.00
WWBLDM65	General Design, Construction, and Operation Guidelines: Constructed Wetlands Wastewater Treatment Systems for Small Users Including Individual Residences (Second Edition)	$14.10*
WWBKDM67	Sewer System Infrastructure Analysis and Rehabilitation	$29.10
WWBKDM68	Technical Support Document for Water Quality Based Toxics Control	$0.00
WWBKDM69	Ultraviolet Disinfection Technology Assessment	$0.00
WWBKDM70	Wastewater Treatment and Disposal Systems for Small Communities	$0.00
WWBKDM71	Retrofitting POTWs for Phosphorus Removal in the Chesapeake Bay Drainage Basin	$0.00
WWBKDM72	Guidelines for Water Reuse	$0.00
WWBKDM75	Combined Sewer Overflow Control	$0.00
WWBLDM76	Mound Systems: Pressure Distribution of Wastewater Design and Construction in Ohio	$4.40*
WWBKDM78	Nitrogen Control	$96.30*
WWBKDM82	Land Application of Sewage Sludge and Domestic Septage	$92.10*
WWBKDM83	Handbook of Constructed Wetlands: Volume 1, A Guide to Creating Wetlands for General Considerations the Mid-Atlantic Region	$16.50*
WWBLDM84	Handbook of Constructed Wetlands: Volume 2, Domestic Wastewater	$9.00*
WWBLDM85	Handbook of Constructed Wetlands: Volume 3, Agricultural Wastewater	$9.60*
WWBLDM86	Handbook of Constructed Wetlands: Volume 5, Stormwater	$11.40*
WWBLDM87	Recirculating Sand/Gravel Filters for On-Site Treatment of Domestic Wastes	$6.90*
WWBLDM88	Single Pass Sand Filters for On-site Treatment of Domestic Wastes	$6.00
WWPKDM89	Producing Watertight Concrete Septic Tanks (Video); and Septic Tank Manufacturing Best Practices Manual (Booklet)	$62.60*
WWBLDM90	Onsite Sewage Treatment and Disposal Using Sand Filter Treatment Systems; Guidelines and Specifications	$11.70*
WWBLDM93	Constructed Wetlands in East Texas Design, Permitting, Construction & Operations Volume 1	$9.80*
WWBLDM94	Constructed Wetlands in East Texas Design, Permitting, Construction & Operations Volume 2	$9.80*
WWBLDM95	Constructed Wetlands in East Texas Design, Permitting, Construction & Operations Volume 3	$9.80*
WWBLDM96	Constructed Wetlands in East Texas Design, Permitting, Construction & Operations Volume 4	$11.40*
WWPKDM97	Effluent Pumps for Onsite Wastewater Education	$45.00

Fact Sheets

WWFSGN84	Constructed Wetlands/Natural Wetlands	$0.40*
WWFSGN98	Ultraviolet Disinfection: A General Overview	$0.20*
WWFSOM20	Ultraviolet Disinfection: A Technical Overview	$0.40*
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WWFSGN102	Trickling Filters Achieving Nitrification: A General Overview	$0.20*
WWFSOM24	Trickling Filters Achieving Nitrification: A Technical Overview	$0.40*
WWFSGN103	Recirculating Sand Filters: A General Overview	$0.20*
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WWFSGN119	NPDES Regulations Governing Management of Concentrated Animal Feeding Operations	$0.40*
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WWFSGN122	NPDES Regulations Governing Management of Concentrated Poultry Feeding Operations	$0.40*
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WWFSGN131	On-Site Wastewater Treatment Systems: Conventional Septic Tank/Drain Field	$1.00
WWFSGN132	On-Site Wastewater Treatment Systems: Subsurface Drip Distribution	$1.00
WWFSGN133	On-Site Wastewater Treatment Systems: Low-Pressure Dosing	$1.00
WWFSGN134	On-Site Wastewater Treatment Systems: Spray Distribution	$1.00
WWFSGN145	Landscaping Septic Systems	$0.75
WWFSGN146	On-site Wastewater Treatment Systems – Sand Filter	$1.00

WWFSGN147	On-site Wastewater Treatment Systems – Septic Tank/Soil Absorption Field	$1.00
WWFSGN148	On-site Wastewater Treatment Systems – Constructed Wetlands	$1.00
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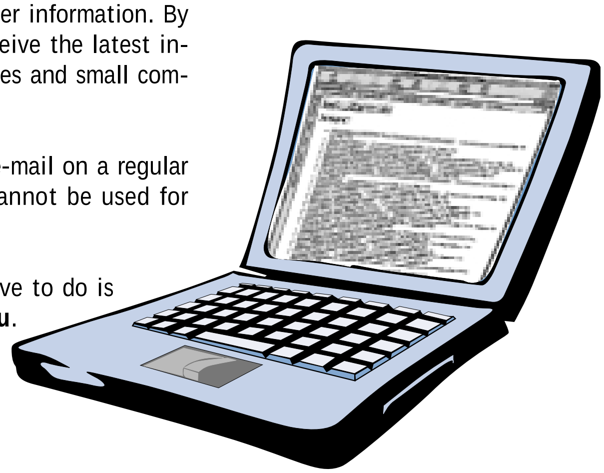
Have the Latest Wastewater Information at Your Fingertips!

In an effort to send out wastewater-related news more quickly, the National Small Flows Clearinghouse (NSFC) established a listserv to announce NSFC publications, new products, and other information. By subscribing to the NSFC News Listserv, you can receive the latest information about sewage treatment options for homes and small community developments.

New information is transmitted to subscribers via e-mail on a regular basis. This listserv is for notification only, and cannot be used for posting messages.

To subscribe to the NSFC News Listserv, all you have to do is send e-mail to **subnsfcnews@mail.nesc.wvu.edu**.
No additional text is required.



Three States Build New Onsite Centers

CONTINUED FROM PAGE 21

held in April 2001. We plan to offer Class I designer/installer training for conventional onsite systems and lift stations as well."

The center holds traditional classroom instruction at a new forestry conference center at the site under a referendum of understanding with the forestry center at West Virginia University. For hands-on instruction, students will use above-ground onsite systems installed as part of NODP Phase III on a two-acre site next to the center. Additional systems also are being constructed for the training center, including a low-pressure pipe system, constructed wetlands, sand filters, home aerobic treatment systems, peat filters, and drainfield alternatives.

Photo by Kevin Sherman

Wayne Crotty of All Pro Services in Kissimmee, Florida, answers questions about water conservation at the Florida Onsite Wastewater Training Center. The 3.5- and 1.6-gallon toilets behind him flush and empty into basins so students can compare the flows.

The center also uses the Chestnut Ridge Demonstration Project located about a mile from the above-ground facility to show trainees actual working examples of onsite systems.

"In the past, onsite wastewater training was done only in the classroom in West Virginia," said Aiton. "Onsite system training and licensing test scores have improved, and the hands-on instruction has helped wastewater professionals learn how to design and install onsite systems properly."

For more information about the West Virginia Onsite Wastewater Training Center, contact Aiton at (800) 624-8301, or e-mail **maiton@wvu.edu**. SF

What on Earth is GASB 34 and why should you care?

CONTINUED FROM PAGE 29

Financial consultants and accountants will face the task of placing values on existing assets, infrastructure under construction, and future projects. Values for assets that are currently being depreciated will be adjusted to reflect the new requirements. GASB 34 allows enough flexibility for state and local governments to adapt the new pronouncement. This latitude is obscured within the terminology of the pronouncement and raises concerns for the financial users. Some state officials are concerned about whether GASB 34's applications will be consistent within branches of state and local governments.

Communities that don't follow GAAP may pay more to issue debt in relation to their bond rating since the bonding agency will not be able to easily compare their financial health with statistical information. Public water systems that refuse to adapt or implement the new accounting procedures also may become casualties by not being able to obtain loans due to a poor bond rating, thus, making them unable to replace non-repairable or outdated infrastructure.

GASB 34 Will Provide a Better Financial Picture

The idea of taking a closer look at a water system will:

1) force systems to perform a more technical analysis and potentially force the accountant to obtain training in the technical aspects of the system relative to past material costs or to obtain guidance from a technical source (engineers, technicians, contractors, operators, etc.); and
2) assist municipalities and public water entities to evaluate their systems and determine the life of their infrastructure, thereby evaluating and generating repair and replacement revenue.

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The authors would like to thank Terry Harless, CPA, and Chris Sforza, CPA, of the West Virginia Department of Administration Financial Accounting and Reporting Section for reviewing this article. SF

Source Water Protection Case Studies Available

A variety of local government source water protection case studies are now available on the U.S. Environmental Protection Agency (EPA) Web site. The case studies are comprehensive local approaches that can serve as good models for other communities interested in designing source water protection programs. Eleven case studies can currently be accessed and additional case studies will be added as they become available. To view the case studies, go to **www.epa.gov/safewater/protect/casesty/casestudy.html**. SF

Conservation Assistance Tool Available on LGEAN

A new database of conservation assistance tools is available on the Local Government Environmental Assistance Network (LGEAN) Web site. The database enables users to search for grants, cost sharing, and technical assistance that is available for natural resources projects in the western U.S. The database is located in the "Financing" drawer of the LGEAN Toolbox at **www.lgean.org/html/toolbox.cfm**. SF

Since When Has Accounting and Financial Reporting Caused Such a Ruckus?

CONTRIBUTING WRITER
Bill Jarocki

GASB 34 has been called a "blockbuster" issue, and it certainly is in terms of how the requirements of GASB 34 will dramatically affect the overall financial reporting of state and local governments. The question we need to answer is, "How will GASB 34 affect my water and/or wastewater utility?"

The purpose of the requirements is to provide more information to those who use government financial reports and to guide and educate the public. This includes understanding the extent to which the government has invested in capital assets, such as roads, bridges, and other infrastructure assets.

Increasing Citizen Knowledge of Infrastructure Cost

Finance officers can safely argue that their annual reports seldom make the best-seller list of even anti-tax firebrands. Nevertheless, GASB 34's goal is to make government financial information more citizen-friendly. If citizen readers of financial reports can learn more about how their governments have invested taxpayer and rate-payer dollars in capital assets, such as water and wastewater systems—or, conversely, learn how their governments have not invested enough public dollars—they can use that information to make personal or collective spending decisions. Whether the new reports give good news or bad, citizens will know more about the true costs of providing safe water, or keeping water free from pollution.

This is relevant for at least two reasons. First, information about the true and full cost of infrastructure, and the corresponding financial performance, allows citizens to understand more about the quality (or lack thereof) of their environmental infrastructure compared to that of other communities.

Second, informed citizens will better understand the costs of different types of governmental services supported through capital investment. Citizen resistance to the costs of investing or reinvesting in water or wastewater capital facilities prevents some communities from complying with environmental laws and regulations. Sometimes, this is because of other local demands for limited taxpayer dollars. Questions, such as, "How do the ongoing and total costs of maintaining public school infrastructure compare to the cost of roads and bridges or the costs of providing safe water or effective wastewater treatment?" may be easier to answer with supporting financial records. Under GASB 34, the financial performance and total costs of the governmental "enterprises" may be compared to other public infrastructure-related services.

Improving Information for Financial Analysis

The GASB 34 requirements should result in improved information for internal and external analysis of a government's financial condition. In meeting the reporting guidelines of GASB 34, governmental finance professionals and their governing boards will possess improved data for determining if environmental infrastructure is adequately financed. The new reporting requirements also give governments flexibility in demonstrating financial responsibility for important public capital assets.

GASB 34 may facilitate external professional review of the government's financial condition. At the same time, it is reasonable to expect that the impact will be greater for medium to small governments than for large governments. Larger units of government, accustomed to seeking bond ratings, have traditionally prepared detailed financial information for external review. The majority of governments in the rural West are not rated and have never received bond ratings. However, after making the adjustments to implement GASB 34, small- and medium-sized governments will be able to provide more complete financial reports to analysts of state revolving funds, and other public and private financing entities.

The fact that GASB 34 may enhance external financial review of governments should be important to the U.S. Environmental Protection Agency, the states, and Congress. The Clean Water and Safe Drinking Water State Revolving Funds provide significant public subsidy to local governments seeking low-interest financing for environmental infrastructure improvements. For public lenders, as the quality of financial reporting improves, the analysis of financial condition may be facilitated so that the best use of state revolving fund resources can be determined. SF

Bill Jarocki is the director of Environmental Finance Center 10 at Boise State University.

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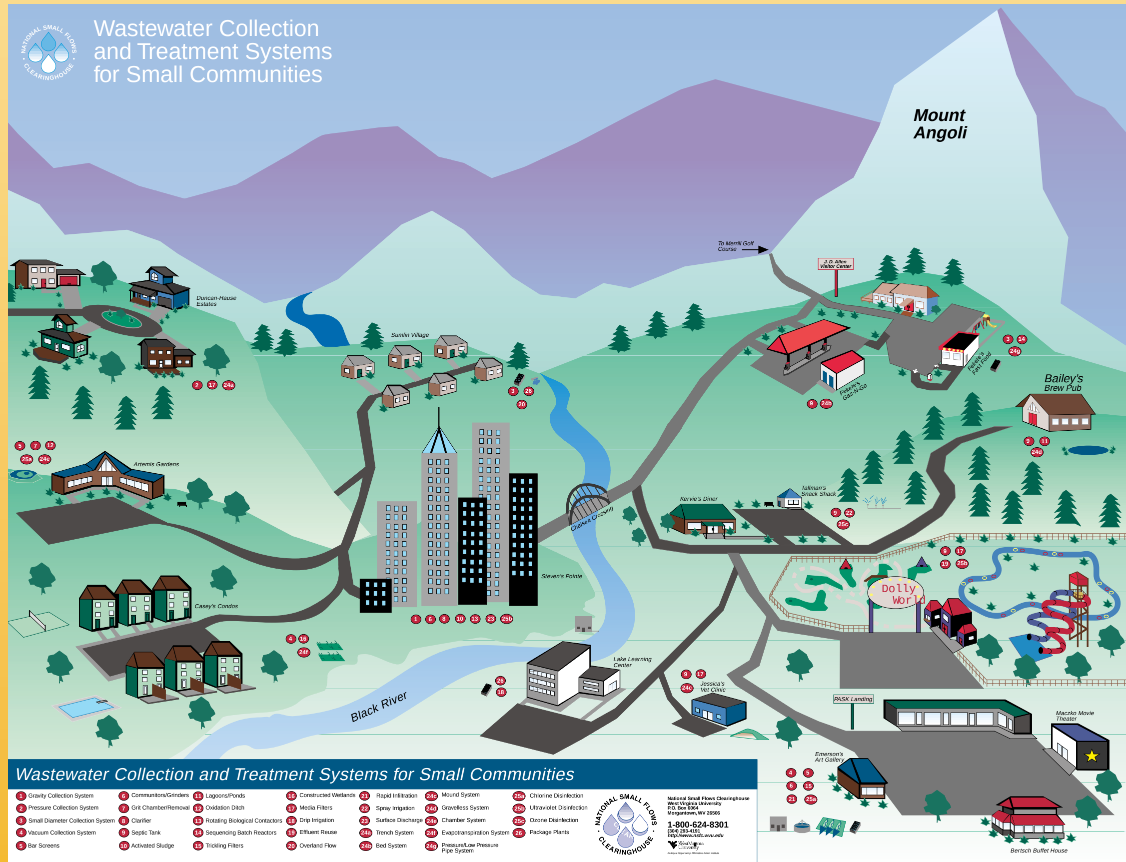
Wastewater Collection and Treatment Systems for Small Communities

The National Small Flows Clearinghouse has developed a new poster, *Wastewater Collection and Treatment Systems for Small Communities*, that focuses strictly on technologies for wastewater treatment in small communities.

Pretreatment options, constructed wetlands, rotating biological contactors, trickling filters, drip irrigation, and alternative collection systems are just some of the 25 technologies discussed.

The technologies the poster describes are applicable to subdivisions, schools, churches, restaurants, parks, shopping centers, and other small-flow situations. Small flows are systems treating fewer than one million gallons per day.

Illustrations and descriptions of each technology are included. This poster also contains a larger all-inclusive illustration depicting typical uses of alternative wastewater collection and treatment systems in a small community setting.



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