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Newsletter welcomes your comments and suggestions

This is the first issue of *On- Site Insights,* a newsletter to inform State and local officials about solutions, problems and issues concerning on- site wastewater treatment.

The newsletter is being produced for the On- Site Wastewater Council by a grant awarded to the Texas Water Resources Institute, which conducts research and technology transfer programs at Texas A&M University in College Station. It will provide information on septic tanks, community systems serving flows of less than 5,000 gallons per day, the impact of conservation, and associated issues.

We value your input and contributions. In particular, we want to hear from you abot specific problems and issues in your area including promising new technologies, projects that you feel might be applicable in solving "real world problems, the impact of conservation, and other topics. We would also like to hear from you if you have comments about the newsletter or ways to improve it.

Please send your comnents or suggestions for story ideas to: Ric Jensen, Editor, *On-Site Insights*, TWRI, Texas A&M University, College Station, TX, 77843. Phone: 409-845-8571. FAX: 409-845-3932.

On-site symposium will be August 9-10-11 in Austin

The Council will sponsor a conference on "Innovative methods of onsite wastewater treatment that are applicable to Texas" in Austin on August 9-10-11.

The meeting, which will be headquartered at the Austin Marriott, will include an optional field tour, presentations on Texas- specific issues associated with on-site wastewater treatment, and a display area with booths where products and services can be exhibited.

If you need more information on attending, presenting a paper, or exhibiting a display, contact: Maureen McReynolds, Center for Environmental Research, City of Austin, Box 1088, Austin, TX 78767 or call 512-322-2777.

Rule change lets counties, colleges take part in Council programs

Thanks to a recent rule change, the On-Site Wastewater Research Council can now accept research, demonstration, and technology transfer proposals from local governmental entities and private consultants as well as from university scientists.

The bill was part of an Omnibus Bill (Senate Bill 2) and was sponsored by Senator Bill Sims of San Angelo and Representative Ron Lewis of Beaumont. It was signed into law by Governor Ann Richards in August 1991.

The bill should provide some obvious benefits, according to Council Chairman Leo Wood of the City of Austin.

"We think it will encourage local governments to work with the Council to develop solutions to local problems," he said. "For example, local government agencies that work with on-site systems on a regular basis know what the problems are in their area. We think we can use their expertise and experience to build research and demonstration projects that can be applied to solve problems that local governments are now facing."

The first project to receive funding under the terms of the new bill is a wetlands evaluation in Kerr County (more details are in this newsletter).

Although the bill will widen the potential pool of applicants for Council funding, researchers at Texas universities are still encouraged to approach the Council with proposals for projects that are applicable to solving real-world problems, Wood said. Research projects have been granted to scientists at the University of Texas at Austin and the University of Texas at El Paso. A technology transfer project has been granted to Texas A&M University.

Applications forms for research projects are available from Ted Johns, Texas Water Commission, Box 13087, Capitol Station, Austin, TX 78756 or by calling 512-834-6663.

Effectiveness of alternative systems being monitored in Kerr County

Monitoring the effectiveness of aquatic vegetation and reed rock filters in treating septic tank effluent is the aim of a Council- sponsored research and demonstration project in Kerr County.

The study is being led by David Litke of the Kerr County Environmental Health District and R. Charles Widenfeld of the Upper Guadalupe River Authority.

Many soils and rocks in the Edwards Aquifer region (and nearly 90% of Kerr County) are not suitable to provide final effluent treatment from a traditional dual compartment septic tank. As a result, the County developed rules and design criteria allowing "alternative technology" systems including "natural" systems that utilize aquatic vegetation. (An article from the EPA that includes information on one such system is also included in this issue). There are at least six systems in the County now. However, little evaluation has been done on how these systems perform.

This research is intended to provide data on the performance and treatment capabilities of these systems using various combinations of plants and seasonal cycles. A particular focus will be the feasibility of these systems for individual residences.

In the study, water quality will be monitored as it enters and leaves the system. Specific water quality parameters that will be studied include biochemical oxygen demand (BOD), total suspended solids (TSS), ammonia-nitrogen, nitrate, total phosphates, fecal coliform, dissolved oxygen and pH. Water use will also be recorded. Homeowners will be surveyed about their concerns, experiences and attitudes about the new technology.

The project will also serve as a demonstration site to show how groundwater pollution can be lessened by pretreating wastewaters before they are disposed in soils, and how vegetation can improve effluent quality. Costs of these "alternative systems" will be compared to traditional systems.

One of the main benefits of the project is that these "natural systems" could provide better wastewater treatment and less pollution potential in regions like this one. Through education and demonstration projects like this, more people in the area may want to adopt this new technology.

UT-El Paso researcher studies low cost systems

Developing on-site wastewater treatment systems that provide effective treatment with minimal operating costs and maintenance is the goal of a Council-funded project by Anthony Tarquin of the Civil Engineering Department at the University of Texas at El Paso.

Tarquin is testing a variety of technologies including anaerobic filters, intermittent sand filters, modified overland flow systems, and reed-rock filters.

Summaries of some of the projects are shown below.

MODIFICATIONS TO AN EXISTING "INNOVATIVE" SYSTEM

An existing "innovative" system that was installed in the Colonias near El Paso had failed and was not functioning properly. Consequently, the system was modified.

An existing septic tank was maintained and cleaned. Two "bio-oxidation" tanks were filled with 11/2 feet of gravel and converted into anaerobic filters. Another tank was converted to a pumping chamber to deliver the effluent from the second tank to two intermittent sand filters. These sand filters consisted of 1,000 gallon above-ground concrete tanks that were partially filled with washed sand. One-inch PVC pipes were placed 1/2 feet above the sand filters, so that effluent from the anaerobic filters could be sprayed onto them for treatment. Effluent from the sand filters was disposed of by using existing drainfield pipes. To reduce clogging, the sand filters have been designed so that one filter can be rested periodically while the other filter is functioning.

Water quality samples were collected weekly from each stage of the treatment system. Data were gathered and analyzed for biochemical oxygen demand (BOD), chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN), nitrate- nitrogen (NO_3), turbidity, coliform bacteria, and total suspended solids (TSS).

Results show that more than 90% of the BOD and COD levels were consistently removed. Effluents have routinely consisted of less than 5 mg/l BOD. Virtually all of the organic and ammonia nitrogen was removed, with all of the reduction occurring through the sand filters. However, roughly 57% of the nitrogen originally present in the effluent remained in the final effluent in the form of NO3. Coliform removal has been outstanding and no coliform bacteria have been observed recently. Effluent from the sand filter will be used to irrigate trees and shrubs at one site.

PILOT OVERLAND FLOW TREATMENT SYSTEM

An aerobic pilot plant was established at El Paso's Northwest wastewater treatment plant. The system consists of three 160-feet channels on a 1° slope Each channel measures 3" by 3" and is filled with 3/4" or 3/8" gravel. Settled wastewater was pumped through the channels at three different loading rates. Samples were taken at 40-foot intervals and were analyzed for water quality.

The system was very effective at lowering levels of COD and BOD. For example, even at the highest

loading rates, COD rates were lowered by nearly 80%. BOD removal rates ranged from 78 to 87%. TKN removal ranged from 78 to 91%, although NO_3 levels increased as the effluent flowed through the system. It appears that NO_3 was either present in other forms such as nitrite or that it was lost from the system due to

evaporation and other processes. Fecal coliform removal was minimal. However, the system could function well for treating septic tank effluent if it was followed by an intermittent sand filter.

ROCK FILTER

A septic tank rock filter system was constructed in Canutillo. In the system, septic tank effluents are pumped through a rock filter that has canna lilies growing on the top of it. The effluent is used to irrigate trees and shrubs.

Three sets of samples have been collected and analyzed. Although the septic tank effluent is relatively weak, the rock filter is performing well. COD and BOD removal is more than 80% while TKN levels were cut in half.

MODIFICATIONS TO AN EVAPOTRANSPIRATION SYSTEM

An evapotranspiration (ET) system was installed at a 3-bedroom mobile home in Socorro. A system with a 1,000-gallon septic tank was originally installed but often failed because it was improperly designed and maintained. Modifications included adding a 1,000-gallon tank that was filled with 1 1/2 feet of gravel and will serve as an anaerobic filter. Effluents will flow into a wet well and will be pumped onto a slightly elevated intermittent sand filter that will be built at the site of an existing ET pit. Half the pit will

be filled with a concrete and sand filter. Existing drainage pipes will be connected to a wet well. Effluent will be used for irrigation.

UT researchers study on-site systems that may work in caliche soils

It's often difficult to get on-site wastewater and septic tank systems to function properly in areas with thin soils that cover layers of limestone and caliche. This is especially true in the Texas Hill Country.

To develop potential solutions, the Council funded a study by Howard Liljestrand j and Susan Parten of the University of Texas Civil Engineering Department.

The objectives of the project are to: 1) determine the capabilities of caliche soils to treat wastes on-site; 2) identify improvements that could be made to existing systems; 3) and evaluate the cost effectiveness of those improvements.

The study consists of three phases.

First, various grades of caliche were used to develop columns that simulate geologic conditions in the Hill Country. Those columns are being evaluated in laboratory tests to assess their ability to filter septic tank effluents. Early results suggest that the filters achieve excellent nitrification and chemical oxygen demand (COD) removal within the top few inches. Soils with a high calcium carbonate content buffer pollutants and help maintain a high pH over time.

The second phase of the study involves building and testing a field model to evaluate treatment processes. Because caliche soils often have a low organic carbon content, they often cannot achieve nitrification and denitrification as well as conventional on-site systems in other soil types. One solution may be to add a source of carbon that doesn't require nitrification. Greywater (water used for bathing, washing dishes and clothes) may provide that carbon source.

Field tests will soon be under way at Austin's Hornsby Bend Wastewater Treatment Plant. The field tests involve treating septic tank effluents in an aerobic filter with a very high calcium carbonate content. Greywater will be added and mixed to the treated effluent to boost denitrification. A low pressure dosing line would then distribute the effluents to a caliche soil testing plot covered with vegetation.

The third phase of the study involves monitoring such a system that has been installed at a residence.

UT literature search brings together a wide range of news on on-site systems

Gathering the latest information about on-site wastewater systems and distributing it to decision makers and the general public should be made considerably easier as a result of

a Council-funded literature search by Susan Parten of the Civil Engineering Department at the University of Texas at Austin.

The project involves searching and compiling bibliographic information on small community and on-site wastewater treatment and related issues. Those references have been entered into a database that will be made available in both paper and computer diskette formats.

The literature search should be very beneficial. If a local health district, consultant, or university scientist wanted information on a particular technology (mound systems, for example) they could uncover reports on the subject that had been published. When the Council decides how best to allocate funds for research and demonstration projects, they could use the results of the literature search to see if similar studies had already been performed in other regions.

The literature search is expected to be completed soon. Details about its availability will be publicized in a future issue of *On-Site Insights.*

EPA report gives overview of reed-rock filters

A conference proceedings that summarizes the use of microbial rock-plant filters to treat septic tank wastes has been produced by the Environmental Protection Agency.

The proceedings, *Municipal Wastewater Treatment Technology Forum,* summarizes a conference in Portland Oregon in 1991. An article in the proceedings by Ancil Jones of the EPA Region 6 office in Dallas titled "Update on the Microbial Rock Plant (MRP) Filter" was included. That article describes how MRP filters may be useful where septic tank tile drain fields fail to function because of poor soil conditions. In those cases, the filters can replace the drain fields and aerobically produce highly treated wastewaters that usually meet secondary treatment criteria.

Other articles in the Proceedings describe sand and gravel filters that may be useful in treating small wastewater flows.

The Proceedings is available from: Ancil Jones, EPA Region 6, 1445 Ross Ave., Dallas, TX 75202 or by calling 214-655-7130.

ASAE proceedings covers on-site systems

Many papers dealing with septic tanks and other onsite wastewater systems are summarized in a new proceedings from the American Society of Agricultural Engineers (ASAE).

The 375-page report is titled *On-Site Wastewater Treatment: Proceedings of the Sixth National Symposium (2991) on Individual and Small Community Sewage Systems.* It deals with management and design, the fate of contaminants, treatment unit performance, site evaluation and loading rates for soil-based systems, clogging dynamics of soil-based systems, community and statewide education, and alternative system design.

Bobby Carlile, a consultant in College Station and a Council member, co-authored three papers in the proceedings dealing with working with county governments to manage such systems, slow rate spray irrigation treatment for individual homes, and pilot scale alternative system demonstration projects. The paper on managing on-site systems is included in this newsletter.

More details on ordering the proceedings is available from: American Society of Agricultural Engineers, St. Joseph, MI 49085 or by calling 616-429-0300.

Kerr County's on-site wastewater management program

By Bobby Carlile
Carlile and Associates
College Station, TX

In 1988, I helped Kerr County, Texas, establish an on-site wastewater management program. Materials developed for the County included soil evaluations, wastewater system designs, a database of water quality that could be used for system operations, and management and operation strategies based on monitoring results. Reports that were produced included a County-specific soil resource handbook; a system design manual with information on modified and alternative residential wastewater systems; and a management and planning guide.

Strategies proposed for the County included: a) water quality limits imposed on on-site systems for nearby surface and ground waters; b) methods for soil and site evaluations; c) minimum lot sizes based on different soils; d) operation and monitoring requirements for each type of system; and e) an inspection and fee system to fund the program.

SOIL AND WATER QUALITY CONSIDERATIONS

Studies indicated that over 95% of the County would be unsuitable for conventional septic tank and soil absorption systems. The soils of the County were classified into five soil resource groups. Each group was identified as a series of individual soils and grouped by soils with similar physical and hydraulic properties; soils with similar site restrictions and soils with similar system design requirements.

Three of the five soil groups, (89% of the County) were typically shallow to very shallow soils over limestone and caliche. A fourth group (6.5% of the County) was made up of soils with shrink-swell clays and seasonal high water tables. Only 4 % of the County was suitable for conventional septic tanks.

It was proposed that on-site systems be designed to meet specific water quality criteria for key pollutants. Systems should treat wastewater to the following limits after passing through or over less than 10 feet of soil material: BOD (10 mg/l), TSS (15 mg/l), NH_4-N (2 mg/ l), TP (1 mg/l), and fecal coliform (200/100 ml). Systems installed within 1,000 feet of the Guadalupe River were subject to more stringent limits for fecal coliforms.

County inspectors were trained in evaluating and determining soil groups on-site using the Soils *Resource Handbook.* The book suggests appropriate systems for individual sites. Wastewater systems were described in the *System Design Manual* . This book described modified, conventional, and alternative systems for use on shallow soils including pretreatment with spray irrigation, subsurface trickle irrigation, reed-rock filters and evapotranspiration systems.

DEMONSTRATION AND MONITORING

Once the design for a system was determined, a demonstration and monitoring program was proposed. This ensured that systems installed under the program would meet treatment levels. Systems selected for demonstration and monitoring were those that were simplest to design, least expensive to install and operate, and still effective for water treatment.

UPGRADING EXISTING SYSTEMS

There are now about 10,000 septic systems in Kerr County, discharging 2.5 million gallons per day of wastewater. Many of these are not meeting the goals of the proposed on-site wastewater program.

Upgrading existing systems is not simple or easy since there will not be an economical on-site solution in many cases. A 5-year program to monitor and upgrade existing systems was proposed.

It recommended that 1) all existing systems to be permitted for a 5-year period and inspected for adequate installation and operation; 2) existing systems not meeting the goals of the program be required to implement a home water conservation program; 3) systems not functioning will be repaired with funds coming from fees, and 4) high density systems not meeting the water quality criteria must determine cost effective offsite alternatives for disposal.

PROGRESS ON PROGRAM IMPLEMENTATION

The technical aspects of the program were adopted by the County Commissioner's Court after workshops, hearings and field trips were held to review the problems and solutions. The County hired and trained personnel and acquired equipment and a laboratory for monitoring.

The soil resource groupings and technical design manual are now being used in the County program. During the first 2 years of the county operated program, the following systems have been installed.

Modified Conventional systems using dosed, alternating trenches and beds in clay soils, and shallow trench designs in shallow soils.

Low Pressure Dosing systems including the use of fill material on shallow soils, filters on the septic tank discharge, alternating fields, and pretreatment.

Aerobic pretreatment and disinfection including ozone disinfection, spray and trickle irrigation, pressure dosing, and trench systems.

Reed-rock filters including landscaping and plant selection, and shallow trench and bed disposal.

Soil replacement and the importation of suitable soils.

Holding tanks and pumping and hauling sewage to proper disposal sites.

All systems are installed under the permit requirements of the County Health Department with no outside review. As a result of the new program, innovative designers and installers have joined forces and educated themselves to a changing technology.

Monitoring of systems installed under the new program has been initiated on a limited basis. A grant from the Council may help to increase the monitoring staff.

Limited sampling on aerobic units and reed-rock filters indicate that the aerobic units, when used for pretreatment, produce a better quality of effluent than do the reed-rock filters. In the winter, reed-rock filters provide little treatment.

NOTE

The complete paper, "Assisting Counties in Managing Their On-Site Wastewater Program," is included in the *Proceedings of the 6th Symposium on OnSite Wastewater Treatment* (1991) published by the American Society of Agricultural Engineers.