Texas On-Site Insights
Information about On-Site Wastewater Treatment Systems in Texas
Volume 2, Number 1, Spring 1993

Council Funds Four Research Projects, Newsletter

Grants for four new research projects have recently been awarded by the On-Site Wastewater Treatment Research Council.

In one study, Anthony Tarquin of the Civil Engineering Department at the University of Texas at El Paso will evaluate on-site systems that can serve a "cluster" of two or more homes. The focus will be to develop low-cost, low-maintenance systems that can be used in Rio Grande Valley"colonias" and other areas.

Objectives of the study are to design and install at least three cluster systems in the El Paso area and to develop design recommendations that can be adopted in the region. Types of systems that will be evaluated include conventional septic tanks, reedrock filters, and anaerobic filters. At least one system will utilize an intermittent sand filter that will recycle a portion of the sand filter effluent back to the septic tank to increase nitrogen removal rates. Chemical, microbiological, and pathogenic testing will be performed to assess how well the systems are functioning.

The Council also funded a project to develop a method to dewater septage (the solids that build up inside septic tanks) and blend it with wood chips to produce compost. The study will be carried out by Susan Parten and Jim Doersam of Community Environmental Services, Inc., of Austin.

In the project, water will be removed from septage using an inexpensive gravity flow system. Wood chips will be used to dewater and filter the septage. The mixture of dewatered septage and wood chips will then be composted for beneficial reuse. In addition, treated, filtered, effluent will also be generated that can be reused for on-site surface or subsurface irrigation.

The Council also funded a research and demonstration project in Henderson that will use septic tanks and constructed wetlands to treat wastewater flows from a convention center. This project will be headed by Kent Adair and Ken Awtry of the Pineywoods Resource Conservation and Development, Inc. (a private non-profit organization in Nacogdoches).

In this study, flows of raw sewage from the Henderson County Exposition Centerwillfirst be treated by a 10,500-gallon capacity septic tank. Effluent will then be pumped into and recirculated in a series of wetlands ponds. Ultimately, some of the effluents will be used

to irrigate grasses and other non-edible crops. Flows and water quality will be measured. The Council hopes the site can be used as a demonstration center to promote the use of this type of technology throughout East Texas.

A research project was also awarded to examine water use among residents of Hidalgo County "colonias" so that the amount of wastewater generated can be more accurately estimated . Anthony Covacevich, Director of the Urban County Program, will lead the study. It will involve interviewing residents in selected colonias and gathering historical data. If it can be shown that colonias residents generate less wastewater, then perhaps design standards for on-site systems can be revised.

The Council also renewed funding for the second year of production of the On-Site Insights newsletter. The newsletter will continue to be produced by RicJensen of the Texas Water Resources Institute at Texas A&M University. This year's budget allows for the printing of roughly 5,000 copies of each issue of the newsletter so that it can be sent to licensed installers and inspectors in Texas.

For details on any project, call the On-Site Wastewater Council at (512) 463-8260.

On-Site Conference will be October 10-12 in Austin

The On-Site Wastewater Treatment Council will sponsor its Second Annual Syrnposium in Austin from October 10-12. The meeting site is the Wyndham Hotel. It is anticipated that a special reduced rate will be available for people taking part in the meeting. The Wyndham's phone number is (512) 448-2222.

Keynote speakers tentatively scheduled to speak at the meeting include U.S. Representatives JJ. Pickle, Greg Laughlin, and Lamar Smith. The Council has awarded a grant to the City of Austin to organize the Conference and to publish a proceedings. At the meeting, there will be opportunities to present technical papers about on-site wastewater issues and to exhibit or display products and services. For details, call Crespin "Chris" Guzman at the City of Austin at (512) 322-2894.

Texas Onsite Wastewater Association Forms

A new Statewide organization is being formed in Texas for professionals that want to work with issues related to on-site wastewater treatment and disposal.

The organization, the Texas Onsite Wastewater Association, would be formed along the lines of the National Onsite Wastewater Recycling Association. The Association held an organizational meeting in Lubbock in March.

Goals of the group are to: 1) work to establish uniform standards for the design, installation and servicing of on-site systems,2) increase the flow of information about on-site issues throughout Texas; 3) help eliminate unsafe and improper wastewater disposal practices; and 4) protect the environment by advocating ecologically sound practices.

An initial Board of Directors has already been developed. Gig Drewery of Hydroflow TWS will serve as president, Dudley Burton of the Institute for Environmental Science at Baylor University will be the vice president, Rick Goldberg of Wastewater Systems of Texas is the treasurer, and Victor Bateman of the Jefferson County Health Department will be the elected secretary.

To learn how you can become part of the organization, contact membership committee leaders Paul Morriss of the Texas Engineering Extension Service at (713) 626-1601 or Bo Burroughs of Leaching Chamber Systems at (806) 372-8714.

Stephen F. Austin to Host Conference about Constructed Wetlands

The American Water Foundation, Stephen F. Austin State University (SFASU), and the Pineywoods Resource Conservation and Development, Inc., are co-sponsoring "The Texas Synergistic Conference on Constructed Wetlands." The meeting will take place August 12-13 at SFASU in Nacogdoches and will emphasize the use of constructed wetlands to improve water quality, including the application of these methods in on-site systems.

A detailed program is now being developed. More information about registration fees and speakers at the meeting can be obtained by calling Pineywoods RC&D at (409) 568-4600.

New Mexico State University Conducts Case Study of Failing System

A recent case study performed by researchers at New Mexico State University (NMSU) examined why an on-site system that utilized a septic tank and an evapotranspiration (ET) bed failed.

The study, *Developing Oiteria for Small On-Site Sewage Treatment Systems,* was conducted by J. Phillip King, Hazem Fahmy, Allie Blair, and Ricardo Jacquez of the Department of Civil, Agricultural, and Geological Engineering.

The research focused on a system in southern New Mexico. In 1978, a 43,560-square foot ET bed was designed to treat flows of 300 gallons per day (gpd) from up to 38 residences. It was operated in conjunction with a 10,000 gallon septic tank. By the early 1980s, numerous problems occurred. The main concerns were that the system could not treat the volume of wastewater and septic tank effluent that was being generated. This caused surface water runoff or "ponding" and saturated the ET bed with raw sewage. There were also fears that nutrient rich effluents might boost nitrate levels in nearby groundwater and that the saturated effluents were killing vegetation that should have helped to remove the nutrients.

Steps taken to remedy the system included pumping the water off the ET bed, building a berm around the site to limit runoff, and pumping the septic tank at regular intervals to reduce pending The researchers collected background information and measured such water quality parameters as fecal coliform bacteria, nitrate, nitrogen and phosphorus as well as water level data. Fecal coliform bacteria were found in the ponded effluent and

posed a health risk. Soil and water samples from a monitoring well showed high nitrate levels were present. During the winter, ponded effluents in the ET bed rose to within 2 inches of the top of the berm, threatening its stability.

The research suggests that the main problem was that the ET bed was too small to treat the amount of wastes it was receiving. If the ET bed was sized properly, it should have been 61,908 square feet or 50% larger than the one that was built. A 4,700-foot leach bed should also have been installed.

NOTE: This study was published by the New Mexico Water Resources Research Institute as Technical Report 271. Contact the Institute at (505) 646-4337 for copies.

Measuring the Impact of Septic Tanks on Lake Granbury

by Tom Conry and Dennis Qualls, Brazos River Authority, Waco, TX, and Wilson Snyder and James Edwards, Texas Water Commission, Waco TX

A pair of studies are now being conducted to gauge if septic tanks may be polluting Lake Granbury. Hood County has roughly 65,000 residents, and many of them live near the lake. Recent estimates suggest that there are as many as 9,000 septic systems near Lake Granbury.

Because so many septic tanks are being used near the lake, there are also concerns that fecal coliform bacteria may be contaminating the lake. In May, 1991, the Texas Water Commission (TWC) conducted an intensive survey of coves along Lake Granbury. Results of fecal coliform bacteria tests showed that 10% of the areas that were tested had over 200 colony forming units (CFU) per 100 milliliters (ml). The State standard is 200 CFU per 100 ml. Numerous complaints have also been filed with the Hood County Health Department and the Texas Department of Health that alleged that individuals were pumping the contents of their septic tanks directly into the lake.

A major source of concern was that many of the lots that were developed in the 1960s were too small to meet current requirements for drainfield sizing and setbacks from the lake. Some of the on-site systems that were proposed for lakefront use included evapotranspiration beds that cost X20,000 or more to install.

Because of these concerns, two programs have been initiated to determine if there is a problem and what can be done about it.

Citizens in subdivisions around Lake Granbury have formed a volunteer monitoring group as part of the TWC's "Texas Watch" Program. That program provides training and support to volunteers, who then regularly test to see if water quality has changed.

In addition, the Brazos River Authority and the TWC began a septic study in September, 1991.

BRA/TWC STUDY

Objectives of the joint study between the BRA and the TWC were to determine if nutrients were migrating from septic systems to Lake Granbury and nearby groundwaters; to identify sources of fecal contamination; and to recommend alternative solutions.

The study involved collecting surface and ground water samples from four coves (see table). As many as eight monitoring wells adjacent to selected, representative septic disposal fields were selected. The wells were five feet from the field and five feet deep. Monthly samples were taken for such parameters as chemical oxygen demand (COD), nitrates, ammonia, sulfates, and fecal coliform. Dye tests were carried out to identify if any untreated wastewater was building up on the surface or running the lake.

SITES SELECTED FOR STUDY

Site	Soil	When Installed	Lot Size
Holiday Estates	Clay	1977	50' x 100'
Scenic View	Thin soils, fractured rocks	Before 1977	120' x 120'
Laguna Vista	Clay and sand	1988	200' x 160'
Oak Trail	Clay, loam, and sand	1977	65' x 125'

Only four sites were selected for the study because of testing costs, and because few homeowners were willing to allow a well to be placed on their property. The four sites are representative of the subdivisions near Lake Granbury. Soil types are different at each site. The age of the septic system, and the guidelines used for the installation of the systems are as diverse as possible. The lot sizes reflect not only the septic system guidelines for installation, but also socioeconomic diversities. One site is owned by a retired couple, two by families with children, and one by a couple without children. The sites will reflect varying water use by the above groups.

Three of the sites (all but Laguna Vista) front the lakes and are located on coves where runoff could cause an immediate problem . Laguna Vista is 500 feet from the lake . However, only the Laguna Vista site was constructed to comply with the most recent State design standards.

Preliminary results suggests that soil types and the underlying geology are the most critical factors in determining whether or not pollution is take place (even more so than lot sizes). High levels of nutrients and coliform bacteria are being recorded in many coves (areas set back as far as 300' from the lake). That's because water in these areas isn't exposed to wind action and currents and has little opportunity to mix with water from the main stem of the lake. Higher levels of nutrients are being recorded in groundwater samples near the on-site systems.

Additional tests are now being conducted and the samples are being analyzed.

VOLUNTEER MONITORING

A volunteer team was assembled in the summer of 1992 and monitoring began in August. Samples were taken every two weeks . Study results gathered from September 1991 through 1992 show that fecal coliform levels were greater than 200 CFU per 100 milliliter (ml) at one lakefront site, Comanche Cove, and greater than 150 CFU per 100 ml at a cove, Indian Harbor.

Texas Watch leaders say there have been numerous benefits because of the group's efforts. For example, the volunteers provided additional data to collect additional fecal coliform bacteria samples (the team has been taken more samples than State agencies were able to take during the past 20 years) . Also, the information collected by the team has provided insights into where septic tanks may be malfunctioning and what problems they may be causing.

Texas Watch is still helping to organize volunteer monitoring groups throughout the State. If you would like to form such a group to monitor for septic tank runoff or any other water quality problem, call them at 512-239-4720.

On-Site System Uses Recycling, Reed-Rock Filters, to Reduce Costs, Loadings

By Dan Schellenberg
Kennard, TX

We are now testing the use of an integrated on-site wastewater treatment and disposal system at our home that emphasizes conservation and recycling.

The system is designed to treat roughly 40 gallons of effluent per day from the master bathroom. We conserve water by using the bath water to flush the toilet. This recycles water and reduces each flush from 3.5 to 1.5 gallons.

The water flows from the bath, bypasses a failed septic tank, and enters a 20 cubic-foot facultative chamber where solids liquify or turn to gases (carbon dioxide and methane) in the lower, open compartment. The gas and liquid effluent rise up through a second story pea gravel bed and root zone, where plants take up nutrients and water. The effluent flows through a 6' long and 2' wide gravel bed to an outlet pipe and two 25' long leach lines.

The leach lines are plastic-covered trenches that are 18" deep and 1' wide and are filled with pea gravel. Plants such as canna lilies, elephant ear, and marsh grasses are planted at 1' intervals. The system is designed so there is 1 square foot of surface area to filter each gallon of effluent that will be treated to secondary quality of less than 30 milligrams (ml) per liter of biochemical oxygen demand (BOD).

To reduce BOD levels further, another leach line that is 25' long and 1' deep is being added. Water in the line will only be 6" deep so that 1.5 mg/L of oxygen can infiltrate the

gravel and root zone. Final discharges will be used to irrigate fruit trees, corn and cherry tomatoes. NASA research suggests that certain foods grown in this type of system aid filtration and are safe for human consumption.

If we were to build a rock-reed filter system for our family of four, we would need to manage about 400 gallons of waste per day. If low-flush toilets and shower heads were utilized, the amount of waste generated would drop to roughly 250 gallons per day. This would in turn reduce the size of the filter media we would need to about 300 square feet.

Typical costs are estimated to run from $2,000 to X3,000 for a full scale system. Our little test unit, including a winter greenhouse, cost only X300 because we provided all the materials and labor ourselves.

NOTE: Dan Schellenberg is a consultant on sustainable systems and is the editor of a newsletter he produces called The Propagelle Report. The newsletter features information on on-site wastewater treatment, water conservation and recycling. He can be reached at (409) 638-4391.

Study Examines Impact of Septic Systems on Galveston Bay

A new report sheds some interesting perspectives on how septic tank runoff may be affecting Galveston Bay. The study, "Characterization of Selected Public Health Issues in Galveston Bay," was produced by Paul Jensen and Yu-Chun Su of the engineering firm of Espey Huston and Associates . The report was prepared for the Galveston Bay National Estuary Program . A large section of the report deals with estimating the volume of partially treated wastewater from failing septic systems.

In preparing the report,Jensen worked with data from the Harris County Sanitarian's Office. That information shows that there have been 13,000 permits issued for septic tanks in the County since 1978. However, adding in the tanks that were installed before 1978 without permits increases that projected total to more than 100,000.

The Harris County Sanitation Offlce now receives 30 to 45 complaints per month regarding malfunctioning septic tanks and most of those involve an actual violation. Many of the problems concern shrink-swell clay soils, small lot sizes, and heavy amounts of rainfall. Site inspections in unincorporated parts of Harris Countyrevealed more than 1,900 cases where septic tanks might be leaking. In Galveston County, the County Health District estimates that there are roughly 4,500 septic tanks in its area. They received 70 complaints during the past year and a half. In the study, Jensen identified 5,275 septic systems that were close to Galveston Bay, and 2,893 systems that were adjacent to West Galveston Bay. He then estimated that 0.1% of those systems might be failing every month.

What do the findings show? The article suggests that fecal contamination from malfunctioning septic tanks will probably be detectable only in nearby areas, and that the worst problems will occur in wet weather. However, this needs to be studied in more

detailed field surveys so that actual data, and not just projections, can be utilized. For details, call Jensen at (512) 329-9584.

An Evaluation of Community Soil Absorption Systems

by Joseph Marina
Civil Engineenng Department
University of Texas at Austin

OVERVIEW

A community soil absorption system (SAS) serves more than one residence and may be used to treat and dispose of household effluents. Wastewater is usually pretreated by septic tanks before it is discharged. Effluents may also be treated to advanced levels before they are discharged to such systems.

In areas where soil conditions and groundwater tables are favorable for wastewater disposal and land costs are low, a community SAS is usually the most cost-effective wastewater disposal and treatment option. This is especially true where flows are less than 35,000 gallons per day (GPD).

Applying the effluent in doses is necessary to assure that wastewaters will be evenly applied over the entire surface and to make sure that proper infiltration will occur.

Absorption beds and trenches are commonly used in conjunction with SAS systems.

Trenches are shallow and are typically 18 to 36 inches deep and one to three feet wide. The bottom is filled with six inches or more of washed gravel or crushed rock. Perforated plastic pipe is laid on top of this bottom surface and is covered with another rock layer. A semi-permeable barrier is placed at the top of the stone to prevent backfilled materials from migrating into the stone trench. Both the bottom and sidewalls of the trenches serve as infiltrative surfaces.

Absorption beds are different from trenches because they are more than three feet wide, may contain more than one distribution pipe, and are recommended only in sandy, permeable soils. The bottom area of the bed provides for rapid infiltration.

Soil absorption systems can be modified in a number of "alternative" designs. Typical examples are shown in Table 1.

STATUS OF THE TECHNOLOGY

The U.S. Environmental Protection Agency (EPA) has funded 50 soil absorption systems that work in combination with septic tanks. However, additional work is needed to design more workable systems for multiple residence use.

Table 1:

Types of Soil Absorption Systems

Design Element	Variations
Bedding	With or without gravel
Piping	Drain tile, clay pipe, or perforated pvc pipe
Configuration	Beds or trenches
Dosing	Gravity (trickle) or pressure dosing
Depth	Above-ground mounds or deep trenches
Distribution	Gravity distribution or pressurized

LIMITATIONS

Soil absorption systems are limited by soil types and permeability, bedrock conditions, groundwater levels, and the topography of the site.

These systems may be used in sites with percolation rates of 5 to 60 minutes per inch. A depth of four feet should be maintained between the trench or adsorption bed and seasonally high groundwater tables. Some regulations require that components of SAS systems be set back from water wells, surface waters, and property lines. These rules can limit the use of these systems on some sites.

Some SAS systems experience minor operating problems which may result in surface water run off and pending, odors, and (in severe cases) health hazards. Water conserving practices should be implemented if minor problems occurbecause they will lessen the amount of effluents that are generated.

DESIGN CRITERIA

Design of SAS systems should include an analysis of local groundwater conditions and the possibility of contamination of shallow groundwater supplies by nitrate-nitrogen and coliform bacteria. System designs should insure that effluents will not infiltrate into groundwater supplies. Generally, groundwater should be at least four feet below the surface.

Systems should be designed to permit resting cycles. For example, additional soil absorption areas should be provided for use when needed. Depending on soil conditions, effluent application rates in the trenches shouldrangefrom 0.1 to 0.2 gallons perdaypersquare foot. Design flows are normally based on local and state regulations, but actual flow measurements should be used if possible to determine if excessive infiltration is possible.

The volume of effluents drained from distribution pipes should be less than 10% of the amount applied. The pressure maintained at the far ends of the distribution lines should be one to two pounds per square inch.

RELIABILITY

None of the 50 systems funded by EPA has yet reported serious problems. With proper site evaluation, a properly designed, constructed and operated system is very reliable.

The most serious operational problem encountered with SAS systems has been the carryover of solids to the drain fields. This is usually due to the lack of proper treatment in the septic tank. One solution maybe to use a large septic tank to serve a clusterofhomes. These large tanks are typically divided into multiple compartments and provide a one-day detention time.

Note: This article is one of a series of fact sheets that was included in a report, Technical Summary: Small Community Wastewater Treatment Systems, prepared by Malina and Michael Barrett for the Texas Water Development Board. It can be obtained by calling the engineering division at (512) 463-7853. Malina can be reached at UT at (512) 471-4614.