# Septic Systems: An Introduction

Rainbow and Silver Springs Basin Working Groups
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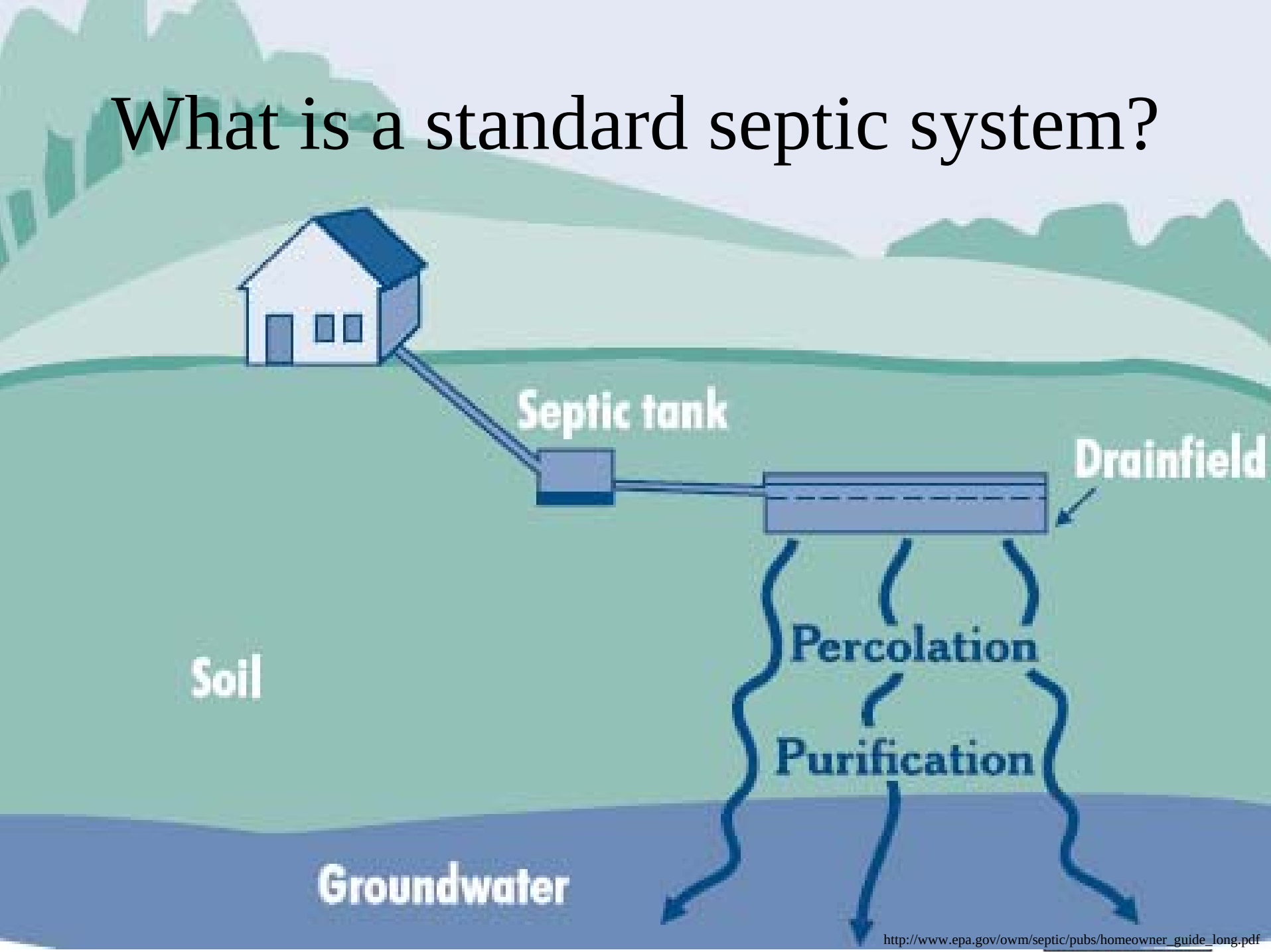
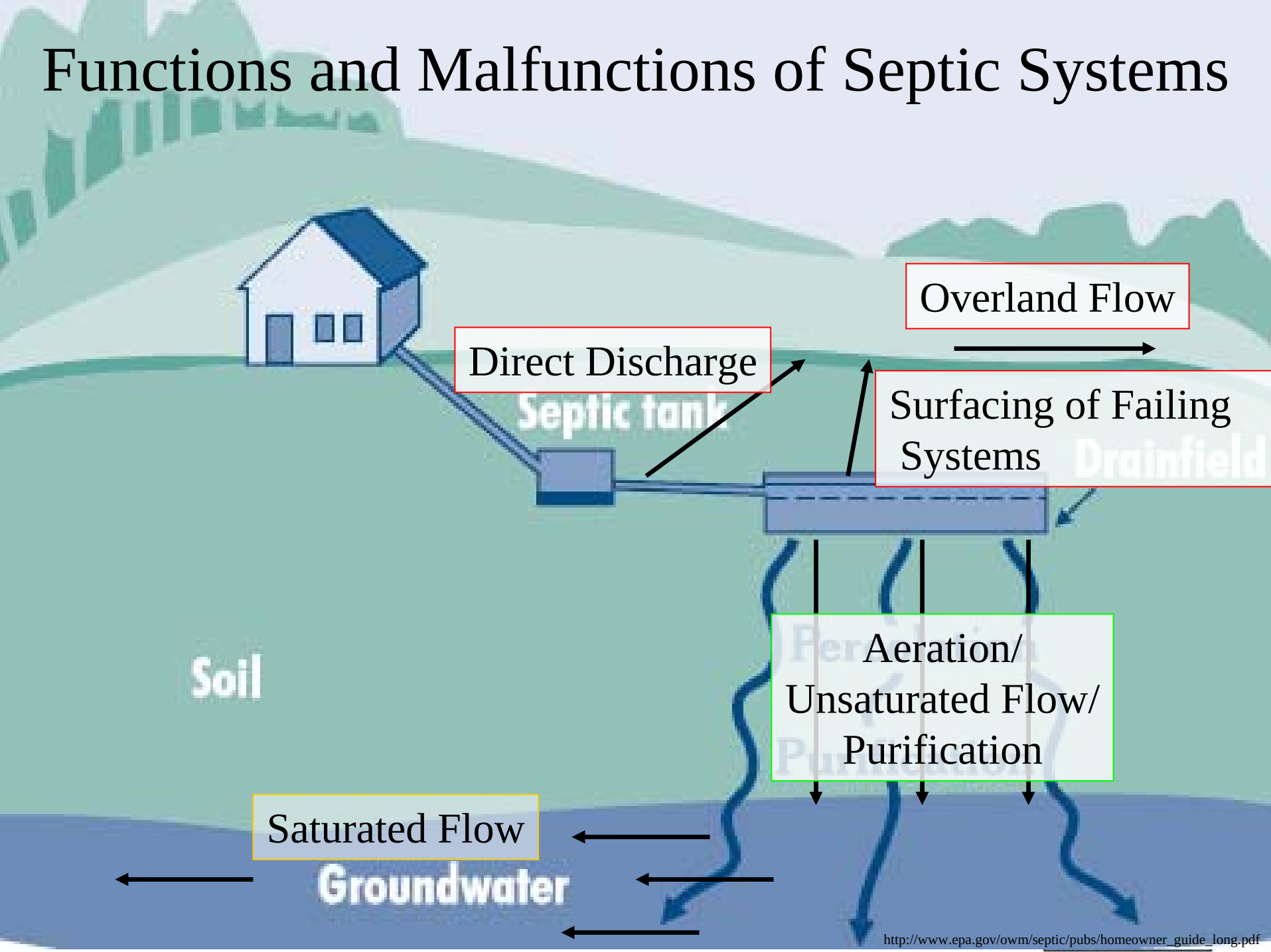
FLORIDA DEPARTMENT OF HEALTH

# What is a standard septic system?




http://www.epa.gov/owm/septic/pubs/homeowner_guide_long.pdf

# Functions and Malfunctions of Septic Systems

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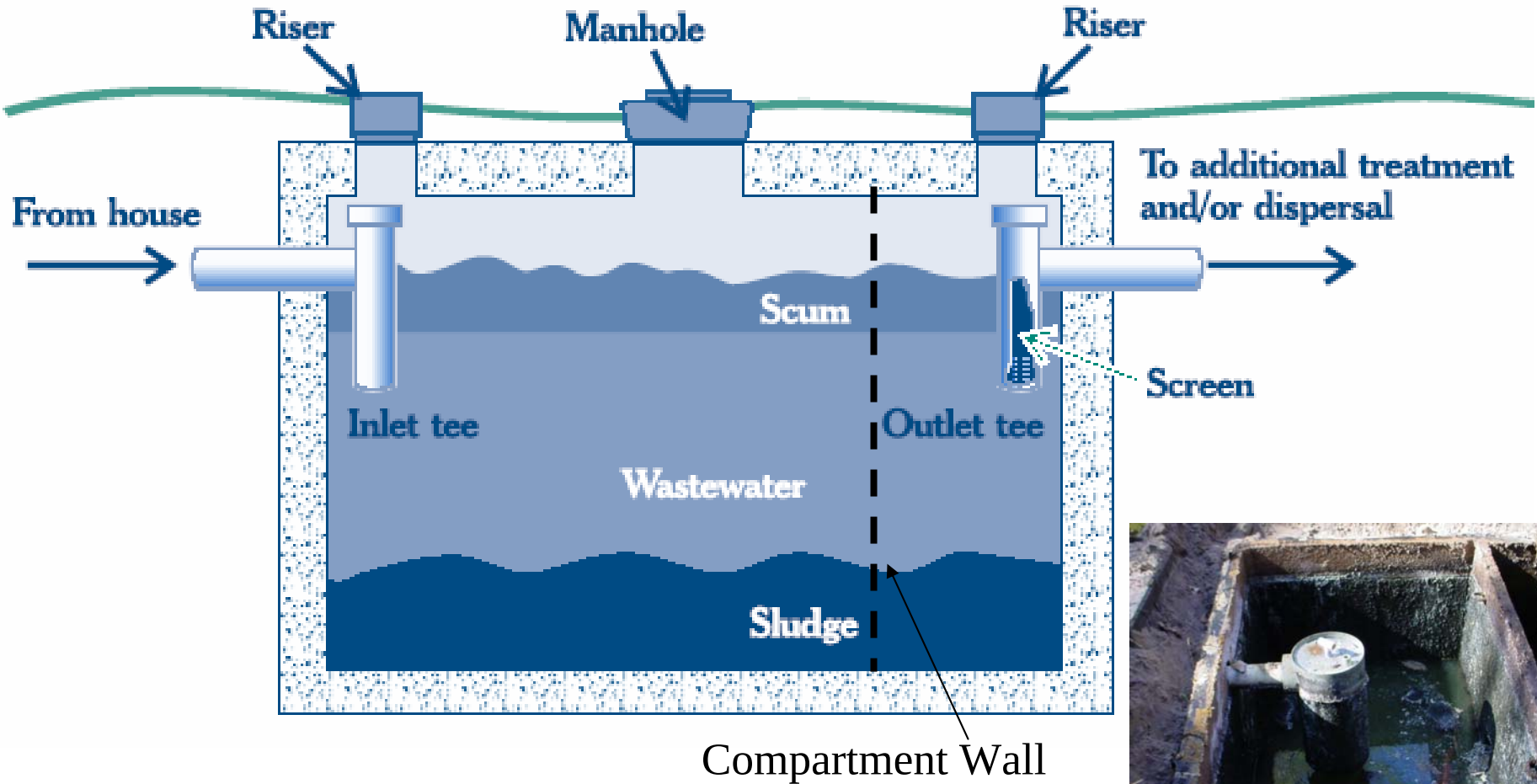
# Septic tank

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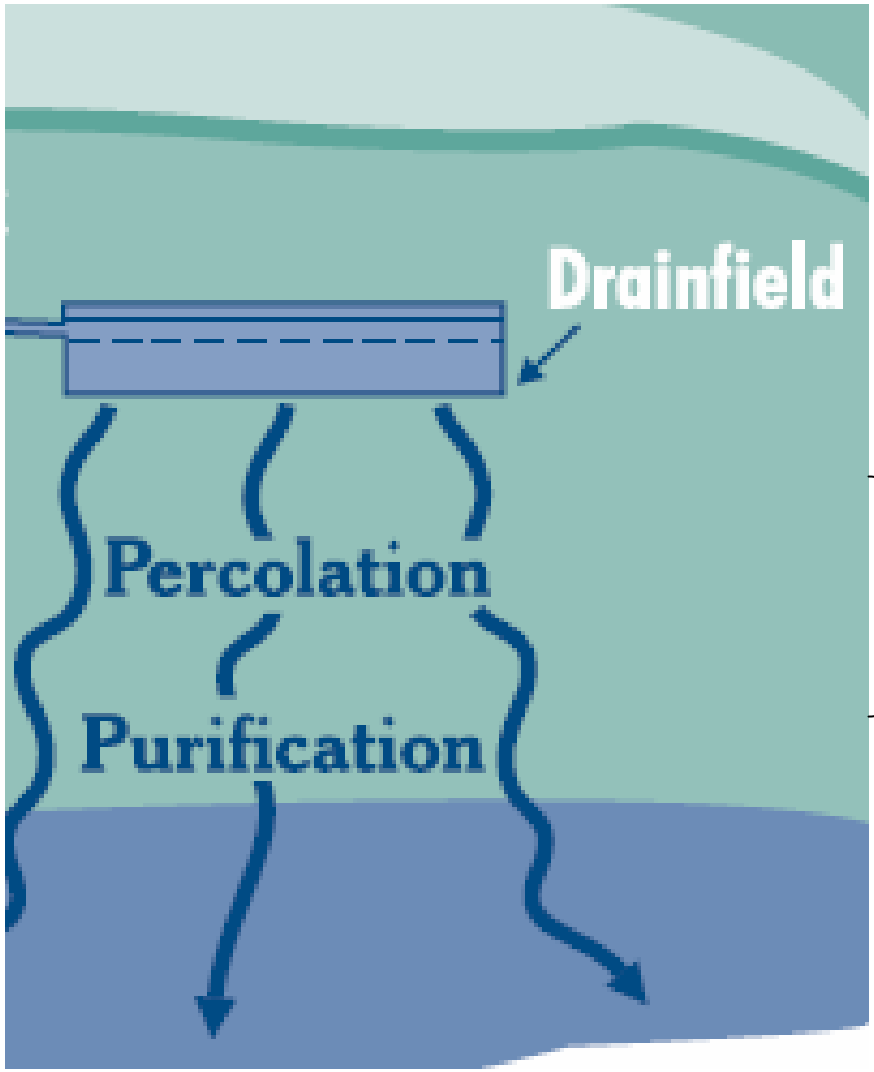
# Drainfield




6” minimum between top of drainfield and ground surface required

thickness of drainfield (12” for gravel)

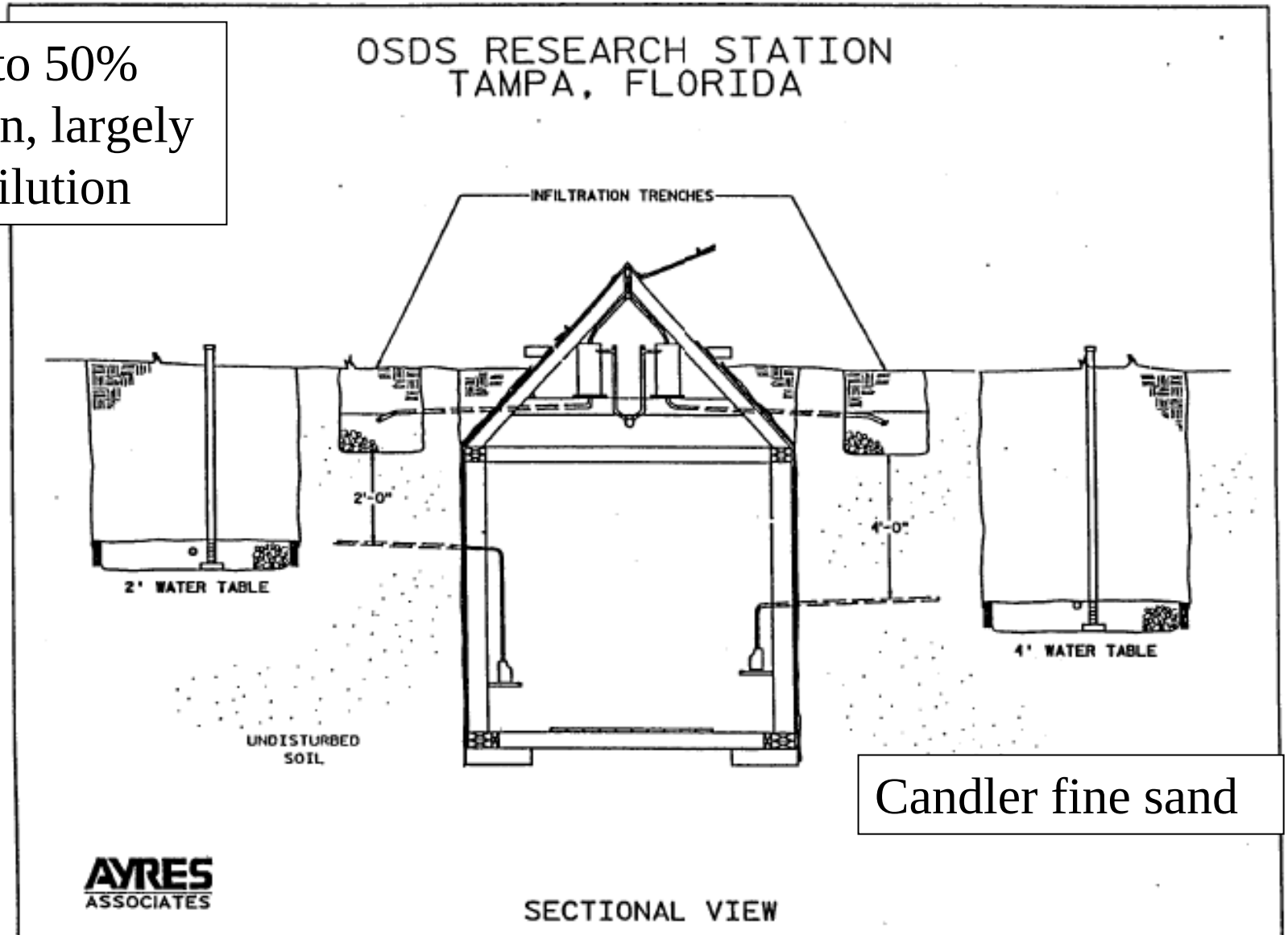
2 feet between bottom of drainfield and seasonal high water table required since 1983

# Nitrogen from septic tank effluent

| Annual Input Estimate | Input/ capita | House-hold size | Input/ system | Data source TN | Data source Flow |
|---|---|---|---|---|---|
| | lb TN/year | capita | lb TN/year | | |
| Recent Review | 10.2 | 2.6 | 26 | Lowe et al., 2007 | Lowe et al., 2007 |
| Florida Studies | 13.9 | 5.0 | 69 | Anderson, 1998 | Anderson, 1998 |
| | 8.5 | 4.0 | 34 | Nielsen et al. 2002 | McAvoy et al. 2002 |
| Wekiva Study | 14.2 | 5.0 | 71 | Seminole Site, 2007 | Seminole Site, 2007 |
| | 14.7 | 4.0 | 59 | Lake Site, 2007 | Lake Site, 2007 |
| | 7.3 | 1.0 | 7 | Orange Site, 2007 | Orange Site, 2007 |
| Current Estimate | **11.0** | **2.6** | **29** | Mid-Range Wekiva | |

# Nitrogen in drainfield study

TN: up to 50% reduction, largely due to dilution




Candler fine sand

# Nitrogen in drainfield studies

- Drip beds (Big Pine Key Study, FL):
  ~40-45% (not accounting for dilution)
- Dosed sand filters (Rich, 2008; La Pine Study, OR)
  ~7% bottomless sand filters (w/o dilution)
  ~18% lined sand filters (w/o dilution)
- Dosed and gravity systems (Bunnell et al. 1999; Pinelands, NJ)
  ~40% dosed systems
  (w/o dilution) ~49% gravity systems (w/o dilution)

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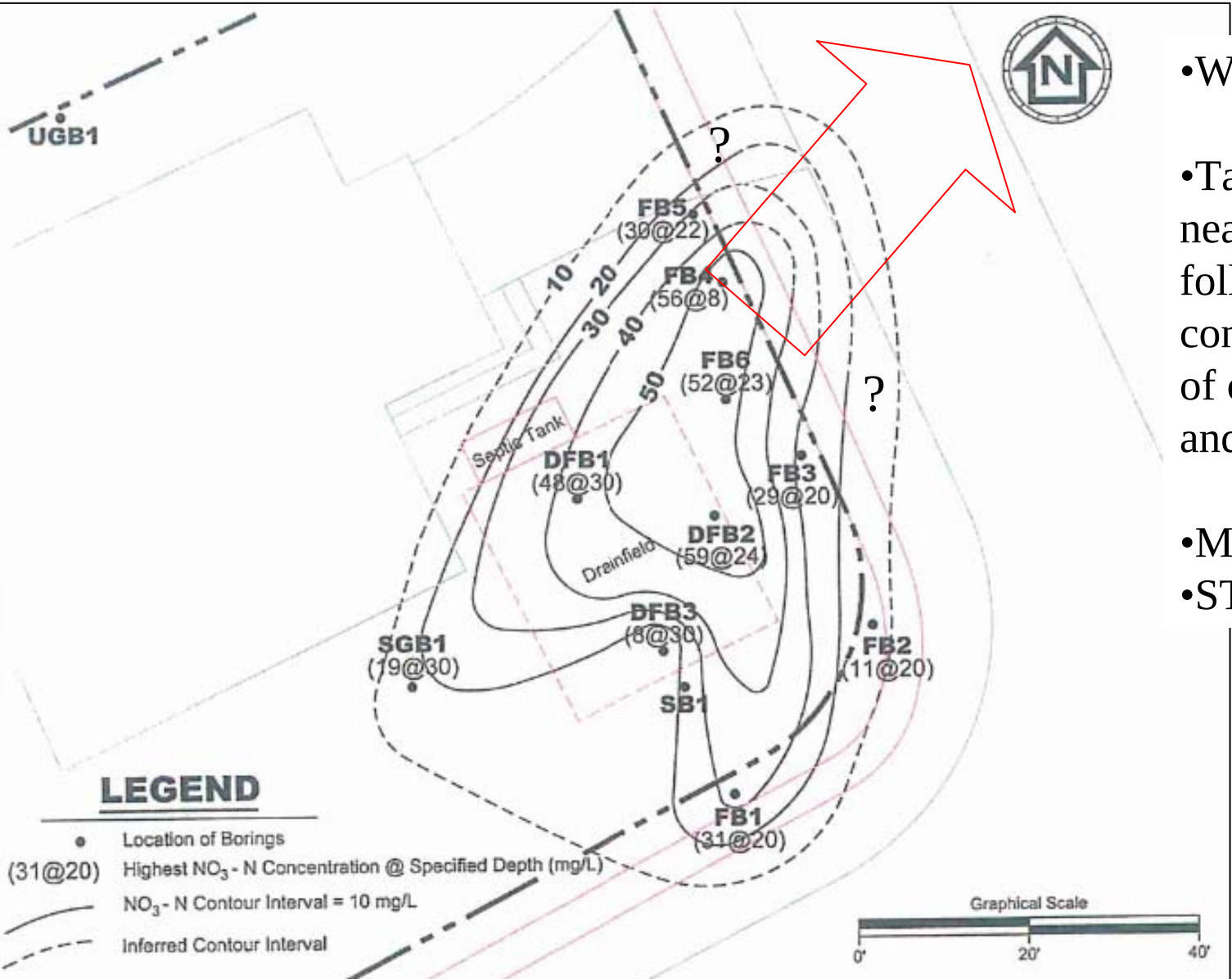
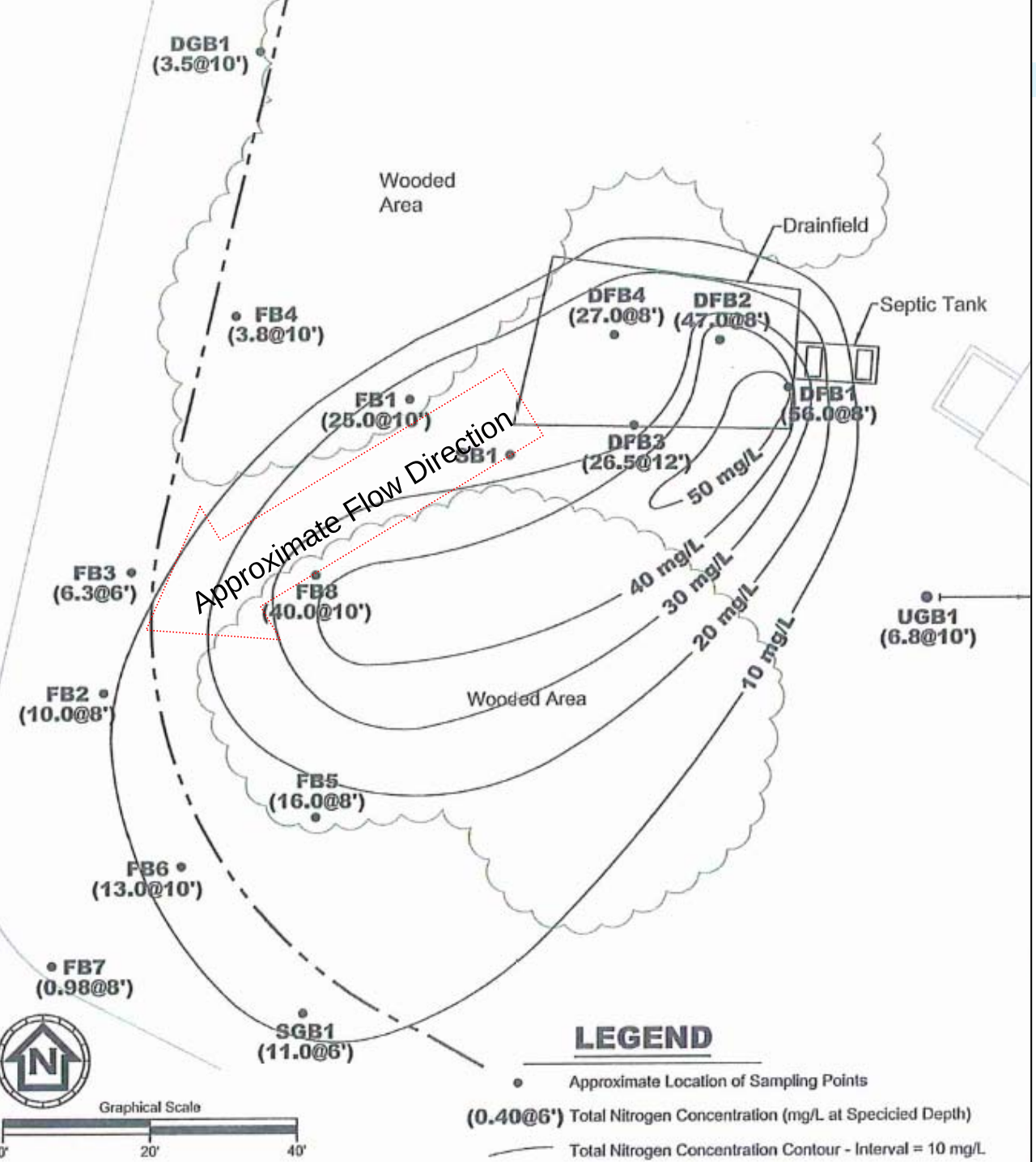
**10-50% Nitrogen Reduction in Drainfields**

# 2007 Orange County Site




- WT>20 ft BGS
- Tavares fine sands near the surface, followed by non-continuous intervals of clay, clayey sands, and fine sands
- Mostly nitrate
- STE C=69 mg/L




# 2007 Seminole County Site

- WT~2 ft below DF
- Myakka fine sand
- Soil was expected to show good nitrogen removal but total nitrogen plume, largely unoxidized nitrogen, was extensive
- STE C=74 mg/L

# Factors that influence nitrogen transport to and in ground water (Otis, 2007)

- Good conditions for denitrification (=removal of nitrogen):
  - Nitrogen present as nitrate after contact with air (pretreatment or drainfield)
  - Denitrification requires absence of air
    - Poorly drained
    - water table no deeper than 3.5-feet below grade
    - high organic carbon in the soil below drainfield (>1%)

# Nitrogen Load to Ground Water

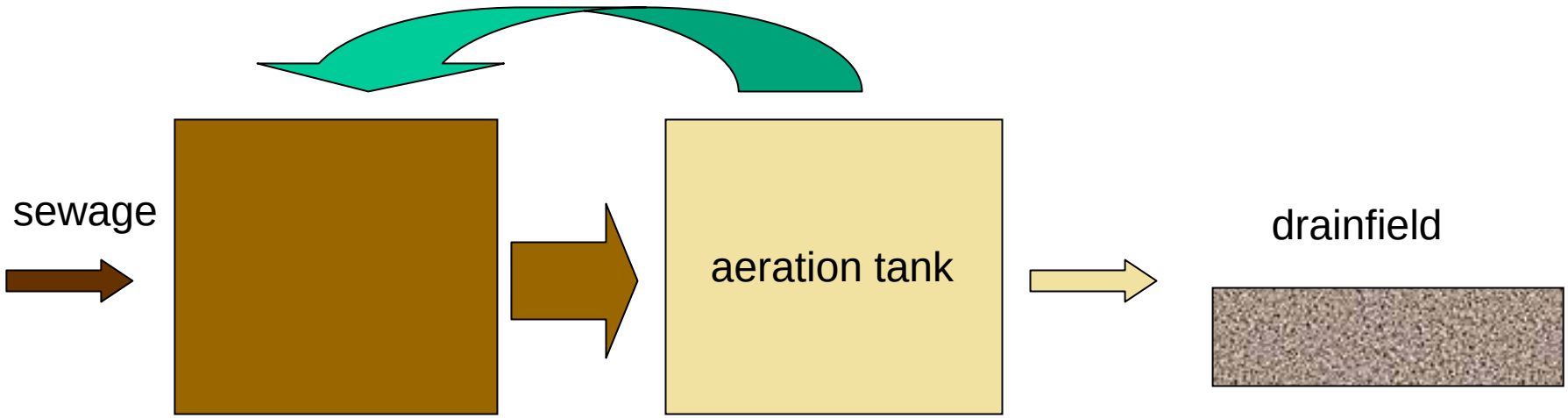
- Nitrogen
  - 20-30 lbs per system released from typical septic tank
  - Some removal (10-50%) under drainfield
  - Further removal depends on ground water conditions
- Total load depends on number of people served by onsite systems and treatment level
- Relative importance depends on presence and magnitude of other sources

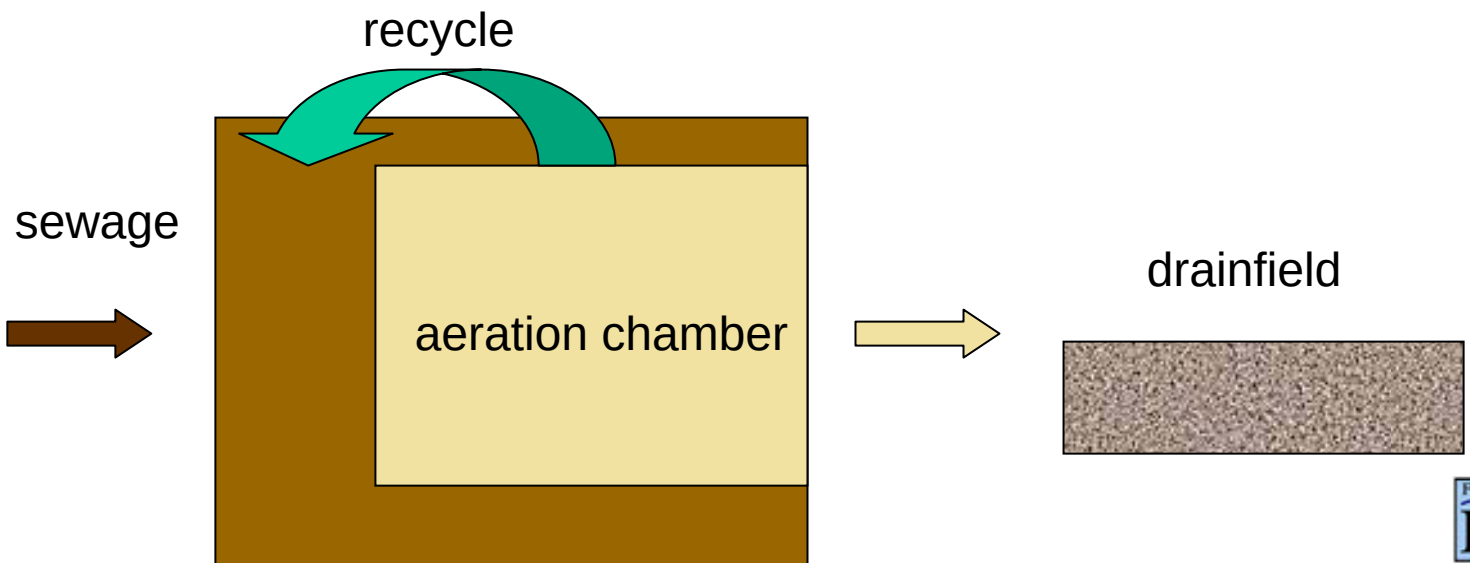
# How can we manage OSTDS Nitrogen?

- No sewage
- Limit flow and/or number of OSTDS per acre. This approach has been in Florida OSTDS rules for at least 30 years to protect drinking water against nitrate contamination.
- Increased Treatment:
  - Nitrogen reducing treatment at onsite scale (e.g., Keys, Wakulla County)
  - Connect to sewer if treatment is better and more cost-effective

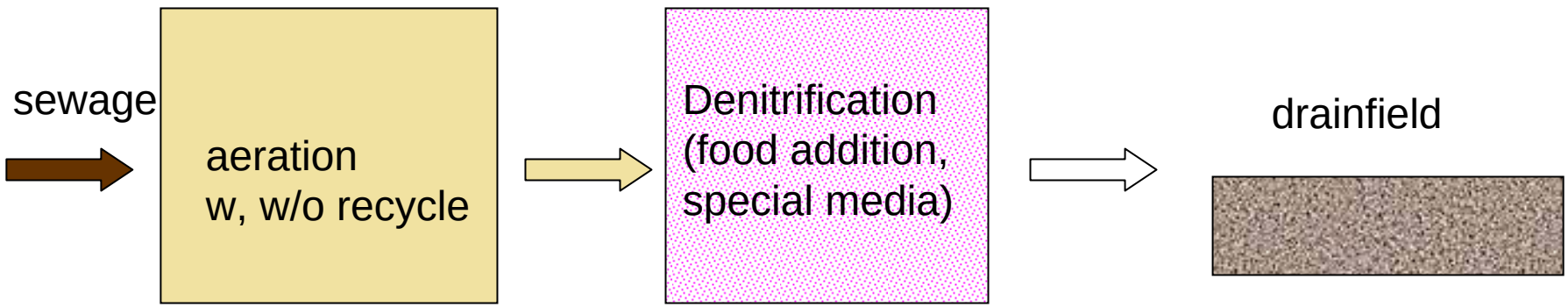
# Treatment of nitrogen in onsite systems

# Examples for Nitrogen Removal Processes



# Examples for Nitrogen Removal Processes
## 2-Stage Process




Innovation continues

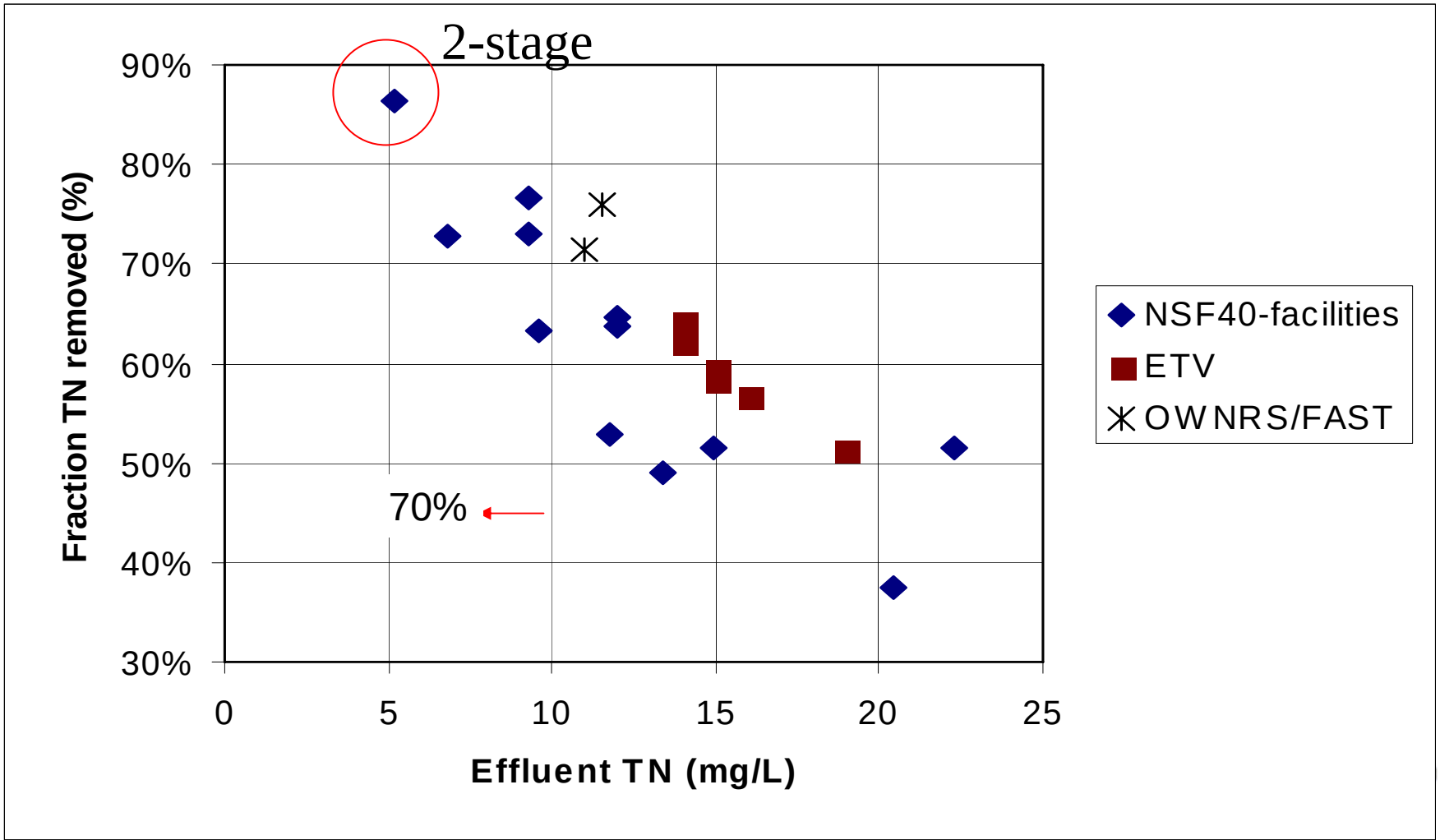
# Aerobic Treatment Unit (ATU)

- Permitting Category:
- ATUs (400-1500 gpd) require
  - Certification by NSF after testing to meet “class I” standards (30-day average cBOD5<25 mg/L; TSS <30 mg/L)
- Technology:
  - “a sewage treatment unit which introduces air into sewage to provide biochemical stabilization within a treatment receptacle” (64E-6.002(2))
    - bubble air through water
    - sprinkle water through air or loose filter material (“passive”)
  - Component can be part of a performance-based treatment system

# Performance-Based Treatment System (PBTS)

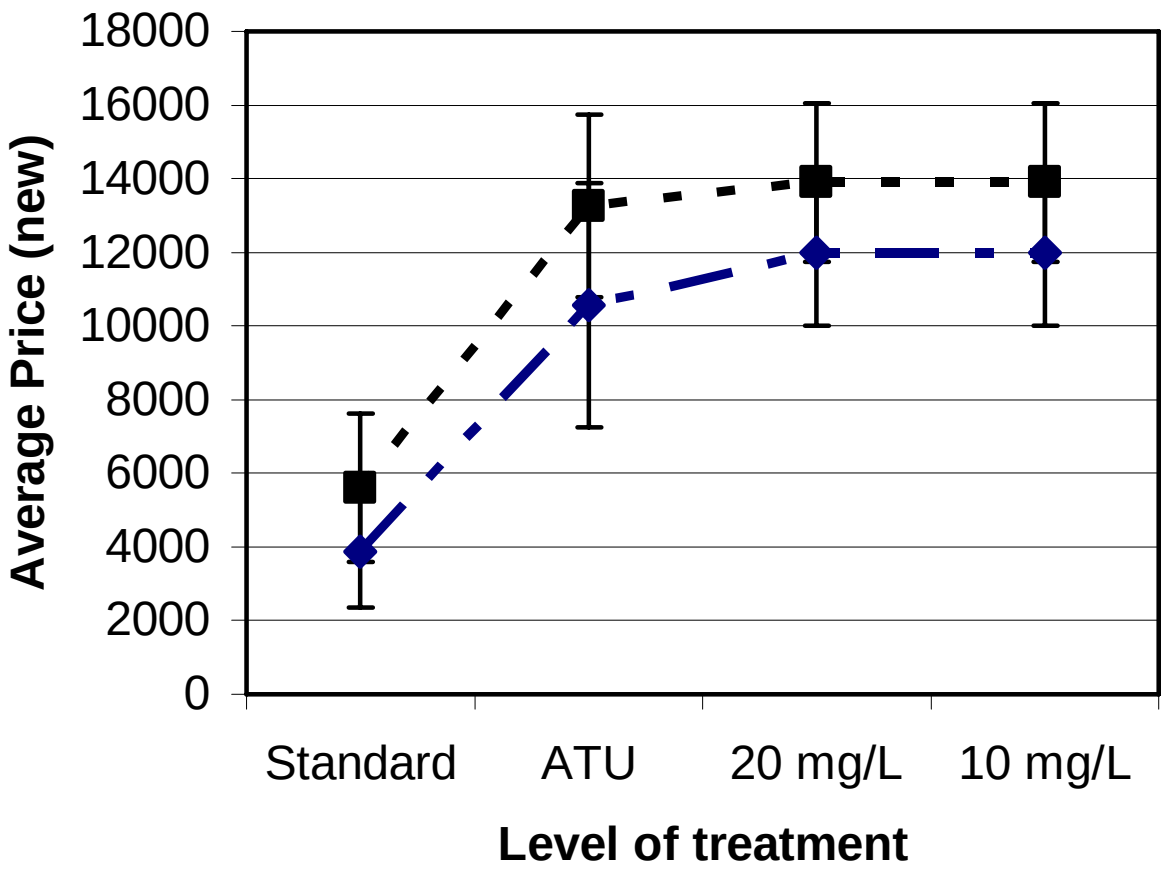
- Permitting Category
- Designed to achieve a measurable established performance standard of
  - CBOD5 (carbonaceous biochemical oxygen demand),
  - TSS (total suspended solids),
  - TN (total nitrogen),
  - TP (total phosphorus), and
  - fecal coliform
- designed by a professional engineer with a background in wastewater engineering, licensed in Florida
- includes innovative systems

# Some results of nitrogen reduction during test center testing



# Installation Cost

- Varies regionally and by pretreatment and fill requirements




Example: Survey for Wekiva Study Area (Orlando) Spring 2007

# Florida Onsite Sewage Nitrogen Reduction Strategy Study

- What is relative cost and effectiveness for new 2-stage technology relative to existing technology and drainfields/modifications?
- How does nitrogen from onsite systems behave in soil and shallow groundwater?
- How would a simple model look like that quantifies nitrogen impacts from onsite systems?

# How to take care of a system?

- Three P's
  - Pump: have your system inspected and pumped as necessary by a licensed septage disposal company every 3-5 years
  - Protect (know where your system is):
    - never drive or park over your system
    - Plant only grass or similar on drainfield to avoid damage from roots
    - Divert gutter downspouts away from drainfield
  - Prevent:
    - Use the toilet only for human waste
    - Do not pour toxic products (medicines, cleaners, paints) down the drain
    - Fix leaky toilets, don't waste water
    - Spread out laundry load
    - Use compost instead of garbage disposal