



9th Annual TOWTRC Conference Meets February 13–14 in Waco

The 9th Annual Conference of the Texas On-Site Wastewater Treatment Research Council (TOWTRC) will meet February 13-14 2001 in Waco. The conference will meet at the Waco Convention Center.

According to TOWTRC Executive Secretary Warren Samuelson, this year's conference will provide an excellent opportunity to learn more about the design, installation, and management of on-site wastewater treatment and disposal systems utilized throughout Texas.

A focus of this year's conference will center around the most recent revisions to Texas regulations about on-site wastewater treatment systems. Staff from the Texas Natural Resource Conservation Commission (TNRCC) will present an overview of the rules changes. There will also be opportunities for participants to ask TNRCC staff questions about the proposed rules.

"The conference will help clarify what the proposed rules changes will address and how that will affect people in this industry every day," Samuelson said. "As a result, we hope this conference will provide a lot of practical information people can put to use."

Several presentations will describe projects recently funded by the Council. Some of the technical issues that will be covered include the extent to which many on-site systems may be chronically malfunctioning; design parameters for systems that treat high-strength wastes; designs for low-pressure dosing systems and drip irrigation systems; the use of caliche soil as a filter medium to dispose of and treat wastewater; and the development of maps to evaluate areas with

shallow groundwater. Other talks will discuss how soil absorption and evaporation can be used in combination to size drainfields; common problems with surface application systems; and characterizing soil hydraulic properties in subsurface drip drainfields.

Attending the conference will be a benefit to professionals in the industry as well as regulators. The conference provides 8 certified hours of continuing education credits for designated representatives and installers. Individuals with a Class D wastewater operator license who perform maintenance on OSSF systems can qualify for 10 hours of continuing education credits.

The conference will also feature many exhibitors, including companies in the private sector as well as representatives from the Texas Natural Resource Conservation Commission (TNRCC) and other agencies and organizations.

Note: An abbreviated version of the schedule for this conference is shown below. For a complete schedule or more details about the conference, contact Warren Samuelson of the TNRCC at (512) 239-4799. The conference agenda is also on the TNRCC World Wide Web site at <http://www.tnrcc.state.tx.us/admin/events/01-02onsite.pdf>. The Waco Convention Center can be contacted at (254) 750-5810. The host hotels for the conference are the Waco Hilton and the Courtyard Marriott.

(PLEASE SEE TOWTRC CONFERENCE, PAGE 8)

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ASAE National On-Site Wastewater Symposium Meets in Fort Worth

Texas On-site Insights

Editor Ric Jensen
TWRI Director C. Allan Jones

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This newsletter and much more information about TOWTRC and on-site wastewater issues in Texas are on the WWW at <http://towtrc.tamu.edu>.

You can also subscribe to an Internet list server that discusses on-site wastewater issues in Texas called "TWRI SepticTalk." Contact us if you want to learn more about this service.

Finally, TWRI is always looking for story ideas from its readers. If you want to suggest an article for the newsletter, please contact the Editor.

An international conference that focuses on on-site wastewater treatment systems will come to Texas in March. The conference, the 9th National Symposium on Individual and Small Community Sewage Systems, will meet in Fort Worth March 11–14. The meeting is sponsored by the American Society for Agricultural Engineering (ASAE).

Major themes of the conference will discuss such issues as soils, new technologies, management, research, risk assessment, standards, and policies. Other topics to be discussed include drip irrigation as well as constructed wetlands.

Many Texas speakers are scheduled to present papers at the Conference, including researchers and graduate students from Texas A&M University (TAMU) and Baylor University (BU) as well as individuals from the regulatory and private sectors.

In addition to the main conference program, "The Septic System Inspection Course" will be offered March 10–11. The course will be taught by staff members from the National Association for Wastewater Transporters, Inc. (NAWT), which will also offer certification. The purpose of this training is to properly teach professionals a standardized procedure about how to reinspect on-site wastewater systems when real estate is transferred. On March 11, a technical tour will take people from Fort Worth to Waco. Sites on the tour include the M&M Mars wastewater treatment system, the BU Wastewater Technology Testing Facility, and Axtell High School.

Note — To obtain details on how to register for the conference, contact ASAE at (616) 429-0300. The fax number is (616) 429-3852. You can also visit the ASAE World Wide Web site at <http://www.asae.org>. The conference hotel is The Radisson Plaza, which can be contacted at (817) 870-2100.

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Disclaimer

The articles in this newsletter do not necessarily reflect the official policies of the Texas On-Site Wastewater Treatment Research Council, the Texas Natural Resource Conservation Commission, or the Texas Agricultural Experiment Station (TAES). Feature articles often present useful information about on-site wastewater issues, but may not always identify systems endorsed by the TNRCC, TAES, or the Council.

New Council Projects Will Study Caliche Soils, Application Rates, Malfunctioning Systems

The Texas On-Site Wastewater Treatment Research Council (TOWTRC) recently funded three studies to investigate how well caliche treats wastewater effluents, to evaluate surface application rates for on-site wastewater treatment systems in Texas, and to assess the extent to which on-site systems may be chronically malfunctioning throughout the State.

"Study Of Caliche Soil As A Filter Medium For Treatment And Disposal Of Wastewater," was awarded to researcher Larry Wilding of the Texas A&M University Soil and Crop Sciences Department. The goal of this study is to develop a working definition of "caliche" in relation to wastewater treatment. This project will include developing a literature review about the effectiveness of caliche soils as a bioremediation filter media in the treatment and disposal of wastes. Wilding will also create a bibliography of peer-reviewed and popular articles about this subject. The project should provide insights about the effectiveness of caliche to treat and dispose of wastewater from subsurface disposal systems used in association with on-site sewage facilities (OSSFs).

"The goal of this project," Wilding says, "is to use previous research to assess how well caliche can be used to treat and dispose of wastewater septic systems. Once we have a firm idea of what has already been learned from research, we can then develop recommendations for issues that need to be addressed in future studies."

"Reevaluating Surface Application Rates for Texas On-Site Sewage Facility (OSSF) Systems" was funded to Clifford Fedler and John Borrelli of the Civil Engineering Department at Texas Tech University. In the initial stages of this project, the researchers will develop data on distribution patterns of various sprinklers and nozzles, and will determine which technologies provide the most even distribution. This information will then be entered into a database. Afterwards, the researchers will develop specifications and design guidelines for surface application systems that address performance and design procedures, and infiltration rates. The design guidelines will also factor in nitrogen-uptake utilization rates, the nitrogen balance, and the effect of various types of vegetation on water use and transpiration. Another aspect of this project is to develop a map of surface application rates for Texas using updated evapotranspiration data and specifications for vegetation. This information will be used to develop recommendations for the design and operation of future OSSF surface application systems.

"We hope to develop site-specific information that can be used

to better design application rates for on-site wastewater systems," Fedler says. "We hope to identify which sprinkler systems may provide the most uniform application, and how the placement of turfgrasses, flowers and trees may influence the amount of wastewater on the site. The results of this study may provide a basis to reuse wastewater in OSSF systems in the future."

"A Study to Determine the Magnitude of, and Reasons for, Chronically Malfunctioning On-Site Sewage Facilities in Texas" is an investigation that will be conducted by Scott Pasternak and

Kristin Keeling of Reed, Stowe & Yanke, LLC. In this effort, the researchers will initially conduct a literature search and interview OSSF professionals to learn some of the reasons septic systems malfunction. They will also extract information about OSSF performance from the Texas Water Development Board statewide water and wastewater survey. Later, they will use this information to develop a survey that will be sent to Texas Natural Resource Conservation Commission (TNRCC) regional offices and designated representatives. Many survey questions will seek to obtain information on the characteristics of failing systems, including soil types, the depth to the groundwater table, climatic factors, system age, and how often maintenance was performed. The researchers hope to obtain a high response rate by publicizing this effort at meetings and

conferences. Survey results will be analyzed on a statewide and regional basis.

"To date, many research studies and projects have been completed in Texas, but we do not have a statewide or regional understanding of how many OSSF systems are malfunctioning, and why these malfunctions occur," Pasternak says. "Information that results from this study will be the most comprehensive and detailed data on OSSF systems available to the Council, and can be used to prioritize and effectively address the problems of malfunctioning OSSF systems across the state."

Note: Wilding can be contacted at wilding@tamu.edu or (979) 845-3604, Fedler at clifford.fedler@coe.ttu.edu or (806) 742-2801, and Borrelli at john.borrelli@coe.ttu.edu. Pasternak can be reached at (512) 450-0991 or spasternak@rsyllc.com.



Texas A&M researcher Larry Wilding (shown here) has extensively studied caliche soils. He was recently funded by the Council to study how well caliche soils may work in on-site wastewater systems.

TNRCC Proposes Changes to OSSF Rules Affecting Maintenance, Planning, Certification

The Texas Natural Resource Conservation Commission (TNRCC) has developed new draft regulations that, if adopted, will affect many aspects of on-site wastewater treatment. The regulations are codified in Title 30, Chapter 285, of the Texas Administrative Code.

The draft rules were published on December 8, 2000 in The Texas Register. The public comment period ended January 12, 2001, and the regulations could be enacted by the TNRCC late this spring. Because TNRCC staff must respond to all public comments before the rules are finalized, it is possible that some of the draft rules changes mentioned here may not be included in the final regulations.

The rules changes cover the following areas: requirements for maintenance companies; changes in planning materials and construction; procedures for authorized agents and permitting authorities; and changes in the certification process.

"In this rules revision process, we worked to make the new regulations more readable," said Warren Samuelson of the TNRCC on-site wastewater treatment (OSSF) section. "We believe making the rules more easily understood should also make these regulations more enforceable."

Some of the highlights in each area are discussed below.

REQUIREMENTS FOR MAINTENANCE COMPANIES

In general, the proposed rule changes clarify the frequency for required maintenance, testing, and repair of proprietary on-site wastewater treatment systems (OSSFs). Under the draft rules, the Executive Director of the TNRCC would have to approve training courses presented by manufacturers of proprietary systems that are used to certify individuals who maintain these systems. Manufacturers of proprietary systems will also be required to provide training to an adequate number of maintenance companies in each county where their systems are marketed and used. When a maintenance company services a system, the rule changes would require that a tag be placed on the unit or marked at the site at the time of a service visit. This would verify that required maintenance was performed.

CHANGES IN PLANNING MATERIALS AND CONSTRUCTION

The draft regulations will affect many aspects of site evaluation and construction. Under the new rules, the TNRCC Executive Director would have to approve planning materials for non-standard disposal systems as well as proprietary treatment and disposal systems. The new rules also clarify the need for a site evaluation as part of the planning process, but remove the need for a soil structure

analysis as part of that site assessment. The site evaluation will have to include an analysis of the gravel used in individual systems. Class III soils can also be used as a backfill material for standard systems. Surface application and distribution lines, valve boxes, and sprinklers will have to be colored purple. Every seven years, manufacturers of approved proprietary systems will have to verify that these technologies can still meet the standards under which they were originally approved. The proposed changes require that surface application systems with setbacks of less than 20 feet must spray at night. They also require that residential septic tanks must be a minimum of 500 gallons. The rules changes also address the proper sizing of leaching chambers and low-pressure dosing systems.

PROCEDURES FOR AUTHORIZED AGENTS AND PERMITTING AUTHORITIES

The draft regulations clarify the process through which OSSF programs are delegated to local governments and other authorized agents. They also emphasize that the permitting authority of municipal authorized agents is limited only to the incorporated area of those cities. The proposed rules changes would allow the TNRCC to assess a "charge-back" fee to local governments for work the Commission performs on OSSFs when there is not a local authorized agent. The draft changes remove the permitting of new cluster systems from the TNRCC OSSF regulations.

CHANGES IN THE CERTIFICATION PROCESS

The rules changes that may affect the largest number of people deal with the certification process. The draft rules remove the experience requirement to qualify as an Installer I, and modify the experience needed to become an Installer II. The proposals also remove all language pertaining to the site evaluator license. The rules changes would prohibit anyone from advertising or representing themselves to the public as an installer without possessing a current license. The term of licenses would be increased from one year to two years.

Notes: The TNRCC has developed a World Wide Web page that contains much more information on the proposed rules changes. It is located at http://www.tnrcc.state.tx.us/enforcement/csd/ics/ossf_changes.html.

The TNRCC will review all the public comments. Samuelson says the agency is committed to incorporating these suggestions into the new rules, when appropriate. Samuelson can be contacted at (512) 239-4799.

Meetings, Conferences, and Training

The Texas Engineering Extension Service (TEEX) offers many excellent continuing education classes related to on-site wastewater treatment. The Installer I class will meet February 6–7 in San Antonio. The Installer II class will be taught February 27–March 2 in Tyler. The Site Evaluator class will be offered February 20–22 in Bryan. For more details about TEEX on-site wastewater training, visit their web site at <http://teexweb.tamu.edu>, or call them at (877) 833-9638.

The WWW site of the Texas Natural Resource Conservation Commission (TNRCC) contains an extensive list of resources describing opportunities for training and continuing education (CE). The WWW site lists approved providers for education relating to on-site sewerage facilities (OSSF), including educational institutions, governmental entities, and private companies. Dates and places classes are offered, course codes, and the number of CE units available for participants are listed. The WWW site address is http://www.tnrcc.state.tx.us/enforcement/csd/ics/ossf_ceu.html.

The phone number for the TNRCC OSSF Section is (512) 239-4799.

The National Small Flows Clearinghouse (NSFC) is a tremendous resource for all kinds of information regarding on-site wastewater treatment and disposal. Free products available from NSFC include magazines, newsletters, and fact sheets. In addition, NSFC has published many special reports on specific topics relating to this field. For more details, visit them at <http://www.nsfcc.wvu.edu>, or call (800) 624-8301.

The Texas Onsite Wastewater Association (TOWA) provides continuing education programs for installers and designated representatives. Their classes help people obtain continuing education credits required by the Texas Natural Resource Conservation Commission (TNRCC). To learn more about these training programs, contact TOWA at (512) 494-1125 or visit them on the WWW at <http://txowa.org>.

NOWRA Publishes Proceedings of 2000 Conference

The National On-Site Wastewater Recycling Association (NOWRA) has published the proceedings of its 2000 conference, "Onsite: The Future of Water Quality."

Major themes in the 292-page proceedings features include the management of onsite systems, government and regulatory issues, education, biosolids management, how to run an onsite business, soil processes, constructed wetlands, wastewater reuse, monitoring system performance, and technological advances. Some of the individual papers dealt with such topics as the long-term economic impact of on-site systems versus sewers; hydraulic loading as a function of soil type; health and safety issues for septic tank

inspectors and pumpers; physical and chemical characteristics of residential wastewater; passive on-site wastewater systems; the longevity of onsite systems; and the consistency of treated wastewater needed for household and irrigation reuse. Other papers describe such topics as planning for water-tightness in precast concrete septic tanks; onsite attenuation of phosphorus and E. Coli bacteria; remote management tools for decentralized systems; and a summary of onsite systems in the United States using data from 1998.

The proceedings can be purchased from NOWRA by contacting them at (301) 776-7468 or <http://www.nowra.org/>.

National Decentralized Project Funds Grants for Research, Education and Training About On-Site Systems

A national program is underway to select, fund, and manage research and education projects related to on-site wastewater issues. The National Decentralized Water Resources Capacity Development Project (NDCP) is funded by the U.S. Environmental Protection Agency (EPA). Several stakeholder organizations are participating in this effort, including the Coalition of Alternative Wastewater Treatment (CAWT), the Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT), the National Onsite Wastewater Recycling Association (NOWRA), the Water Environment Federation (WEF), the Water Environment Research Foundation (WERF), the National Rural Electrical Cooperative Association (NRECA), and the Electric Power Research Institute (EPRI).

The NDCP was created to identify and fund projects that address research gaps, regulatory issues, and policy and manage-

ment questions related to decentralized wastewater treatment.

So far, two education projects have been awarded to develop university curriculum related to on-site systems, and to create a model curriculum for practitioners. In the regulatory arena, studies have been funded to create a model ordinance for California, and to compare state authorities and practices that govern onsite systems. Other NDCP projects cover such topics as quantifying the impact of on-site systems on watersheds; development of a framework for risk assessment to evaluate onsite technologies; and the creation of guidance manuals for alternative systems. In the future, this program will likely create additional opportunities to research issues related to on-site wastewater treatment.

For more detailed information, contact Andrea Arenovski at (510) 658-2686 or a_arenovski@earthlink.net.

BRA Works with Salado Downtown Businesses to Outline Wastewater Treatment Options

A regional water management agency is cooperating with the business district of a small town to explore alternatives for on-site wastewater treatment systems that serve the central business district.

The study is being led by the Brazos River Authority (BRA), at the request of downtown businesses. The study was initiated by the businesses in November 1999 and is expected to be concluded by the end of 2001. The assessment is funded in part by a grant from the Texas Water Development Board.

INTRODUCTION

According to Michael Jahns of the Bell County Health Department (BCHD), whose agency regulates on-site systems in Salado, the crux of the problem is that the size of current on-site systems may be inadequate for many businesses. Currently, some businesses with inadequately sized systems have been grandfathered in by previous regulations. These systems can continue to be used as long as they are still functioning properly.

Since many buildings have been converted from their original purpose (often a home), they now generate significantly more wastewater than their septic systems can treat. As a result, Jahns said, his agency has detected problems in which effluents have surfaced, especially in low-lying areas. There have also been complaints of foul odors coming from septic tanks and drainfields.

As a result of the failure of septic systems, the county health department has asked several restaurants and bed-and-breakfasts to curtail their water use, and hours of operation, in order to not overload their systems. Some of these businesses resolved these problems in part by installing water-conserving toilets, faucets, and by adopting more water-efficient dishwashing methods.

DEVELOPING SOLUTIONS

An associated problem is that many business owners have expressed a desire to expand the size and scope of their operations,

but feel they are limited by having to reserve a large percentage of their property for a septic system and drainfield. Obviously, you don't want to put a parking lot or a heavily-trafficked area on top of the drainfield. Changing from septic systems to a community sewer may free up space now used by drainfields, thus potentially allowing businesses to grow. Another challenge is cost. One restaurant reported that the expense associated with replacing its on-site system with a unit that could properly treat its wastes was roughly \$50,000.

According to Denis Qualls of the BRA, which manages a series of wastewater treatment systems throughout the region, this project is interesting for a variety of reasons. First, while many projects are community-wide, this one focuses on the special needs of the downtown area. As a result, he anticipates that the majority of

homes in the small town will be able to stay on septic systems and will not be required to join a centralized system. The only exception may be for homes located within the central business district. Secondly, Qualls noted that the timing of this study parallels the decision by Salado voters to incorporate, but emphasized these are separate movements that are not related.



PHOTO COURTESY OF MICHAEL JAHNS/ BCHD

The BRA study will explore wastewater treatment options for the downtown Salado business district

SUMMARY

Although no preferred strategies or options have been identified so far, Qualls noted that there may be an opportunity to connect downtown Salado businesses with a BRA regional wastewater plant sited between Temple and Belton.

The main goal of this project, he said, is to fully explore the nature of how systems are currently functioning and what problems exist, and to identify potential alternative technologies and how much it will cost to implement them.

"Once this is done," Qualls says, "we will be able to go to the business owners and give them a price to solve these problems. They can then decide if what we've outlined is something they want to participate in."

Note: For details, contact Qualls at (254) -776-1441 or Denisq@Brazos.org. Jahns can be contacted at bcehfp@bellcountytexas.com or (254) 939-2511.

TAEX Report Reviews Performance of Constructed Wetlands in Texas

A new report by the Texas Agricultural Extension Service (TAEX) provides a comprehensive examination of many factors that affect how well constructed wetlands treat domestic wastewater.

The report, "Constructed Wetlands for Prevention of Non-Point Source Pollution Caused by On-Site Sewage Disposal," summarizes the results of a Section 319-h project funded by the U.S. Environmental Protection Agency (EPA). The project began in March 1995 and ran through September 1999.

The work was led by Bruce Lesikar of the Texas A&M University (TAMU) Agricultural Engineering Department and Rick Weaver of the TAMU Soil and Crop Sciences Department. Several TAMU graduate students also participated, including Srinu Neralla, Matt Johns, Byron Neal, Russell Persyn, and Jeffrey Lane.

The goal of the project was to demonstrate that constructed wetlands are a best management practice for on-site wastewater treatment. "One of the things we wanted to do in this project was to answer many of the questions people often asked about the performance of constructed wetlands for wastewater treatment," Weaver said. "We wanted to find out more information about how well these systems remove pathogens and treat wastewater and which plants work best. We want to be able to confidently tell people, based on research, the circumstances under which constructed wetlands are a viable wastewater treatment alternative."

In this effort, constructed wetlands were designed and constructed to treat wastewater on-site at eight residences throughout Texas. At five of these sites, the existing on-site systems were failing and needed to be replaced. The performance of these systems was monitored extensively for a year at each site. Major components of this project involved planning and designing the constructed wetlands, evaluating the performance of these systems, and transferring this technology to regulators, industry professionals, and the public.

PLANNING AND DESIGN EFFORTS

At the onset of this project, the research team carried out a literature review and developed a quality assurance plan. The team worked with the Harris County Engineering Department and local County Extension agents and selected sites for four subsurface flow constructed wetlands in Houston, Tomball, Bryan, and College Station.

A model developed by the U.S. Environmental Protection Agency (EPA) was used to design the constructed wetlands. The strategy was to model the systems to develop wetlands that would produce secondary-treated domestic wastewater. The EPA design

model was evaluated to determine if it is applicable for the climate in many regions of Texas. A sensitivity analysis was conducted to evaluate how well various parameters in the model work for Texas conditions.

EVALUATING SYSTEM PERFORMANCE

The researchers monitored water quality as it entered and exited the four subsurface flow constructed wetlands developed for this project, as well as four wetlands of this type which had already been installed. The existing wetlands were located in D'Hanis, Dublin, Weslaco, and Stephenville.

The evaluations covered such issues as pathogen levels; concentrations of nitrogen, phosphorus, and organic matter; the pathways by which nitrogen is dispersed as it passes through these wetlands; the identification of plant species which may perform best in these systems; and how well constructed wetlands lower biochemical oxygen demands (BOD) and remove nitrogen.

Pathogen levels were investigated by measuring fecal coliform counts as the wastewater moved through the system. Water quality data were collected and analyzed for such parameters as BOD, ammonia-nitrogen, total suspended solids (TSS), volatile suspended solids (VSS), and phosphorus. Labeled-nitrogen (N-15) was used to study the fate of nitrogen as it passes through these wetlands systems. The performance of 20 plant species in constructed wetlands was evaluated in laboratory and field studies. Attempts were made to correlate the performance of constructed wetlands across various climatic regions of Texas.

TECHNOLOGY TRANSFER & EDUCATION

A number of projects were developed to educate the public about the use of constructed wetlands for residential wastewater treatment, in general, as well as specific findings from this effort. An educational videotape was produced that describes this technology. Fact sheets were developed and distributed that discuss how constructed wetlands should be designed, installed, operated, and maintained. Educational meetings and workshops were conducted at the eight sites to present information generated through this project.

RESULTS FROM THIS PROJECT

In general, contaminant removal was excellent from these constructed wetlands. The systems were able to consistently produce secondary quality effluent. However, low levels of fecal coliforms remained in the wastewater that exited from these systems, documenting the need for additional treatment. Tablet

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PHOTO BY RIC JENSEN/ TWRI

TAMU graduate student Srinu Neralla (left) and researcher Rick Weaver (right) take a water quality sample from this septic tank, which is used with a constructed wetland.

Schedule for the TOWTRC Conference

TUESDAY, FEBRUARY 13

GENERAL SESSION 8:30 AM
CONCURRENT SESSIONS 9:45–11:30 AM
Designated Representatives: History and Future
Developing an Enforcement Case for Justice of the Peace Court
OSSF Industry: Past, Present & Future
Certification: Past, Present & Future
Chronically Malfunctioning On-Site Sewage Facilities in Texas
Communications
Evaluation of Design Parameters for Modern Grease Traps and High-Strength Waste

CONCURRENT SESSIONS 3:30 TO 5 PM
Texas Department of Highways and Texas Department of Public Safety Vehicle and Highway Requirements
Common Problems with Surface Application Systems
Electrical Requirements for OSSF Systems
Study of Caliche Soil as a Filter Medium for Treatment and Disposal of Wastewater
Maps for Shallow Groundwater Evaluation

WEDNESDAY, FEBRUARY 14

CONCURRENT SESSIONS 8:15–9:45 AM
Owning Your Own OSSF Business
Managing a Maintenance Company
Would You Like Fries or a Shake with that On-Site System?
Design Overview of Drip Irrigation Systems
Characterizing Soil Hydraulic Properties in a Subsurface Drip Drainfield

CONCURRENT SESSIONS, 10:15 – 11:45 AM
OSSF Rule Revisions
Soils: A Common Sense Approach
Depth of Drip Tubing Installation and Water Surfacing
Installation of Drip Irrigation Systems (Panel Discussion)

WETLANDS (FROM PAGE 7)

chlorination was used to reduce fecal coliform levels in one system, so that the effluents could safely be used for surface irrigation.

It appears that these systems may have been oversized, since they were developed to handle maximum flows. The use of winter air temperatures appears to be too conservative a parameter to design these systems for Texas. However, the use of soil temperatures proved to be a more accurate factor in the design of constructed wetlands.

Labeled-nitrogen was used to determine the fate of nitrogen as it moved through the system. These studies suggest that the majority of nitrogen was lost through ammonia volatilization, not plant uptake. As a result, the plants in these constructed wetlands did not contribute significantly to improved wastewater treatment, although they did remove a lot of water through evaporation and transpiration. In addition, the plants made these systems more aesthetically pleasing.

Four of the 20 plant species that were evaluated (umbrella palm, dwarf umbrella palm, and broad and narrow leaf cattail) performed very well in the constructed wetlands monitored for this study. In particular, umbrella palm was shown to be winter-hardy, insect-resistant, did not go dormant, and recovered rapidly after frosts and freezing periods.

Note: Lesikar can be contacted at (979) 845-7453 or b-lesikar@tamu.edu. Weaver can be reached at (979) 845-5323 or rw-weaver@tamu.edu. Weaver published a paper about this project, "Improvement of Domestic Wastewater Quality by Subsurface Flow Constructed Wetlands," that was published in *Bioresource Technology* in 2000. Contact TWRI at (979) 845-8571 or at twri@twri.tamu.edu and we will send you a copy.

TOWTRC Proceedings Are Now on the WWW

Two proceedings from annual conferences of the Texas Onsite Wastewater Treatment Research Council (TOWTRC) have been scanned in and put on the World Wide Web. As part of a project to update and redo the Council's WWW site, Ric Jensen of the Texas Water Resources Institute (TWRI) is leading efforts to place

the full-text of all TOWTRC conferences on the web. So far, the proceedings from the 1993 and 1998 conferences have been posted. The proceedings can be accessed in standard html web format and as an Adobe Acrobat pdf file. The proceedings are on the Council's WWW site, <http://towtrc.tamu.edu>.