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Council Funds A&M-Kingsville Research to Examine Performance of Drip Irrigation Systems in "Shrink-Swell" Clay Soils

A research project now underway at Texas A&M University-Kingsville may provide critical insights into the performance, and failure, of subsurface drip irrigation systems utilized in on-site wastewater treatment and distribution systems along the Texas Gulf Coast.

The Texas On-Site Wastewater Treatment Research Council is funding the research. The study is led by A&M-Kingsville researchers Andrew Ernest of the Environmental Engineering Department and Duane Gardiner of the Agronomy and Resources Sciences Department. A&M-Kingsville graduate students Alondra Barnes and Krishna Pavanandan are also participating.

According to Ernest, the goal of this project is to collect and analyze performance data from subsurface drip irrigation systems used for on-site wastewater treatment and disposal. The researchers have identified 20 individual systems sited throughout the Texas Gulf Coast, including systems which treat waste from individual and multiple-family homes, convenience stores, and restaurants. "From conversations we have had with many local regulators, it appears that some of these systems may be failing," Ernest says. "A potential problems seems to be that, in some cases, systems may have been installed at sites that were not appropriate for drip irrigation systems. There is a need to better manage these systems. We are also trying to identify sites in which it is most likely that drip irrigation systems may successfully treat wastewater."

Currently, the researchers are gathering data about the quality of effluent while within treatment units, before it enters the drip irrigation system, and following treatment. The goal of this phase of the project is to gather roughly three samples from as many of these systems as possible. Samples will be taken in triplicate for quality assurance purposes. Water quality parameters which are being monitored include chemical oxygen demand (COD), biochemical oxygen demand (BOD), total suspended solids, and salinity. In addition, a suite of soils information is being collected on-site for such values as soil moisture, cation exchange capacity, soil texture, and the shrink-swell capacity of expansive clay soils. The researchers will analyze this data by statistical and deterministic methods.

As a result of this research, it is hoped that new insights can be gained into how the types of wastewater being generated, as well the nature of clay soils, influence the performance of subsurface drip irrigation systems. Other information that will be generated by this project includes how drip irrigation systems may be modified to perform better and whether it is cost effective to improve or rehabilitate these systems. It is hoped that the project may lay the groundwork to develop improved design parameters for these systems.

"It is essential to know the precise properties of clay soils at specific sites in order to predict how well drip irrigation systems may function," Ernest says. "There may be some marginal shrink-swells which may allow drip systems to work well and we need to identify where these soils exist." The project will conclude at the end of August 1999. For details, contact Ernest at a-ernest@tamuk.edu or (361) 593-3041 or Gardiner at (361) 593-3691 or duane.gardiner@tamuk.edu.

Council Awards Contract to TAEX to Review Literature Regarding Shallow Groundwater Tables

Synthesizing current information about the presence of shallow groundwater tables and how they may affect the operations of on-site wastewater treatment systems is the aim of a literature search now being carried out by the Texas Agricultural Extension Service (TAEX). This project is led by John Jacob , who is with TAEX and the Texas Sea Grant Program. He is located at the Armand Bayou Nature Center in Clear Lake. The project is funded by a contract from the Texas On-Site Wastewater Treatment Research Council. This effort will be concluded by August 31, 1999.

According to Jacob, information about shallow groundwater tables in Texas is currently difficult to access and interpret, even though shallow groundwater tables are often encountered by on-site wastewater professionals and regulators. As a result, Jacob says it is important to develop technically sound information about this topic which can easily be applied by individuals making site evaluations, local and regional regulators, and professionals in the on-site industry in Texas.

"The goal of this project is to identify knowledge gaps in the literature," Jacob says. "I hope to, in a broad way, provide some guidance into areas where research may potentially be needed to allow us to better understand shallow groundwater systems in Texas." Equally important, Jacob says, is the need to develop easily understood, "user friendly" information which will have a practical benefit to those working with on-site wastewater issues in Texas.

In this effort, Jacob will focus on gathering information on many topics, including physical indicators of soil water tables and soil redoximorphic features (which indicate periods of saturation and reduction). He will also review information dealing with how hydrologic features affect the presence of shallow groundwater systems as well as the use of computer simulation models to simulate when and where seasonally high groundwater tables may exist. Jacob also wants to look into a variety of information regarding the

topic of soil saturation, including its definition, methods to accurately measure this phenomenon in the field, and how saturation may affect pathogen survival.

The end product of this project will be a report which summarizes the literature review and makes recommendations for future research about soil water tables. For details, contact Jacob at (281) 291-9252 or jjacob@tamu.edu.

New Brochure Describes Council History, Mission, Programs, Funding Opportunities

A new, attractive brochure has been developed which describes the mission, goals, and programs of the Texas On-Site Wastewater Treatment Research Council program in an easy-to-read manner.

The brochure, titled "Improving On-Site Wastewater Treatment and Reducing Costs by Enhancing Technology Transfer and Facilitating Research," was published in September 1998. Brief summaries are presented about the history of the Council as well as its authorizing legislation and statutory authority, how Council members are appointed, and Council meetings.

In addition, the brochure describes how the Council is funded, the types of grants and contracts the Council can award, the Council's work in supporting training centers, annual conferences sponsored by the Council, and TWRI's work to produce this newsletter and the Council's World Wide Web site.

The brochure is an excellent way to present information to people who may not be aware of the Council and its programs, but desire a brief overview of Council activities. It may be especially useful for state and local environmental agencies which deal with on-site wastewater issues, so that they can better explain the Council's operations to professionals and the public.

To obtain a copy of the brochure or for more information, contact Warren Samuelson of the Texas Natural Resource Conservation Commission at (512) 239-4799 or wsamuels@tnrcc.state.tx.us.

Literature Search at Prairie View A&M Examines How Long-Term Disposal of Effluents May Affect Groundwater

A literature search is now being conducted by a Prairie View A&M University researcher to assimilate information about how the long-term disposal of effluents at sites where on-site wastewater treatment systems are being used may affect the environment.

The study is being undertaken by researcher Raghava Kommalapati and graduate student Ahmed Noman of the Prairie View Civil Engineering Department. The project is funded by the Texas On-Site Wastewater Treatment Research Council.

The overall goal of this project is to review literature about the broad topic of hydraulic and organic loadings from on-site systems. In this project, Kommalapati hopes to gather information about how the use of different on-site wastewater systems may impact long-term nutrient loads. He is also trying to compile published literature about how long-term disposal of effluents may present water quality problems throughout a variety of soils. Part of the project involves gathering data about the depth to groundwater at Texas sites where effluents have been applied, as well as information about the composition of wastewater at these locations. Other issues which will be examined include whether pretreatment before disposal is needed to protect public health and the environment, rates at which effluents have been applied over time, and the amount of land required to properly dispose of effluents without causing environmental damage.

In addition to identifying areas where additional research may be needed, Kommalapati suggests the project will also have practical applications. For example, a key goal of this project is to compare the information about long-term infiltration rates against the Texas on-site wastewater regulations to determine if the rules are scientifically valid or if modifications should be considered.

"I am enthused about this project," Kommalapati says, "because it is obvious that on-site wastewater systems are being used extensively throughout rural areas of Texas. The challenge is to get a better understanding of the extent to which the long-term use of these systems may be affecting the environment over time, especially since little monitoring of existing systems is taking place."

This project will conclude at the end of August 1999 and a summary of the literature review will be published. It is hoped that the results of this literature search may help provide recommendations for future research in this area.

For details, contact Kommalapati at (409) 857-2418 or r_kommalapati@pvamu.edu.

Council Renews Contract with TWRI to Continue Production of Texas On-Site Insights Newsletter, Update WWW Site

The Texas On-Site Wastewater Treatment Research Council recently renewed its contract with the Texas Water Resources Institute (TWRI) to assure that its public information materials, including this newsletter, will continue to be produced over the next two years.

The Council voted to continue its contract with TWRI so that Information Specialist Ric Jensen will keep on publishing the *Texas On-Site Insights* newsletter until at least August 2001.

In addition, the Council's action also provides funds to maintain its World Wide Web site (<http://towtrc.tamu.edu>). For the first time, the contract includes funds to support live demonstrations of the TOWTRC WWW site at meetings and conferences.

"Obviously, we're elated that we can keep on producing this newsletter as well as the WWW site and related efforts," Jensen says. "It is very satisfying to help inform regulators, professionals, and the public with much-needed information they can use. There's a tremendous need for educational resources about on-site wastewater in Texas and we hope we are filling that void."

During the next two years, Jensen says he wants to include more articles in the newsletter which have been suggested by readers. If you have any ideas for topics that should be featured, feel free to contact Jensen and he will be more than happy to discuss these concepts with you.

Subscriptions to *Texas On-Site Insights* are free upon request. To receive a subscription to the newsletter or speak with Jensen, contact him at (409) 845-8571 or rjensen@tamu.edu.

TNRCC Takes Aggressive Actions to Enforce OSSF Rules, Issue Fines and Suspensions

**By Warren Samuelson, Robert Brach, and Richard Craig,
Texas Natural Resource Conservation Commission (TNRCC),
On-Site Sewage Facility (OSSF) Program,
Austin, TX**

The intent of this article is to provide a brief summary of the types of wrongdoing that have been identified and a review of the actions which the TNRCC has taken regarding the On-Site Sewage Facility (OSSF) program.

Much of the information in this article was presented by the TNRCC at the 1999 Texas On-Site Wastewater Treatment Council Annual Conference in Waco.

Background Information

Through formal enforcement action, the TNRCC can issue a letter of reprimand from program staff or it may issue one of three types of orders. The orders are issued by the TNRCC Enforcement Division against individuals who may have violated agency OSSF regulations. The types of orders which the TNRCC may issue include agreed, findings, and default orders. The TNRCC may issue a letter of reprimand after corrective action has occurred in a timely manner.

Under an "agreed order," people neither admit to nor deny charges which are brought against them and the order does not become part of their compliance history. Still, agreed orders require individuals to pay a deferred administrative penalty and may require corrective action to resolve complaints within a specified time period.

When a "findings order" is issued, individuals either admit to wrongdoing or have had a case reviewed by the State Office of Administrative Hearings and a judge has determined the violations were valid. However, their license is at risk if future violations occur. A

findings order becomes part of an individual's compliance record. Administrative penalties may be assessed and corrective action may be required.

A "default order" is typically issued when people refuse to work with the TNRCC to resolve complaints. By law, individuals who are issued default orders admit that charges which are brought against them are valid. Normally, a default order carries an enhanced penalty and an individual's certificate of registration is often revoked or suspended.

Recent TNRCC Enforcement Actions

Between May 1996 and May 1999, 481 complaints were filed with individuals who were registered with the TNRCC OSSF Program. Of these, 17% resulted in agreed, findings, or default orders being issued. In addition, another 17% are pending while 29% were still under investigation. It should be noted that 20% of the complaints were closed due to insufficient evidence. In May 1999, one certificate of registration was revoked for two years and another was suspended for six months. Overall, seven certificates of registration have been revoked and one has been suspended.

Administrative penalties during this time totaled \$142,415. Twenty agreed orders totaled roughly \$28,660, four findings orders were issued for \$25,397, and 17 default orders totaled \$88,623.

What types of wrongdoing were most often cited by the TNRCC in developing and processing these orders? Often, installers took deposits from owners, but then abandoned the installation of systems before they were completed. In other cases, installers began the installation of on-site systems without approval from the permitting authority. In yet other instances, systems were installed or repaired which did not meet the minimum requirements of the Texas Health and Safety Code for OSSF facilities. Some individuals installed systems even though they were not licensed or registered to do so. Sometimes, improper materials were used to install systems.

Summary

These actions by the TNRCC confirm what everyone in the on-site wastewater industry in Texas should know -- namely, that the agency is committed to enforcing OSSF rules and that it will take action when the regulations are willfully violated.

It should also be apparent that individuals who have broken the regulations have had orders taken against them, have incurred fines, and, in some cases, had licenses suspended or revoked.

Clearly, the bottom line is that the best course of action for on-site professionals is to make sure they are complying with all the regulations for on-site wastewater systems.

NOTE: For more information about the TNRCC OSSF Enforcement Program, contact Brach at (512) 239-2150 or rbrach@tnrcc.state.tx.us, Craig at rcraig@tnrcc.state.tx.us or (512) 239-2328, or Samuelson at (512) 239-4799 or wsamuels@tnrcc.state.tx.us.

TNRCC STEP Program Helps East Texas Subdivision Fix Problems with Failing On-Site Wastewater Treatment Systems



A subdivision near Tyler is just the latest example of how a "self-help" program overseen by the Texas Natural Resource Conservation Commission (TNRCC) can replace failing on-site wastewater treatment and distribution systems.

For many years, families in the Gresham Oaks subdivision (south of Tyler) were faced with a host of problems centering around failing on-site systems. For example, partially treated wastewater often surfaced at many of the homes and yards in the subdivision after heavy rains, creating odor and public health problems. According to the organizers of the project, part of the problem is the widespread presence of clay soils in the region.

In March 1997, however, things began to slowly turn around. Two community leaders, Sheree Sanders and Carol Biggs, contacted George Freitag of the TNRCC and learned about the Texas Small Towns Environmental Program (STEP). Sanders and Biggs began serving as "sparkplugs," organized community meetings, and began lining up volunteers, firms which could contribute labor and materials, and sources of funding. Smith County Commissioner Sharon Emmett was instrumental in working with the community on road construction options to help cut costs significantly. Consulting engineer Reese Brown and contractor George McKinney also worked closely with the community to keep the costs within a tight budget.

The technical solution that was decided upon was to connect all the homes in the subdivision to a gravity sewer, owned and operated by the Tall Timbers Utility Company wastewater system. Individual septic tanks and drainfields are no longer being used, except for a few instances in which homeowners previously replaced their standard systems with aerobic units.



The results were dramatic. Working within the STEP framework, they queried companies and firms that would perform needed services at reduced rates. A construction company was subcontracted to install new main wastewater lines. Later, Sanders and Biggs organized a team of 10 to 20 people who spent many weekends crushing existing septic tanks and filling with them dirt, digging trenches, and accomplishing many other hands-on tasks. One of the biggest positive features of STEP is the cost-savings which results when "sweat equity" is invested. For example, a low interest loan was obtained from The

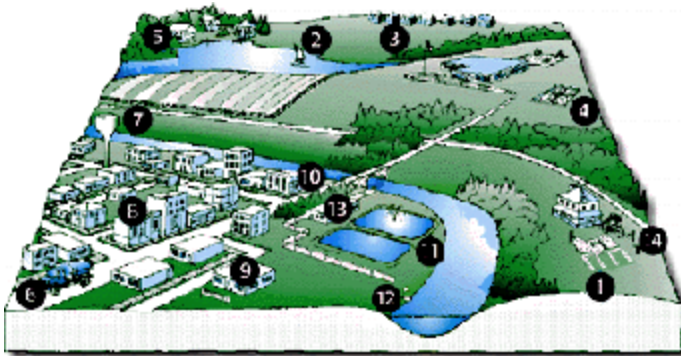
Rensselaerville Institute (TRI), which originated the STEP program. Sanders estimates that the final cost of replacing the on-site systems using STEP was only roughly \$38,000, compared the original estimated cost of \$100,000.

"Texas STEP offers small communities affordable solutions for water and wastewater problems by utilizing self-help wherever possible," said TNRCC Commissioner Ralph Marquez. "Gresham Oaks residents have had major input into how this project has progressed, and this undoubtedly gives them a sense that they have a voice in their community's quality of life."

NOTE: TRI partners with the TNRCC and other state agencies to implement STEP throughout Texas. For more information about how to utilize this program in your community, contact Freitag at the TNRCC STEP Program at (512) 239-6123 or gfreitag@tnrcc.state.tx.us.

Interactive Poster On NSFC WWW Site Features On-Site Information

A new, interactive, poster has been developed by the National Small Flows Clearinghouse (NSFC) at West Virginia University which lets individuals utilize the World Wide Web to gather education materials about on-site and small community wastewater treatment and disposal options.



The poster, "Small Community Options and Resources," depicts wastewater treatment options as well as resources about such topics as wastewater management, environmental training, and funding.

Some of the specific topics which are featured include septic systems, sand filters, alternative sewers, home aerobic system units, septic system maintenance, managing on-site wastewater treatment systems, and lagoons. In addition, there is also information about public health, financing and funding for wastewater and water systems, training for system operators and maintenance staff, and general news about water and wastewater topics.

Selecting any of these choices (which are shown as graphic icons) will lead you to detailed information from NSFC newsletters or reports.

The poster is located at http://www.estd.wvu.edu/nsfc/NSFC_optresourc.html. For details, contact the Clearinghouse at (800) 624-8301 or at nsfc_orders@estd.wvu.edu.

Developing System for Austin Arts Center Proves Challenging Due to Slopes, Poor Soils

When you first view the new Barton Creek Arts Center, it makes quite an impression. The Center, designed to be a haven for performing artists as well as a trendy office complex, sits atop a rocky hill in the environmentally sensitive Barton Creek watershed. Many of the buildings in the Center incorporate stained glass and other artistic touches, including a "Southwestern" style auditorium. Designing an on-site wastewater treatment and distribution system for this site required its own artistry, in terms of creativity and persistence.



According to David Venhuizen, who played a lead role in creating the on-site system for the Center, it was challenging to develop an on-site system for this site because of site constraints, regulatory hurdles, and the desire of the developer to incorporate environmentally friendly features into this effort.

"It was difficult to determine design flow rates because the function of the building was unique -- there are not many design standards for a meditation center or a performing arts arena," he says. "In addition, we had to deal with steep slopes and problem soils."

Background Information

Some of the most pressing physical challenges at this hilly Austin site include slopes and soils. Venhuizen notes that slopes here range from 5% to 30%. Only shallow soils are present. Even where suitable soil depth exists, soils are often very rocky and of poor



quality for plant growth. To compensate for the lack of suitable soils, the developers are hauling in 11,000 cubic yards of loamy soils to provide a soil depth of at least one foot below the drip irrigation lines.

The permitting process for this system began in 1996 and permits were obtained by the end of 1997. The original design flow for the system was 6,300 gallons per day (gpd). Because the flow was greater than the 5,000 gpd regulatory limit for on-site facilities, the system fell under the jurisdiction of the Texas Natural Resource Conservation Commission's Municipal Wastewater Division, where it was reviewed by Phillip Urbany, Louis Herrin, and Dale White. Even though the revised plan has scaled down the development, and peak flows

are estimated to be about 2,500 gpd, the municipal permit is still in place. As a result, the site developers will have to hire an individual with a Class D wastewater license to monitor the performance of this system. "We'll monitor the system to see what the flows really are," Venhuizen says. "We will establish that the flows generated here actually are consistently under 5,000 gpd. We should then be able to have the permit changed to an on-site system when it comes up for renewal in five years."

The plan was to use sand filter technology for all treatment. It was originally envisioned that some flows might be separated, and graywater could be treated in a separate unit and then utilized as a supply for toilet flushing. Another strategy which was considered included post-treating sand filter effluent with a slow sand filter to produce water for flushing toilets. These other options were dropped when the project was downsized, as it is expected that the first phase treatment system will now handle the entire design flow rate for the full project.

Technical Details About the System

In its final form, wastewater from the performing arts center first flows to a 1,000-gallon septic tank, while wastewater from the office complex is directed to two 750-gallon septic tanks. These three primary septic tanks are used for settling and primary treatment. Effluent from these tanks flows through small diameter gravity sewers to two 1,250-gallon septic/recirculation tanks, which are arranged in series. Ultimately, effluents flow into a recirculating sand filter where they receive additional treatment. Effluent from these tanks flows into the sand filter dosing tank, where pumps intermittently dose it onto the sand filter beds. The sand filtration process produces a very high quality effluent. Some of this effluent is recirculated back through the system, joining the septic tank effluent to flow through the septic/ recirculation tanks. The rest of the sand filter effluent flows to the effluent tank, where pumps send it to the drip irrigation fields.

"I like sand filters because they are inherently stable," Venhuizen says. "They are a very reliable and consistent treatment method, if managed properly. Unlike many competing technologies, I feel sand filters are much less likely to fail."

Two drip field areas were established, which cover an area of 11,000 square feet. The amount of drip lines which were used totaled roughly 6,000 linear feet. Effluents are pumped into drip fields at 15 pounds per square inch (psi). As long as the effluents which flow into the drip lines are of a high quality, Venhuizen says there should not be a problem with clogging. Still, he anticipates the drip lines may have to be flushed once a year or so with clear water for preventative maintenance or with an acidic solution or chlorine if there is evidence of emitter clogging.

The system cost roughly \$40,000 to construct. Although this may sound like a lot of money for an on-site system, Venhuizen says the cost should be looked at in a broad context. "Without a suitable on-site system, it may not have even been possible to develop this property," he says. "If you look at the cost of the system in terms of the total cost of the project, it's really pretty minimal. It also compares well to other types of on-site treatment and disposal which would have worked on this site." There will be added

costs for weekly testing of biochemical oxygen demands, total suspended solids, and other parameters, which is a requirement of the municipal permit. Installation of the system was recently completed and it will be in operation soon.

NOTE: Venhuizen says he has designed and overseen the installation of roughly 20 systems of this type in Central Texas, most of which serve single-family homes. He can be contacted for more information at waterguy@ix.netcom.com.