Troubleshooting Soil Treatment Areas (STA)

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NOWRA Troubleshooting Track
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Acknowledgements:

- Dr. Dennis Sievers
- Kyle Shern, Installer
- Many other onsite wastewater professionals
Every Treatment Train is Essentially Unique!
(Covered in Previous Presentations)

• Must be appropriate for the wastewater flow and strength.

• The sequencing and ordering of the components are critical.

• The performance of each component has a strong influence on each component downstream.
Troubleshooting

• Every component of a TT performs one or more of these three processes.

• Always ask, “IS THIS A PHYSICAL, BIOLOGICAL OR CHEMICAL PROBLEM?”
Processes of Wastewater Treatment

- **Physical**
  - Filtration
  - Dispersion
  - Dilution
  - Separation

- **Chemical**
  - Adsorption
  - Ion-exchange

- **Biological**
  - Anaerobic
  - Aerobic
  - Predation
  - Disinfection
AND REMEMBER:

People will flush any thing and every thing down the system as well as perform other modifications around the system!!!!!! (and deny it!)
Troubleshooting

• Troubleshooting is a systematic means of identifying problems in small onsite wastewater treatment systems.

• The 8-step procedure, outlined here, can help find and correct most system malfunctions.
Troubleshooting Basics

1. NEVER take anything for granted
2. A problem cannot be solved until it is IDENTIFIED
3. GATHER AS MUCH INFORMATION AS POSSIBLE: What is supposed to happen, operate, and so forth when this component is working properly? What is it doing now?
4. EXAMINE ALL OTHER FACTORS: Make a visual inspection of the area. What unusual things are happening now? What should be happening under normal operation?
5. **ANALYZE WHAT YOU KNOW:** What part of the system is working correctly? Is this a mechanical failure, electrical failure or is the soil contributing to failure?

6. **USE FLOW CHARTS TO IDENTIFY POTENTIAL PROBLEMS:** All potential problems may not be the real problem. Look for interactions.
Troubleshooting Basics

7. PINPOINT THE CAUSE OF THE PROBLEM: Exactly where is the problem and what is causing it.

8. RECOMMEND REPAIRS TO ELIMINATE THE CAUSE: Not only repair the cause, but suggest any other changes that may help prevent problems in the future.
Nine Step Troubleshooting Procedure (Conventional System)

1st Step: Find the permit

Locate permits, approval forms, system design, and system set up, including STA line lengths and depths, pressure head, pump delivery rate and other factors
2nd Step: Determine the nature of the observation

Is it...

• Surface discharge (over septic tank, pump tank, D-box, or drainfield)?
• Backing up into the house?
• Slow-draining house fixtures?
• Ground water contamination?
2nd Step: Determine the nature of the problem

Is it..

• Seasonal "wet weather" or continuous problem?
• Flowing sewage or small wet spot
• Immediate failure or failing after a number of years of operation?
3rd Step: Determine the wastewater flow

• Check permit for design flow.
• Determine water consumption and actual flow into the system, which are not the same.
• If meters are available, check water bills or check meter yourself over a month.
Determine flow

What is the difference between actual flow into the system and water consumption?
3rd Step: Determine the wastewater flow

• Is there an abrupt increase in flow and what is the flow pattern? The flow may be coming from leaking plumbing, added appliances, or changing water use habits in the home.
3rd Step: Determine the wastewater flow

• Excess flow may be from a purposeful addition such as a sump pump, rain spouts, foundation drains, a heat pump, water softener, a swimming pool, an ice machine, industrial waste, commercial water, or floor drains.
Wastewater flow

What about “Shower Tunnels” or Jacuzzis??
4th Step: Observe the topography and surrounding properties

- Observe topography and surrounding properties, including:
  - Density of development. Lot size and the shape of the property may influence what can be done to repair the problem.
  - Performance of surrounding systems.
4th Step: Observe the topography and surrounding properties

- House location relative to the system. Water from gutter drains, patios, driveways and roofs may cause wet weather problems.
4th Step: Observe the topography and surrounding properties

- *Location and types of trees near the system.* Tree roots may cause clogging in conventional systems and hole clogging in low pressure pipe systems.
- Check for saturation in trenches in front of and behind the tree.
Trees

TRENCH

TREE

TRENCH
Trees in distribution field

- Roots will
  - Grow into tank risers
  - Clog conventional and LPP/LPD system drainfields
  - Damage components
4th Step: Observe the topography and surrounding properties

- Undesirable tree species include willow, willow (water) oak, elm, tulip poplar, some maples, and sweet gum.
- These trees should be cut off and their stumps treated.
- Hickory, white oak, dogwood and sourwood trees could be left.
4th Step: Observe the topography and surrounding properties. *Cut areas.* Is the system installed in an excavation area? Are cut areas down slope of the system?
5th Step: Evaluate soil properties

• *Determine soil properties.* Are the soil properties at the system likely to be the cause the problem?
• What other soil conditions exist on other areas of the lot?
• *Use information from soil evaluation or a new evaluation to determine if site can be used for repair installation.*
5th Step: Evaluate soil properties

- *Determine the particular loading rate for the soils.* This is a function of soil depth, soil texture, soil structure, soil wetness, morphologic properties, trench bottom depth, abrupt textural changes in profile.
5th Step: Evaluate soil properties

• The appropriate loading rate and area needed will depend on the LTAR at the trench bottom, the rate of water flow through the most slowly permeable underlying soil horizon and the linear loading rate that the site can handle without surface discharge.
5th Step: Evaluate soil properties
5th Step: Evaluate soil properties
Lateral Flow
Lateral Flow

- **Q, gpd/ft^2**
- **CLASS III SOIL DEPTH**
- **SATURATED SOIL**
- **RESTRICTIVE LAYER - IVb CLAY, CLAYPAN, FRAGIPAN, etc.**
- **ACCUMULATING LATERAL FLOW**
Linear Flow Rate

The question becomes – “How fast will the water move away from the trench bottom and down slope? Can we estimate that rate?”
Linear Loading Rate (LLR)

LLR: Amount of wastewater applied daily along the landscape contour. It is expressed in gallons per day per linear foot along the contour (gpd/ft of contour).

J.C. Converse, 1998
Linear Loading Rate (LLR)

1. Estimates the soil’s ability to move water away from the Infiltrative Boundary
2. Does not depend on water quality (e.g. BOD)
3. Aerobic treatment does not affect LLR
4. Length of contour is most important
Application/Distribution Options

• **Gravity-flow distribution - Description**
  – Effluent flows out of one component to next downstream component and on to infiltrative surface by gravity
  – Flow dependent on when and how much flow occurs
  – Distribution considered to be non-uniform over infiltrative surface
  – Unless properly managed, the biomat may become too restrictive
6th Step: Investigate the functioning of distribution devices

• *Uncover the D-box and check its condition.* This can tell which way to look for the problem, either toward the septic tank or toward the STA.
Gravity-flow Distribution

• **Parallel distribution** - Distribution box
  – Problem with assuring outlets stay at same level
  – Tools exist to help assure this
6th Step: Investigate the functioning of distribution devices

• Is effluent flowing from the septic tank toward the D-box?
• Is effluent overflowing the D-box (higher than the outlets)?
• Are there excessive solids in the D-box?
• Is one or more line receiving too much flow?
6th Step: Investigate the functioning of distribution devices

*Check the outlet of the tank:*

- Is it full of solids and grease?
- Is the outlet working properly - holding back solids, paper and grease? Is there an effluent filter?
- What is the depth of tank? Does it indicate the drainfield is too deep?
Application/Distribution Options

- **Dosed-flow distribution**
  - Predetermined volumes of effluent are held in a chamber and dosed to the next component.
  - This provides:
    - More uniform loading to next component
    - Resting times between doses
Dosed-flow Distribution

• **Dosing methods** - **Demand**
  – Dose occurs when sufficient volume of effluent has been collected.
  – Dosing frequency depends on how much wastewater is being generated.
  – There is no control on how much effluent is being dosed daily (Socially controlled)
Pressure Distribution

• Objectives:
  – Quickly pressurize network
  – Be fully pressurized for most of dose
  – Minimize draining into lower laterals
  – Have about the same amount of effluent reach each square foot of infiltrative surface
6th Step: Investigate the functioning of distribution devices

*Check the pressure distribution system.*

- Water level in the pump tank?
- Is the pressure head high? If so, holes may be clogged.
- Is the pressure head low? If so, there may be a leak caused by a broken pipe or the gate valve may be clogged.
6th Step: Investigate the functioning of distribution devices

*Check the pressure distribution system.*

- Calculate the pump delivery rate efficiency. Is the actual pump delivery rate the same as the system was designed to deliver?
6th Step: Investigate the functioning of distribution devices

*Check the pressure distribution system.*

- Check impulse and elapsed time pump counters.
- Check for proper operation of pump, controls, float, and alarm.
7th Step: Check the STA trenches

- Find trenches and determine the level of ponding in them
- Put observation tubes in the trenches if needed.
- Determine if ponding is permanent or periodic.
- Check for overload on one part of the system.
7th Step: Check the STA Trenches
7th Step: Check the STA trenches

- Determine if soil capability varies across the site.
- Find depth of lines. Are they too deep, in shallow water table, or picking up perched water?
7th Step: Check the STA trenches

• Note if lines run into a hill rather than on a contour. Are they too shallow or on uneven topography?
• Look to see if gravel (or gravel-less product) is in-filled with soil, which could be caused by discharge over certain holes or root mats.
7th Step: Check the STA trenches
7th Step: Check the STA trenches
8th Step: Determine the wastewater absorption rate into the soil

1. Use water meter to determine water volumes.
2. Put observation tubes in trenches.
3. Mark level of ponding in the observation tube.
4. Use NO water for 8 hours. Turn water off to the house and let it sit. Effluent level in the trenches will go down some.
5. Record initial water meter reading (volume).
8th Step: Determine the wastewater absorption rate into the soil

6. Have someone turn on water and let flow until effluent level in the trenches reaches the initial ponding mark in the tube. Check final water meter reading.

7. Final meter reading – initial meter reading = volume of effluent absorbed in 8 hours.

8. Determine effluent absorbed in soil in 1 day (= amount absorbed in 8 hours x 3).

9. If system overload is less than 35 percent, then water conservation should correct the problem.

\[
\% \text{ overload} = \left( \frac{\text{avg. daily water use} - \text{amount water absorbed}}{\text{average daily water use}} \right) \times 100%.
\]
8th Step: Determine the wastewater absorption rate into the soil
Failure Due To Broken Pipe Or Leaky Connections
Is there evidence of traffic over the system?
Stripes Over Gravity STA Ok?
Uneven Stripes: Uneven Distribution
Uneven vegetation
Even Stripes Over STA
Vegetative Growth Over Chamber Trenches
Even Stripes Over LPD Laterals
Any construction near site?  Any utility work in progress?
Do You See Surface Flow with Vegetative Patterns?
Standing Effluent and Vegetative Growth
Compaction, Rutting, and Breakout
“Waterfall” and Vegetation From a Mound: Not good!
Appropriate Vegetation?

Planting at base of mound is NOT appropriate
Bull’s-Eye Pattern
Uniform Growth Over Drip Field
Trees in distribution field

- Roots will
  - Grow into tank risers
  - Clog conventional and LPP/LPD system drainfields
  - Damage components
Water Management Devices

- Curtain, Interceptor, French Drains: Controlling Surface and Subsurface Flow of Water

- Surface Diversions: Controlling Surface Water
Curtain Drains

- Also called Interceptor Drains
- Also called French Drains
- Manage surface and subsurface flow of water in sloping soil landscapes
Many Soils Possess Drainage Restrictions

- Redoximorphic Features
- Mottles
- Landscape Position
- Location within the Watershed
- Perched water tables versus apparent water tables
Perched Water Table
Potential Curtain Drain Site

- Extend fill 5' past trenches before feathering
- 12" - 18" loamy soil
- 1-1/2" - 3" dia. clean gravel
- Perforated distribution pipe
- 24" min.
- Restrictive layer
- Perched water table
- Original grade
- 12"
Slope Considerations

Horizontal Flow

1

2

3
Slopes

- Position
- Hydrologic cycle
- Slope considerations
- Drainage
Surface Water Management

• Is surface water effectively managed/diverted away from the total site?
• Is surface water effectively diverted away from OSWS?
• Is there an odor within 10’ of the perimeter of the system?
• Is there evidence of recent construction or utility work in or around system?
• Is there evidence of compaction, rutting, traffic over the system?
• Is the system protected from traffic?
• Are the system components free from settlement or erosion?
Surface Diversions

• A device to manage the surface flow of water
• Does not lower water level in subsoil (this is accomplished with a curtain, french, or interceptor drain)
• Works on a sloping soil landscape
Is Surface Water Effectively Diverted Away from System?

Surface water diverted away from distribution fields (turtle backed)
Diversion berms and swales

- Required?
- Present and effective?
Water Control Devices

• Can be a relatively inexpensive and low cost system to allow the soil treatment field to perform more effectively and efficiently.

• Important for the longevity of the soil treatment system
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