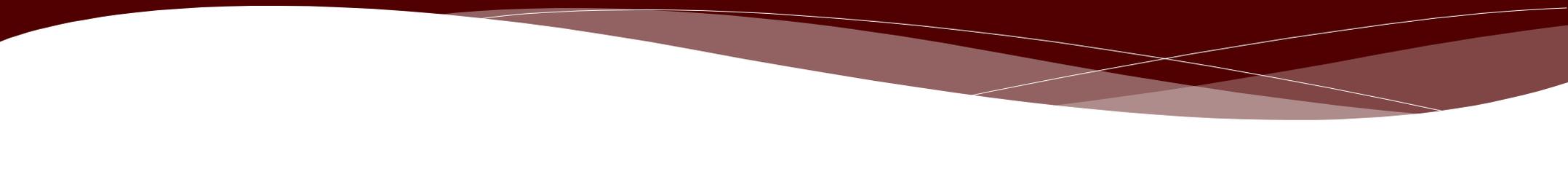




Introduction to Onsite Wastewater Treatment

Ryan Gerlich
Program Specialist
Texas AgriLife Extension Service

TEXAS A&M
AGRILIFE
EXTENSION





Overview

- ⌘ What is an On Site Sewage Facility (OSSF)?
- ⌘ Why are we concerned about wastewater?
- ⌘ Evolution of onsite wastewater treatment
- ⌘ Identifying OSSF issues
- ⌘ Addressing OSSF issues
- ⌘ Education and outreach





Onsite wastewater treatment system





Onsite wastewater treatment systems?

- ⌘ Rural and Exurban wastewater infrastructure
- ⌘ Water Quality Protection
- ⌘ 25 - 40%, Wastewater Infrastructure

- ⌘ What is the system called?
 - ⦿ OWTS – Onsite Wastewater Treatment System; Nationally
 - ⦿ OSSF – On-Site Sewage Facility; Texas
 - ⦿ Septic System





Permitting wastewater treatment systems in Texas

- ⌘ Texas Commission on Environmental Quality (TCEQ), Chapter 285, 5000 gallons per day or less
 - Local Authorized Agent – Usually local Health Department
 - TCEQ Regional Office

- ⌘ TCEQ, Chapter 217, Greater than 5000 gallons per day.



Malfunctioning onsite system





Evolution of wastewater treatment goals

- ⊗ From outdoor plumbing to water reuse
- ⊗ We need to review the history to understand the present



Outdoor plumbing: the pit privy

- ✘ Goal: designated place
- ✘ No carrier needed to convey waste
- ✘ Waste applied directly to the soil
- ✘ Public health concerns addressed
- ✘ Management: relocate





Indoor plumbing

- ⌘ Convenience
- ⌘ Water carrier to convey waste out of facility
- ⌘ 'Collection system'
- ⌘ Public health and pathogens
- ⌘ Management: keep pipe flowing



Disposal

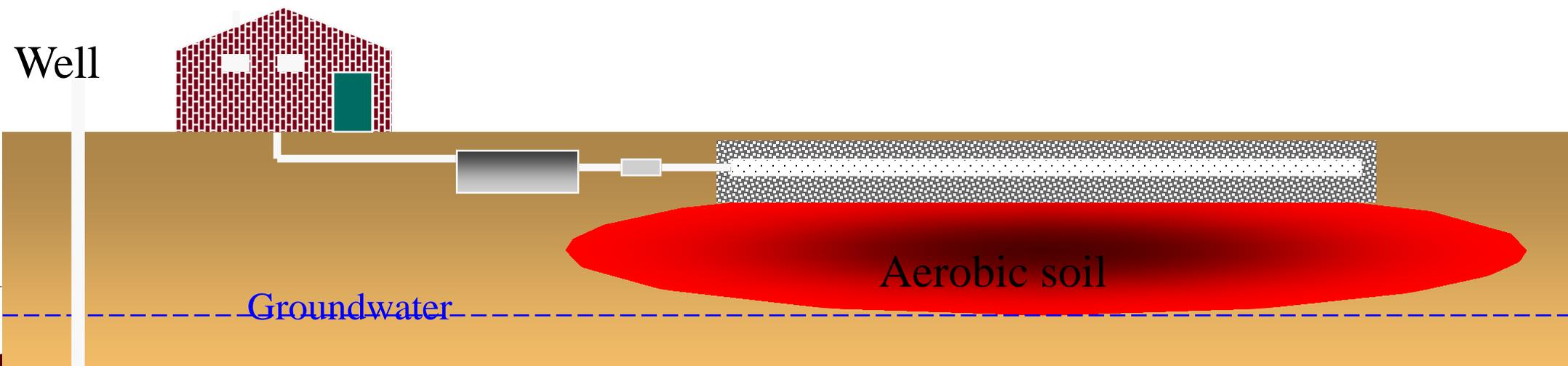
- ⌘ Goal: limit human contact
- ⌘ Keep wastewater below ground
- ⌘ Disposal options
- ⌘ Public health
 - ⦿ “Disposing” of pathogens
 - ⦿ Treatment?
- ⌘ Environment: groundwater contamination
- ⌘ Management: install, flush and forget





Septic tank & soil treatment area

- ⊗ Evolving goal:
 - ⊙ Disposal: effluent goes away versus treatment
 - ⊙ Dispersal: TREATMENT
- ⊗ Public health AND environmental issues addressed
- ⊗ Management:
 - ⊙ Disposal: often no management at all
 - ⊙ Dispersal: system management is critical





Goal: Treatment and Dispersal

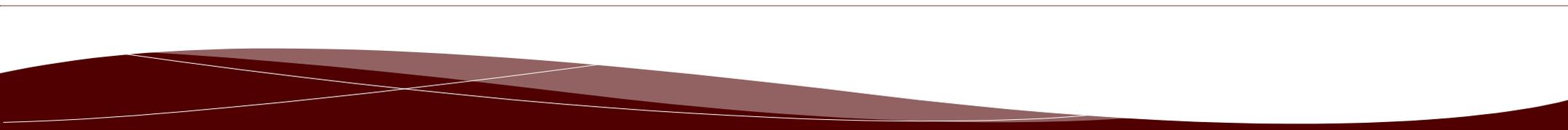
- ⌘ Starting to address both environmental concerns in addition to public health concerns
 - ⦿ TMDL Program
 - ⦿ CZMP Program
 - ⦿ Watershed Protection Plans
- ⌘ Technological advancements now allow removal of:
 - ⦿ Pathogens
 - ⦿ Solids
 - ⦿ Nutrients
- ⌘ System management is vital to treatment
- ⌘ Goal is now DISPERSAL
 - ⦿ Hydrologic cycle



Changes in goals means:

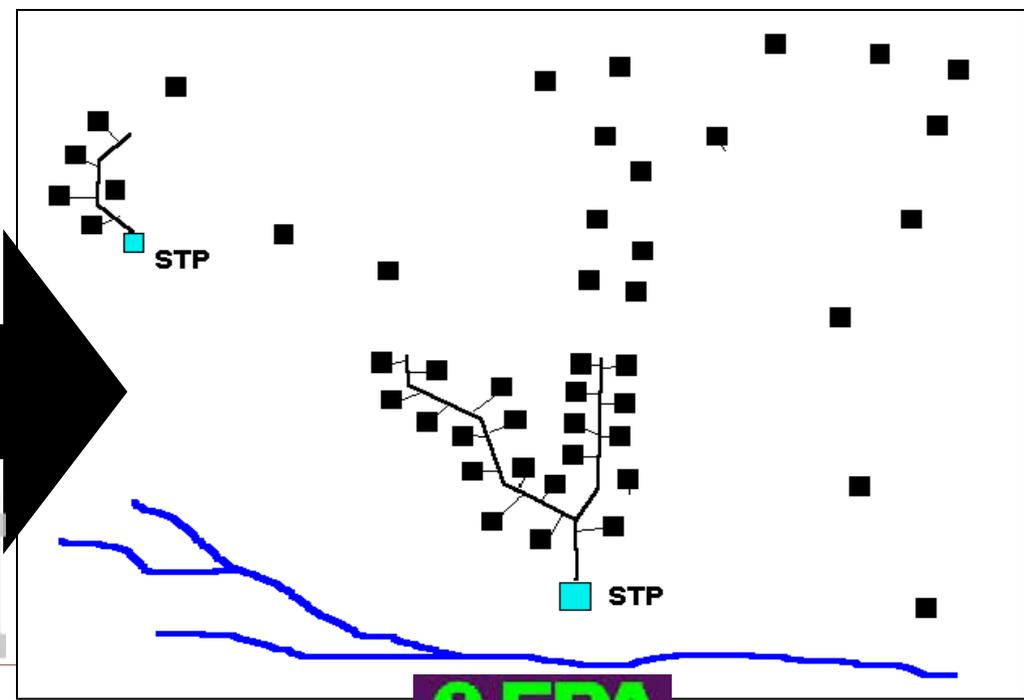
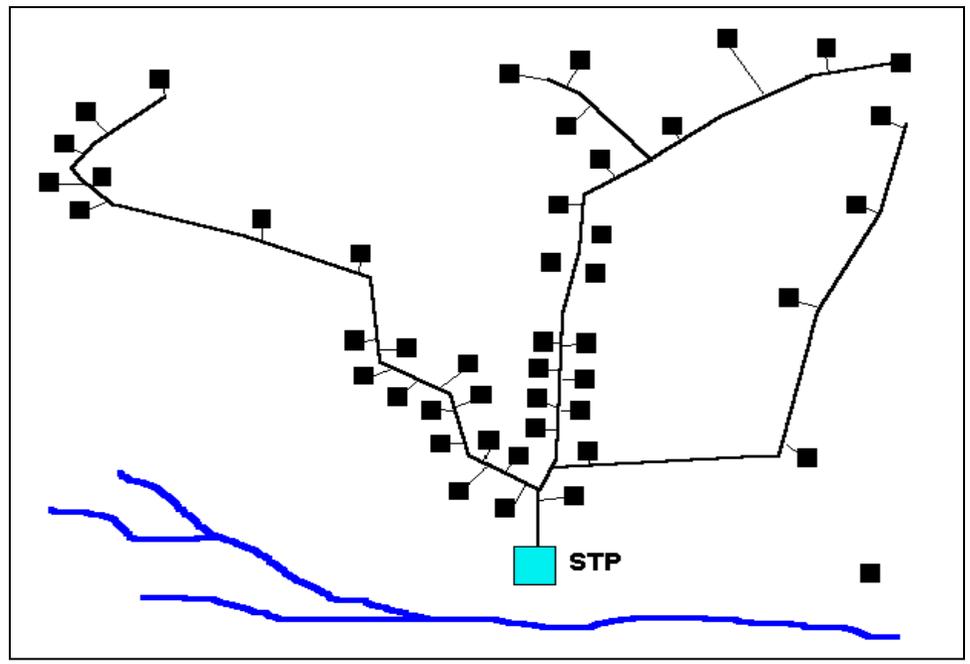
- ⌘ Approach must also change
 - Siting requirements
 - Choice of treatment components and systems
 - System O&M
 - Management program
- ⌘ Public acceptance of change
- ⌘ Public willing to pay for additional service, \$\$\$
- ⌘ Enforcement on participants not willing to change – public will to support enforcement

Education





Decentralized Approach

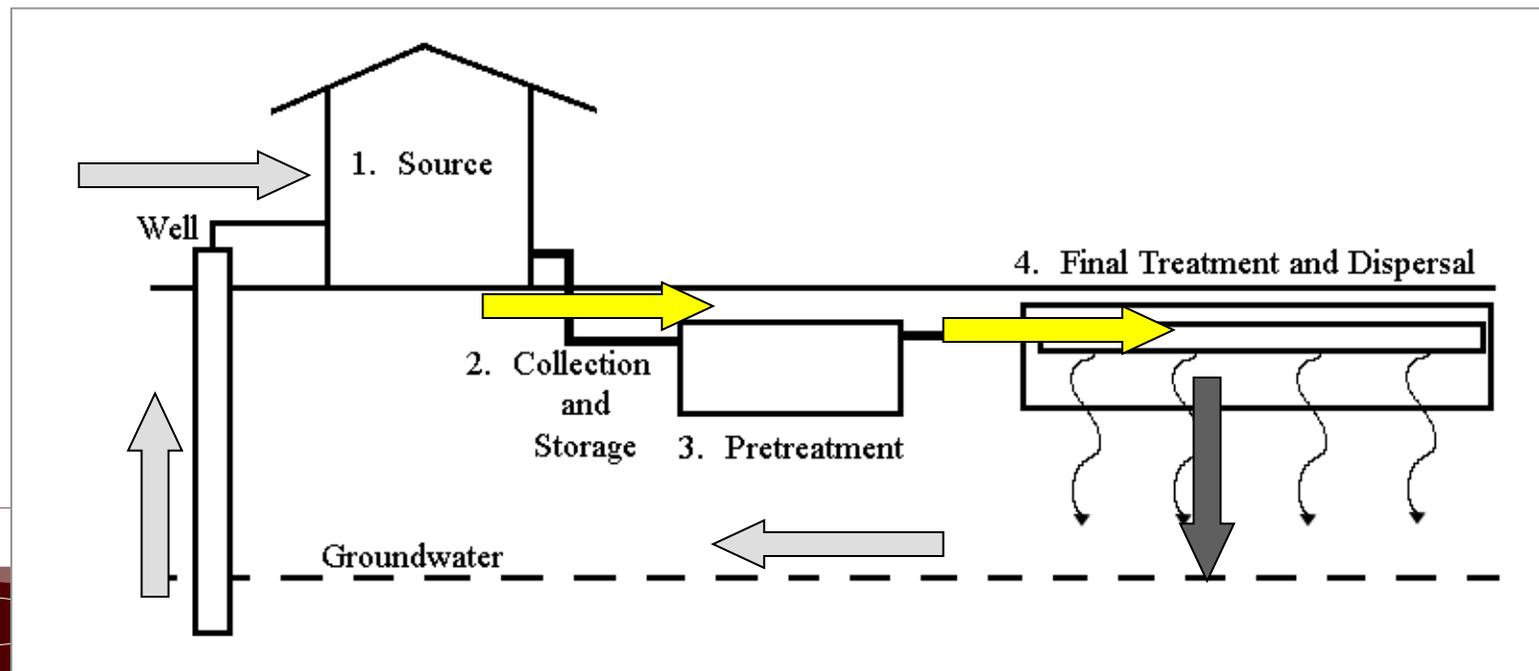


Distributed Management



What is an onsite wastewater treatment system?

1. Wastewater source
2. Collection and storage
3. Pretreatment components
4. Final treatment and dispersal components



Wastewater source



- ✘ Facility type
 - Domestic
 - Commercial

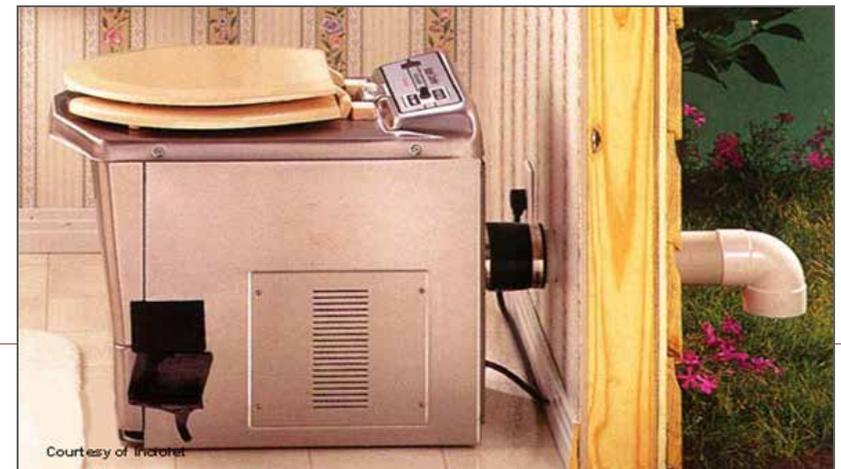
- ✘ User
 - Owner/family
 - Employees



Collection

- ⌘ Piping from facility with cleanout
 - Blackwater
 - Graywater

- ⌘ Collection Options
 - Holding tanks
 - Composting toilets
 - Incinerating toilets



Pretreatment

- ⊗ Pre-treating waste before it reaches the soil
 - ⦿ Septic tanks
 - ⦿ Aerobic treatment units
 - ⦿ Media filters
 - ⦿ Constructed wetlands
 - ⦿ Disinfection



Final treatment and dispersal

- ⌘ Final treatment occurs in the soil
 - ⦿ Conventional trench or bed distribution
 - ⦿ Low pressure distribution
 - ⦿ Drip field
 - ⦿ Spray field
 - ⦿ Evapotranspiration beds



How do we make the OSSF work?



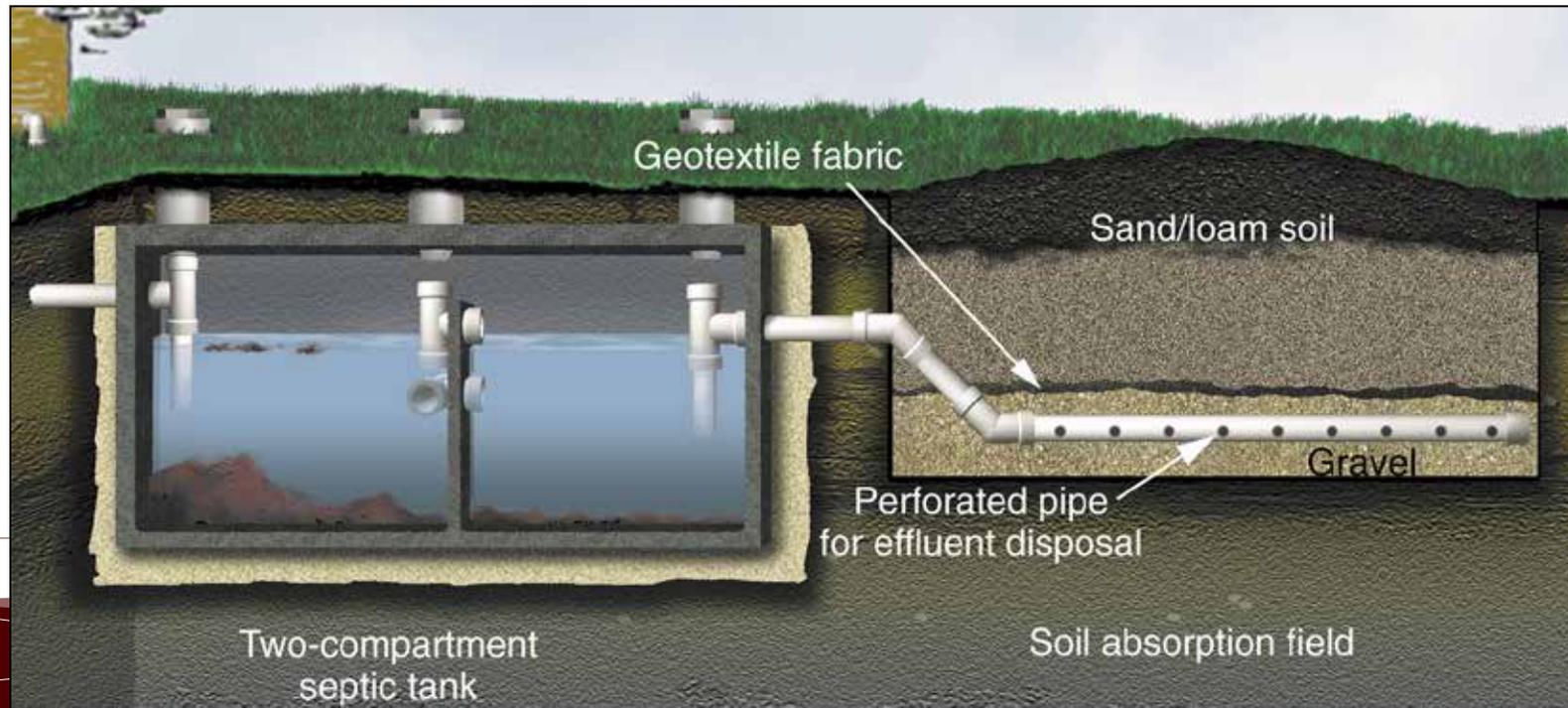
- ✘ Evaluate the wastewater source:
 - Hydraulic and organic loading
- ✘ Evaluate site
 - Wastewater treatment
 - Wastewater acceptance
- ✘ Choose a final treatment and dispersal component
- ✘ Choose the appropriate pretreatment system
- ✘ Operation and maintenance



What quality do you desire?

Pretreatment

- ⊗ Primary treatment
 - ⦿ Gross solids removed
 - ⦿ Septic Tank / Trash Tank
 - ⦿ Effluent screen
- ⊗ A properly operating septic tank can remove
 - ⦿ 30 - 40% BOD
 - ⦿ 60 – 70% TSS





What quality do you desire?

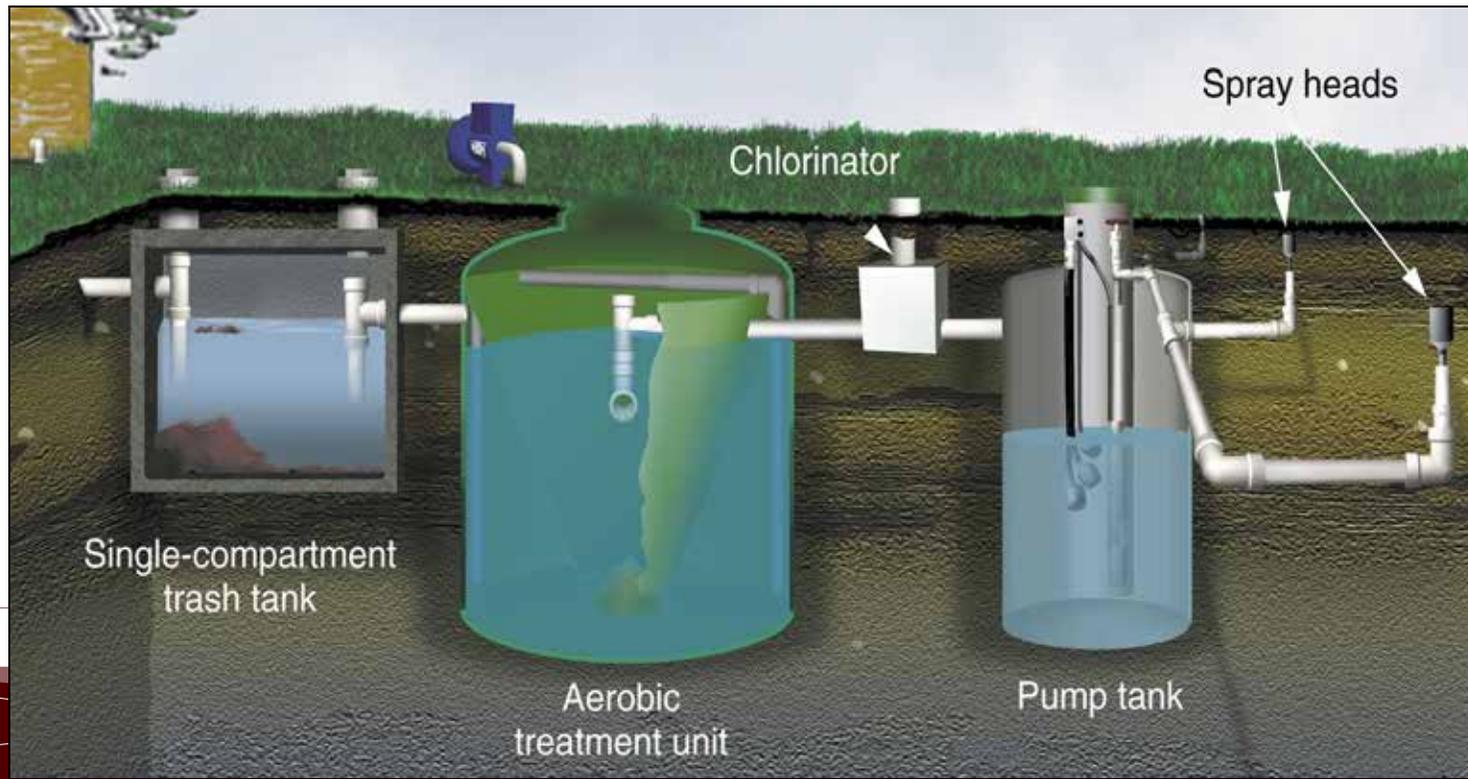
Advance pretreatment

⊗ Secondary treatment

- ⊙ Aeration, media filters, sand filter

⊗ Removal of:

- ⊙ 85 – 98% BOD
- ⊙ 85 – 98% TSS



Advance pretreatment

- ⌘ Disinfection
 - ⦿ Chlorine
 - ⦿ Ultraviolet Light
 - ⦿ Ozone
 - ⦿ **NOT Sterilization!**

- ⌘ Tertiary treatment
 - ⦿ Nitrogen and phosphorous removal





Water quality – spray field

- ⌘ High potential for human contact
- ⌘ This is effluent – ***NOT DRINKING WATER!!!!***
- ⌘ Soil microbes are the final treatment!
- ⌘ A healthy cover crop is essential for the system to function properly.
 - ⦿ Take up water and nutrients
 - ⦿ Stabilize the soil and prevent erosion
 - ⦿ Provide food and habitat for beneficial soil organisms



Roles with septic system management

- ✘ Site evaluation
- ✘ Design
- ✘ Installation
- ✘ Startup
- ✘ Inspection
- ✘ Operation
- ✘ Maintenance
- ✘ Monitoring
- ✘ Pumping



Site evaluation

- ⌘ Comprehensive evaluation of soil and site conditions for a given land use.
 - ⦿ Wastewater treatment
 - ⦿ Wastewater acceptance



***Licensed OSSF Site
Evaluator,
Professional Engineer***



Design

- ⊗ The process of selecting, sizing, locating, specifying and configuring treatment train components that match site characteristics and facility use, as well as creating the associated written documentation.
- ⊗ A design is also the written documentation of size, location, specification, and configuration.

***Professional Engineer,
Registered Sanitarian***



Installation

- ⊗ The assembly and placement of components of a system, including final grading and establishment of an appropriate cover
- ⊗ Startup

Licensed OSSF Installer I

or

OSSF Installer II



Inspection

- ✧ The evaluation of and reporting on the status of a wastewater treatment system

Designated Representative

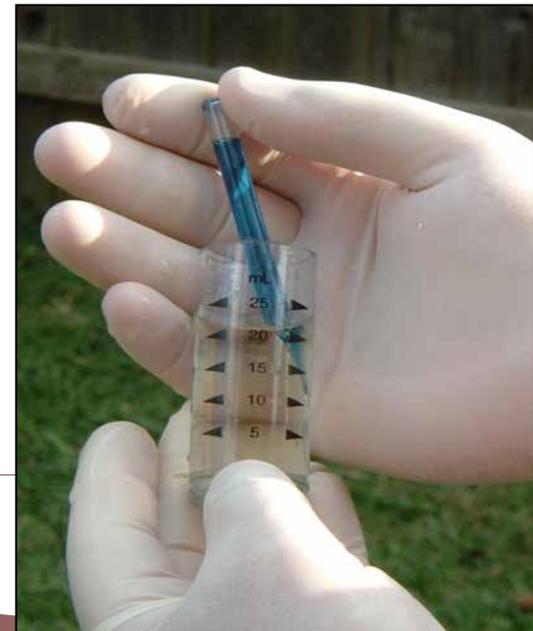




Operation and maintenance

- ⌘ Operation
 - ⦿ Assessing whether each component of the system is functioning properly
- ⌘ Maintenance
 - ⦿ taking care of the pieces
- ⌘ Monitoring
 - ⦿ verifying performance for a regulatory authority or a manufacturer

***OSSF Maintenance Provider /
Technician***



Pumping

- ⌘ The action of removing septage from a wastewater treatment system component
- ⌘ Necessary to prevent accumulated solids from moving into downstream components
 - Drain fields
 - Pumps
- ⌘ TCEQ Registered Sludge Transporter

Pumper



OSSF issues in your watershed

- ✘ Identifying issues
 - Reconnaissance
 - Voluntary inspections

- ✘ Addressing issues
 - Homeowner education
 - Replacement / upgrades



Identifying issues

- ✘ Consult local Authorized Agent
 - Permit records - age and location of systems
 - Complaints history
- ✘ Soil types and water table
- ✘ Separation distances
 - Wells
 - Property lines
 - Surface water
- ✘ 1990 Census Data
- ✘ Reconnaissance
- ✘ Inspections



Reconnaissance





OSSF inspections

- ✘ Voluntary inspections
- ✘ Visual inspection of septic tank
- ✘ Operational status of the system
- ✘ Participants receive:
 - Free system pump out
 - Visual inspection of the septic tank
 - Report of operational status
 - A better understanding of OSSF operation and maintenance
 - Suggestions to improve accessibility





Accessibility issues

- ⊗ Accessibility = ease of maintenance
 - ⦿ Depth of installation
 - ⦿ Inspection ports & risers
 - ⦿ Encroachment





Safety concerns



Point of sale inspection

- ⊗ Inspect the treatment system at the time of property sale.
- ⊗ Chance to upgrade the wastewater treatment system if needed.
- ⊗ Must have trained professionals.
- ⊗ No licensing in Texas for this person.

Good time to fix problems!



Homeowner education

- ✘ Address homeowners' FAQs
 - ✘ How do you live with an OSSF?
 - 1st home with an OSSF?
 - Maintenance requirements

- ✘ Education and outreach
 - Classes
 - Website
 - Factsheets, publications, & manuals

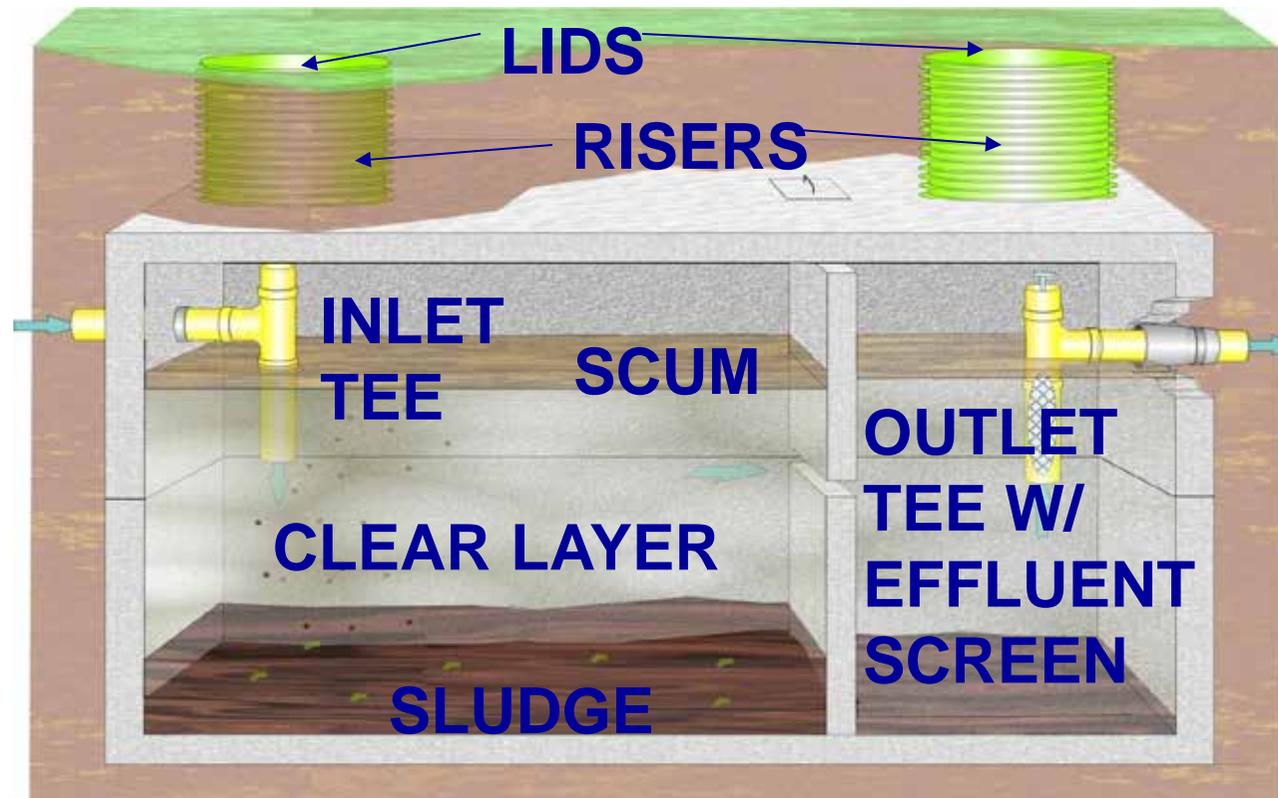


Early plumbers

Homeowner FAQs

What is a Septic Tank?

- ⊗ Water tight containers
 - ⦿ Concrete
 - ⦿ Plastic/ Fiberglass
- ⊗ Gravity separation/ detention time
 - ⦿ Typically 2-3 days
 - ⦿ Heavy sinks
 - ⦿ Lighter floats
- ⊗ Calm conditions
- ⊗ Anaerobic digestion





Septic system additives

- ⊗ Not been proven to be beneficial to system performance
- ⊗ Not recommended
- ⊗ Break up particles that are settled at the bottom and make them suspended
- ⊗ Potential solids loading to downstream components



Kitchen

⌘ Dishwasher

- Hydraulic surges of wastewater
 - Space out loads
- Organic load
 - Clean/scrape plates

⌘ Garbage Disposal

- Increases scum by 20%
- Pumping required 1-2 years sooner
- Organic matter had not been digested, so it will take longer to break down
- Small particles take longer to settle





Fats, oils and grease

Constituent	State at room temperature	Comments
Fats	Solid	Non-toxic to the system, origin – animals, will separate in water
Oils	Liquid	Non-toxic to the system, origin – plants, trouble separating in water
Grease	Solid	Residual material on appliances; solid material on pans/equipment; petroleum products; moisturizers; bath oils; tanning oils; toxic to the wastewater system

Room temperature assumes 74 degrees F

A degreaser will move all components through a system



Laundry

- ⌘ Use should be spread out
 - Returning from vacation

- ⌘ Liquid soap is recommended
 - Use less
 - Remove risk of fillers in powders

- ⌘ Install High Efficiency appliances



Bathroom fixtures

- ⌘ Garden tubs
 - ⦿ Use large volumes of water
 - ⦿ Add hydraulic surges
 - ⦿ How often it is used?
- ⌘ Multi-head showers
- ⌘ No every-use shower cleaner





Toilet

- ⌘ Only urine, feces, soap, toilet paper and limited amounts of cleaner should be going down drain
- ⌘ No feminine products, prophylactics, cigarette butts, etc.
- ⌘ No every-flush toilet bowl sanitizers

Septic Safe?



Toilet paper

- ⌘ Excessive use results in faster sludge build up
- ⌘ Treated toilet paper (with lotions) prevents paper from settling
- ⌘ Wet wipe disposal is discouraged





Prescription drugs & antibiotics

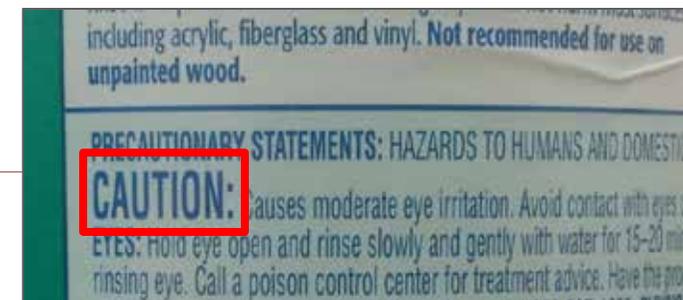
- ⌘ Can kill microbes living in system
 - ⦿ Won't discriminate against organisms living in the system
- ⌘ Additional treatment components may be necessary
- ⌘ Increase maintenance
- ⌘ Do not pour unused medicines down the drain





Cleaning products

- ⊗ Cumulative effects on system performance
- ⊗ Look at Labels!
 - ∅ **DANGER**: Means the chemical will kill the bacteria, and its use should be minimized or eliminated.
 - ∅ **WARNING**: Means limited use should have a minimal impact on the system.
 - ∅ **CAUTION**: Typically means the product will have little effect.





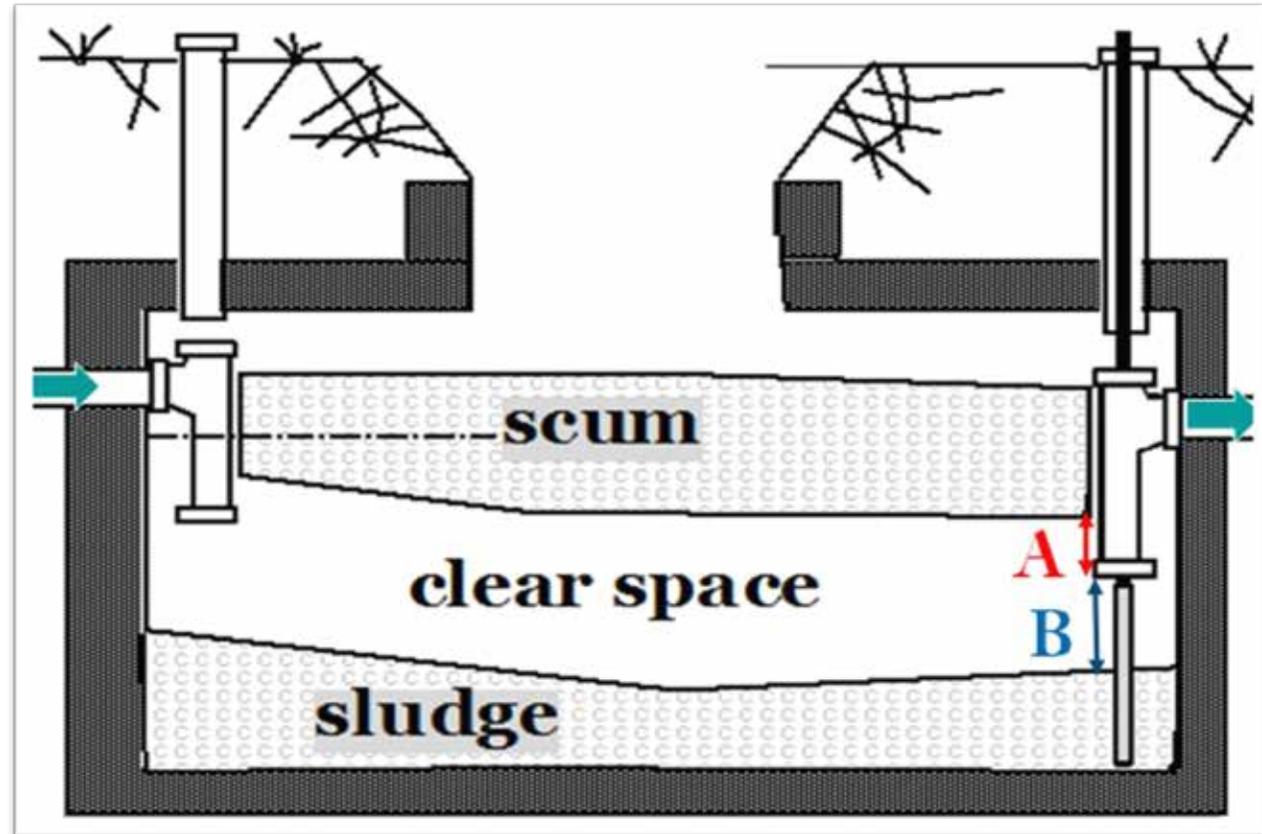
Drain cleaner

- ⊗ Toxic drain cleaners can impact ability to properly treat wastewater
- ⊗ Affect bacteria activity



Septic tank pumping recommended?

- ⊗ Should be pumped when total solids reach 25-33% of tank capacity.
 - ⊙ If 'A' is less than 3"
 - ⊙ If 'B' is less than 12"
- ⊗ Typically required every 3 to 5 years
- ⊗ Pump during dry seasons to reduce the risk of tank floatation



Measuring solids



Scum Layer

Clear Layer

Sludge Layer



??

Septic tank pumping recommended?

Tank Size (gals)	Household Size (Number of People)									
	1	2	3	4	5	6	7	8	9	10
500	5.8	2.6	1.5	1.0	0.7	0.4	0.3	0.2	0.1	—
750	9.1	4.2	2.6	1.8	1.3	1.0	0.7	0.6	0.4	0.3
1,000	12.4	5.9	3.7	2.6	2.0	1.5	1.2	1.0	0.8	0.7
1,250		7.5	4.8	3.4	2.6	2.0	1.7	1.4	1.2	1.0
1,500		9.1	5.9	4.2	3.3	2.6	2.1	1.8	1.5	1.3
1,750			6.9	5.0	3.9	3.1	2.6	2.2	1.9	1.6
2,000			8.0	5.9	4.5	3.7	3.1	2.6	2.2	2.0
2,250				6.7	5.2	4.2	3.5	3.0	2.6	2.3
2,500					5.9	4.8	4.0	4.0	3.0	2.6

Note: More frequent pumping needed if a garbage disposal is used.

Education & outreach: Publications

- ⊗ Operation and Maintenance
- ⊗ Siting requirements
- ⊗ Various OSSF technologies
- ⊗ 20 publications available in Spanish

AgriLIFE EXTENSION
Texas A&M System

B-6377
01/10

On-site wastewater treatment systems

Gravelly fabric
Sand layer
Perforated pipe for effluent disposal
Two-compartment septic tank
Soil absorption field

Figure 1: A septic tank and soil absorption field system.

Selecting and permitting

Bruce Lesikar
Regional Agricultural Engineer
The Texas A&M University System

About 30,000 on-site wastewater treatment systems are installed annually in Texas to treat wastewater from rural and suburban homes as well as from small businesses. An on-site wastewater treatment system collects, treats and applies wastewater to the soil.

By definition, wastewater managed by an on-site system cannot leave the property where it is generated. The water can evaporate into the air, seep through pipes or seep through the soil as groundwater. An effective on-site system removes wastewater from the home, treats and distributes the wastewater and prevents raw water evaporation.

Selecting the appropriate system for the site conditions is critical to the system's success. If you select the wrong system or design, or install, operate or maintain the system improperly, it can fail, which could result in pollution of your property and that of others. You must also be aware of state regulations and permitting for conducting or contracting for maintenance of a system, they should be involved in selecting the technology, or type of system used.

State regulations

In 1987, the Texas legislature passed a law (108-1175) to regulate on-site sewage facility (OSSF) systems statewide. The law called for regional and local governments — such as counties, cities, river authorities and special districts — to implement and enforce on-site sewage regulations with approval and oversight by the Texas Commission on Environmental Quality (TCEQ).

*Extension Agricultural Engineer for Biological and Agricultural Engineering, Editor and Extension Communications Specialist, Extension Program Specialist and Extension Assistant, The Texas A&M University System

AgriLIFE EXTENSION
Texas A&M System

B-6234
01/10

Living with an Aerobic Treatment Unit and Spray Field

Bruce J. Lesikar, Diane Brown, Justin Mitchell, and Ryan Gerlich*

If you own an aerobic treatment unit and spray field, you are required by law to make sure that your system is treating wastewater adequately.

In do this, you can either contract with a company to conduct the required system inspections, wastewater tests, and report completion and submit to local governmental agencies, or you can do the work yourself.

For both options, you'll need to know the components of your wastewater system and understand how they work. Basic information about aerobic systems is given in these Texas AgriLife Extension Service On-site Wastewater Treatment Systems series.

- Aerobic Treatment Unit
- Inlet Chlorination
- Liquid Chlorination
- Ultraviolet Light Disinfection
- Pump Tank
- Spray Distribution System

These publications are available on the Web at <http://agrilifebooks.tamu.edu>.

You also need to know the basics of aerobic systems inspection and their maintenance. For information on general on-site wastewater treatment systems, see Extension publications On-site Wastewater Treatment Systems: Operation and Maintenance and Understanding and Maintaining Two Types Systems.

And unless you don't mind repairing and replacing it often or having system backups, you'll need to adopt beneficial practices that will protect and prolong the life of your system.

Performing the work yourself

An advantage of doing the inspecting, testing, and reporting work is saving money. You also can be certain that the work has been done properly and the reports are filed on time. However, if you conduct the work yourself, you will need to:

- Get informed. To maintain an aerobic, onsite wastewater treatment system properly, you must have extensive knowledge. This knowledge can help prevent injury to yourself, other people, the system components, and the environment. Obtain the manufacturer's literature describing system components and the particular maintenance practices from the company's Web site. For a list of sources for maintenance providers on maintaining aerobic systems, see the Texas Commission on Environmental Quality (TCEQ) Web site at <http://www.tceq.texas.gov>. For a listing of centers offered through the Texas AgriLife Extension Service, see the Wastewater Treatment and Reuse Web site at <http://www.tamu.edu>.

AgriLIFE EXTENSION
Texas A&M System

L-5234S
7-09

Sistemas individuales para el tratamiento de aguas negras

Tubo perforado
Suelo absorbente/drenaje
Tubo perforado para distribuir aguas residuales
Fosa séptica de dos compartimentos
Campo de absorción

Figure 1: Una fosa séptica y sistema de campo de absorción.

Fosa séptica convencional/campo de drenaje

Bruce Lesikar and Juan Enciso
Extension Agricultural Engineering Specialists
The Texas A&M University System

El sistema de fosa séptica convencional ha sido la tecnología más comúnmente utilizada para el tratamiento de aguas negras. Este sistema utiliza la gravedad para tratar y distribuir las aguas negras en el suelo. Las fosas sépticas son económicas y requieren de un mantenimiento mínimo, el cual generalmente se limita al bombeo periódico del tanque séptico.

Un sistema séptico convencional de distribución puede ser uno de los tipos de tanques o un tanque con subdistribución. Este consiste en fosa séptica de grava, cámara de flotación o cámara de distribución. Los tanques sépticos son utilizados para recibir las aguas negras y tratar parcialmente las aguas negras antes de que lleguen al sistema de distribución. El sistema de distribución puede ser uno de los tipos de campo de drenaje subterráneo. Este consiste en fosa séptica de grava, cámara de flotación o cámara de distribución. Los tanques sépticos son utilizados para recibir las aguas negras y tratar parcialmente las aguas negras antes de que lleguen al sistema de distribución. El sistema de distribución puede ser uno de los tipos de campo de drenaje subterráneo. Este consiste en fosa séptica de grava, cámara de flotación o cámara de distribución. Los tanques sépticos son utilizados para recibir las aguas negras y tratar parcialmente las aguas negras antes de que lleguen al sistema de distribución.

Education & outreach: Workshops

- ✘ Intro to Septic Systems
 - 2 hour class
 - PowerPoint with visual aids

- ✘ Homeowner Maintenance of ATUs
 - 6 hour class
 - Manual: “Checking my Aerobic System”



Workshop results

- ✘ Intro to Septic Systems
 - March 29, 2012 La Marque, TX
 - 6:30pm to 8:30pm
 - 21 attendees

- ✘ Survey
 - Level of understanding
 - Plans to adopt

**Texas A&M AgriLife Extension Service
Participant Survey**

Your views on the quality and effectiveness of Extension programs are extremely important. Please take a few minutes to tell us about your experience with this activity. Your answers to the following questions will help us better meet your needs. Please do not write your name on this form so that your responses are anonymous. Thank you!

MARKING INSTRUCTIONS
CORRECT: ● INCORRECT: ☒ ☓ ☐ ☑

1. For each item listed below, mark the ONE number in the left column that best describes your level of understanding **BEFORE** the program; and then mark the ONE number in the right column that best describes your level of understanding **AFTER** the program.

	Poor				Fair				Good				Excellent			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Your understanding of . . .																
Understanding of how septic systems are a part of our wastewater infrastructure.	<input type="radio"/>															
Understanding of how practices in the home affect sewage characteristics.	<input type="radio"/>															
Understanding of septic tank operation and maintenance criteria.	<input type="radio"/>															
Understanding of how soil treats sewage.	<input type="radio"/>															
Understanding of how aerobic treatment units remove waste from sewage.	<input type="radio"/>															
Understanding of how a malfunctions septic system can impact water quality.	<input type="radio"/>															
Importance of proper septic system operation for protection of public health.	<input type="radio"/>															
	<input type="radio"/>															
	<input type="radio"/>															
	<input type="radio"/>															

2. Please indicate your intentions to adopt each item listed below or indicate if you have already adopted the item listed or if it does not apply to your situation.

Practice or technology that could be adopted . . .	Definitely Will Not	Probably Will Not	Undecided	Probably Will	Definitely Will	Already Adopted	Not Applicable
	1	2	3	4	5	6	7
Implement water conservation practices to limit water to the septic system	<input type="radio"/>						
Limit organic loading to the septic system	<input type="radio"/>						
Perform operation and maintenance activities on my septic system	<input type="radio"/>						
Pump out my septic tank as needed	<input type="radio"/>						
	<input type="radio"/>						
	<input type="radio"/>						
	<input type="radio"/>						
	<input type="radio"/>						

63639

Please continue on the other side

Workshop results

- ⌘ Percent of respondents who increased their understanding of . . .
 - ⦿ (94%) – how septic systems are a part of our wastewater infrastructure
 - ⦿ (88%) – how practices in the home affect sewage characteristics
 - ⦿ (94%) – septic tank operation and maintenance criteria
 - ⦿ (71%) – how a malfunctioning septic system can impact water quality

- ⌘ Percent of respondents who definitely will adopt the following practices
 - ⦿ (59%) – Perform operation and maintenance activities on my septic system
 - ⦿ (76%) – Pump out my septic tank as needed

Summary

- ⌘ OSSFs will play a vital role in our future infrastructure needs.
- ⌘ Environmental regulations will continue to be more stringent.
- ⌘ A site evaluation is critical to determining the potential for a site to treat wastewater.
- ⌘ Advanced pretreatment and final treatment and dispersal technologies are available for most situations.
- ⌘ Operation and maintenance is critical for long-term function
- ⌘ Identifying and addressing OSSF issues

Thank you

Ryan Gerlich

Office # 979-458-4185

RAGerlich@ag.tamu.edu

<http://ossf.tamu.edu/>

On-Site Sewage Facilities (OSSF)

OSSF Basics Events Contact Publications

Operation and Maintenance

Onsite Wastewater Treatment and Reuse

Our Mission:

To provide information on the technologies available for managing wastewater so that people can make informed decisions when selecting, operating, and maintaining their onsite wastewater treatment systems.

- OVERVIEW
- Onsite Wastewater Treatment Systems (OWTS)
- Wastewater Source (Homeowners)
- Collection and Storage
- Pre-treatment Components
- Advanced Pre-treatment Components
- Disinfection
- Final Treatment and Disposal
- Siting and Permitting
- Operation and Maintenance
- EDUCATIONAL MATERIALS
- ADDITIONAL RESOURCES

News & Updates

Two-Hour Seminar Maintenance of Septic Systems done in La Marque, TX, March 29, 2015, 6:30pm - 8:30pm