An Abridged History of Onsite Wastewater

Early Years to Present

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Department of Health and Human Services

The Big Questions: Where & How?

- Where and how to dispose of waste and sewage
- De-urbanization & re-urbanization
- Technological innovations
- NC History
  - Methods
  - Laws and Rules
  - Research, demonstration and training

Photo courtesy of Steve Reid

From Antiquity to the Modern World Domestic Wastewater Treatment

- Nomadic Period ~10,000 – 4,500 B.C.
  - Moving tribes
  - Biological (BUGS) soil treatment via land application

The Early Years of Sanitation: Ancient World

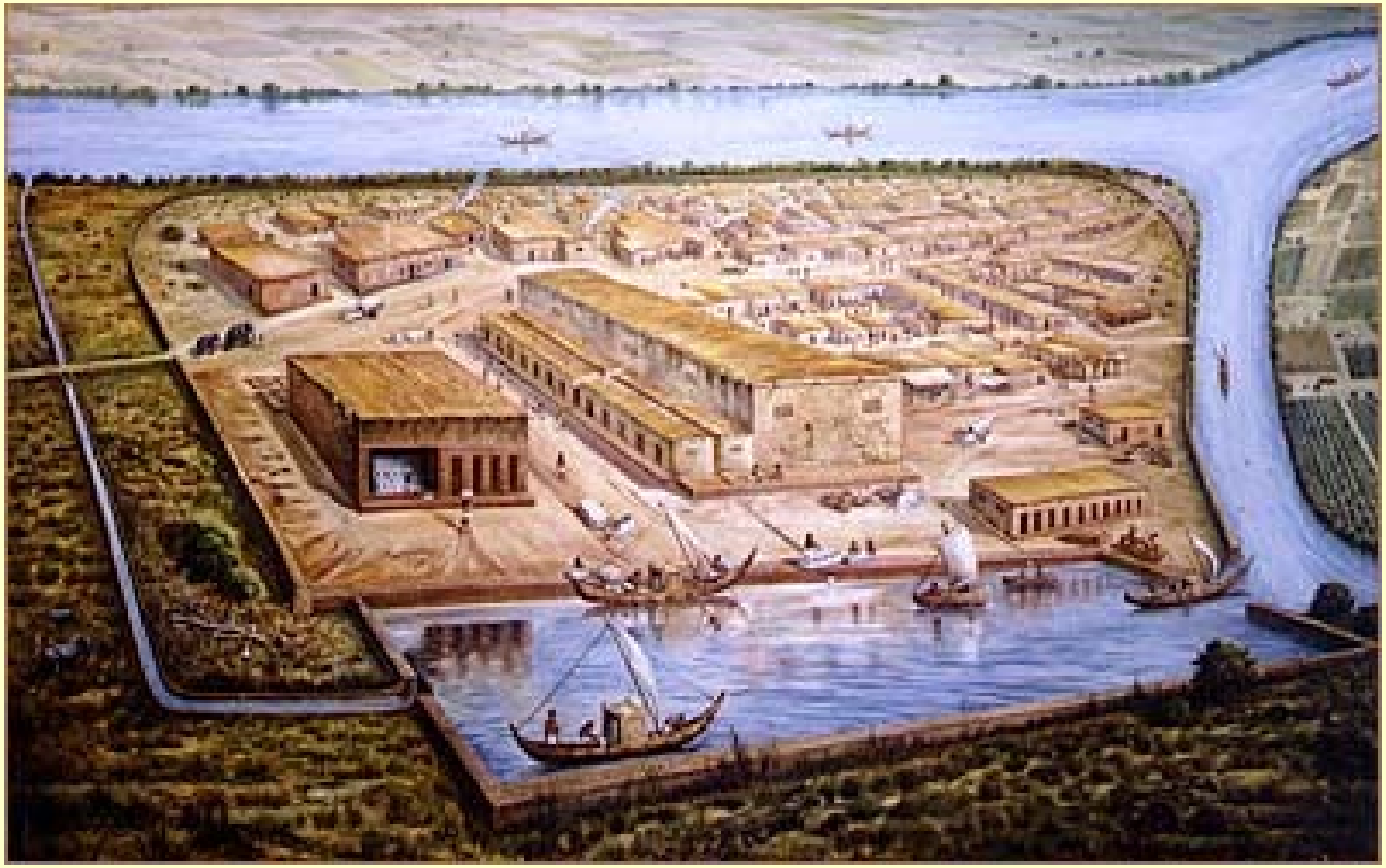
Deuteronomy 23:13

"When thou wilt ease thyself abroad, thou shalt take a shovel and dig therewith, and shalt turn back and cover that which cometh from thee."

From Antiquity to the Modern World Domestic Wastewater Treatment

- Ancient World: ~ 4,500 B.C. - 500 A.D
  - Urbanization (e.g. 62,000 people /sq mi)
  - Economic differences: facilities within cities
  - Improved hygiene to a point
  - Various waste technologies
    - Bury it
    - Flush it to sewers
    - Public conveniences: port-a-potties, pay toilets, modesty capes

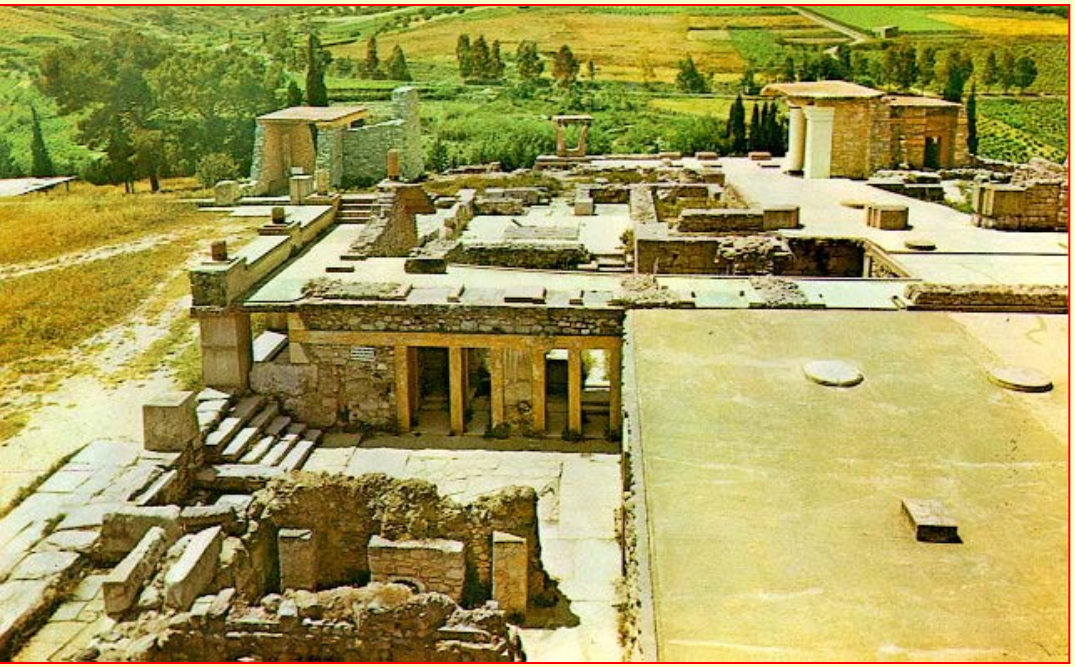
4500 years ago in Lothal, India

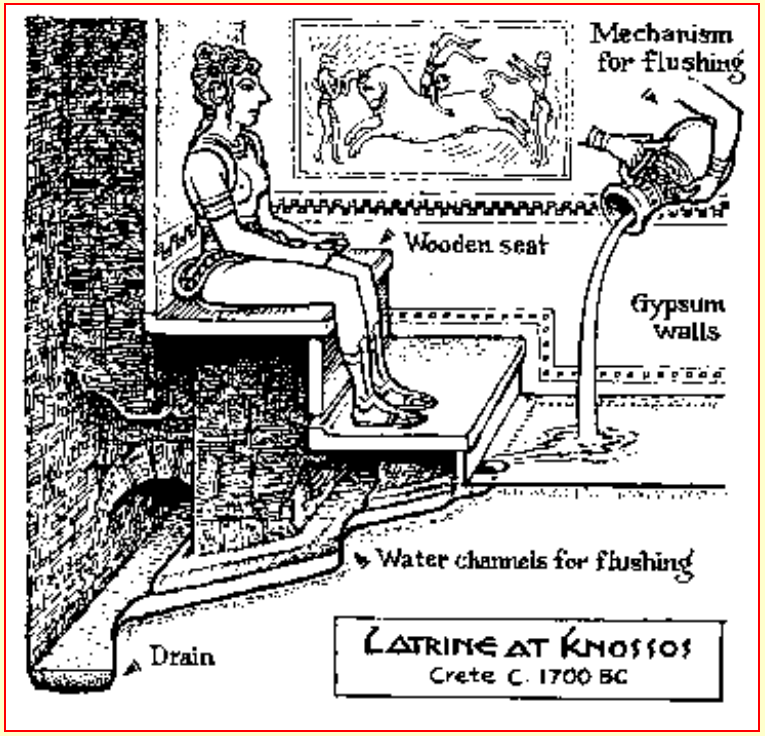


Toilets in every house

Minoan palace at Knossos

- 1700 B.C.

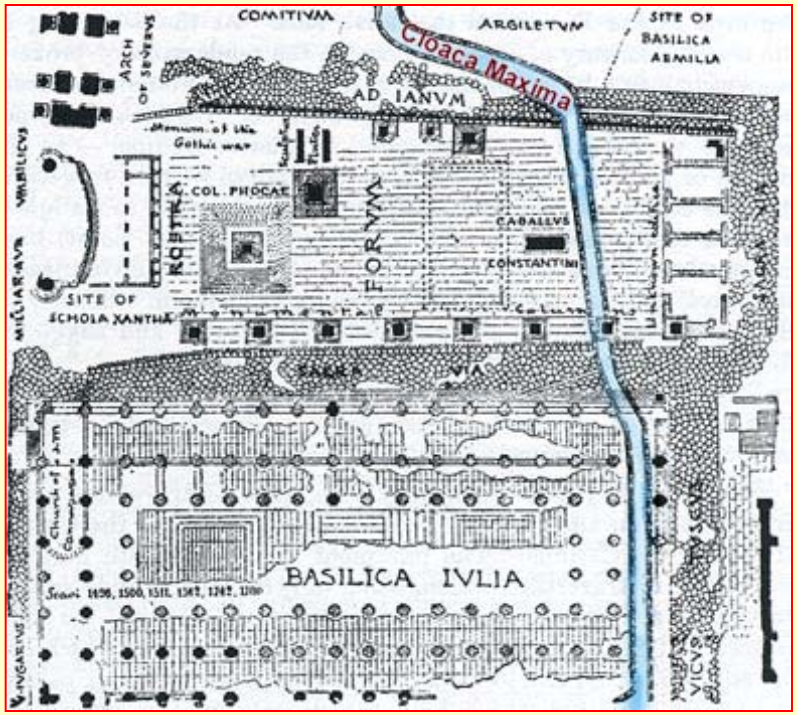




Roman times: moving waste

- Roman toilet: private and public
- To ‘flush’ - elaborate lines to waterways

Roman sewer: Cloaca maxima



Venus Cloacina:
Goddess of Health, Beauty…
and SEWERS

Ancient World

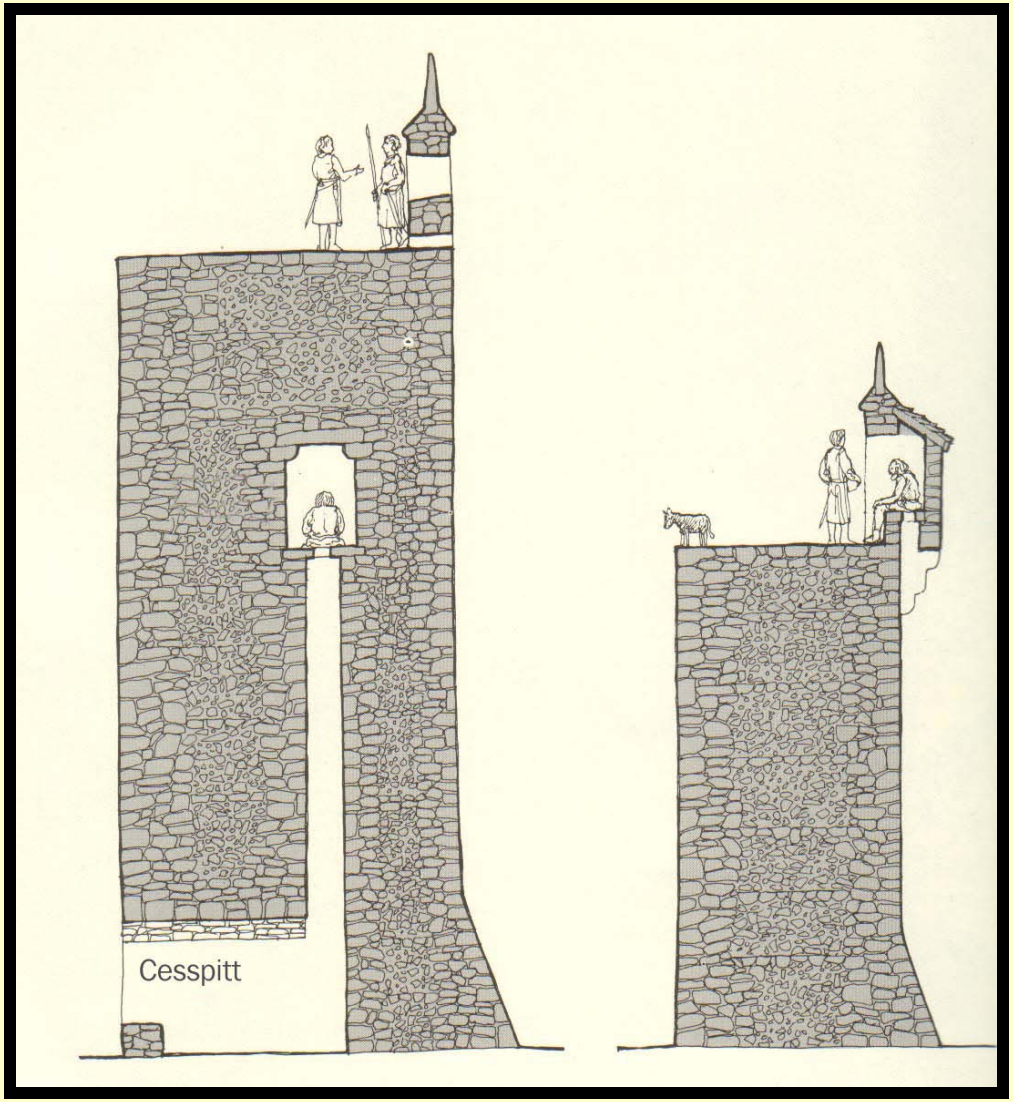
- Early Roman Law governing chamber pots (500 B.C.)
  - *Dejecti Effusive Act*
    - A person shall be fined and pay damages to the injured party for throwing or pouring “missiles of mirth” out an open window and hitting someone.
    - Note: Law only applied during daylight hours.
    - Note: Does not cover soiled clothes.

Middle Ages ~500 A.D.-1500 A.D.

- “Dark Ages”
  - Fall of the Roman Empire: urban societies convert to rural societies
  - Reduced population density – a return to traditional disposal methods
    - Outhouse”, open trenches, chamber pot - at all levels of society
  - Decline in sanitation

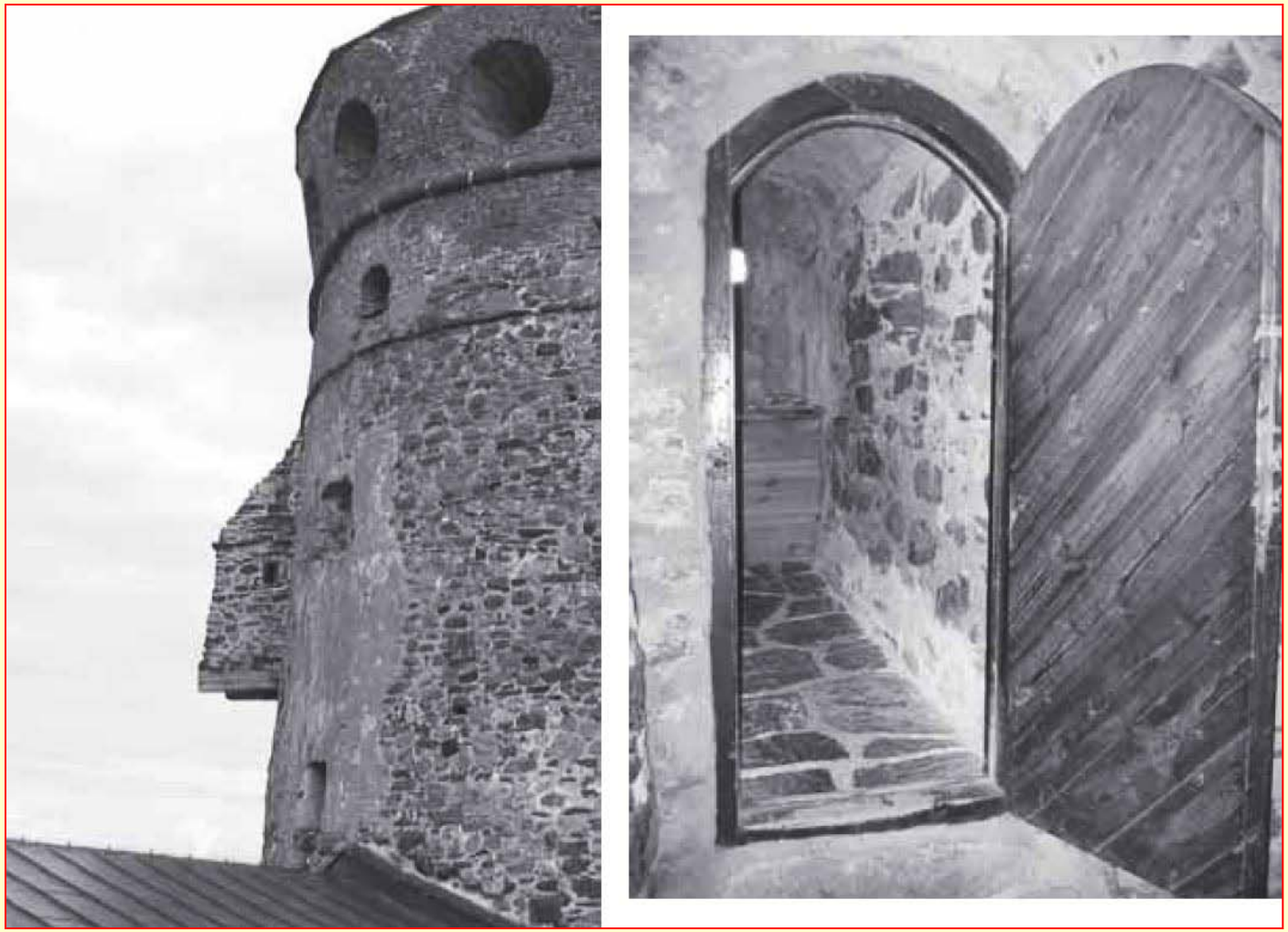
Middle Ages / Dark Ages

- Medieval houses
  - Toss it outside!
- Medieval castles
  - 500 B.C.

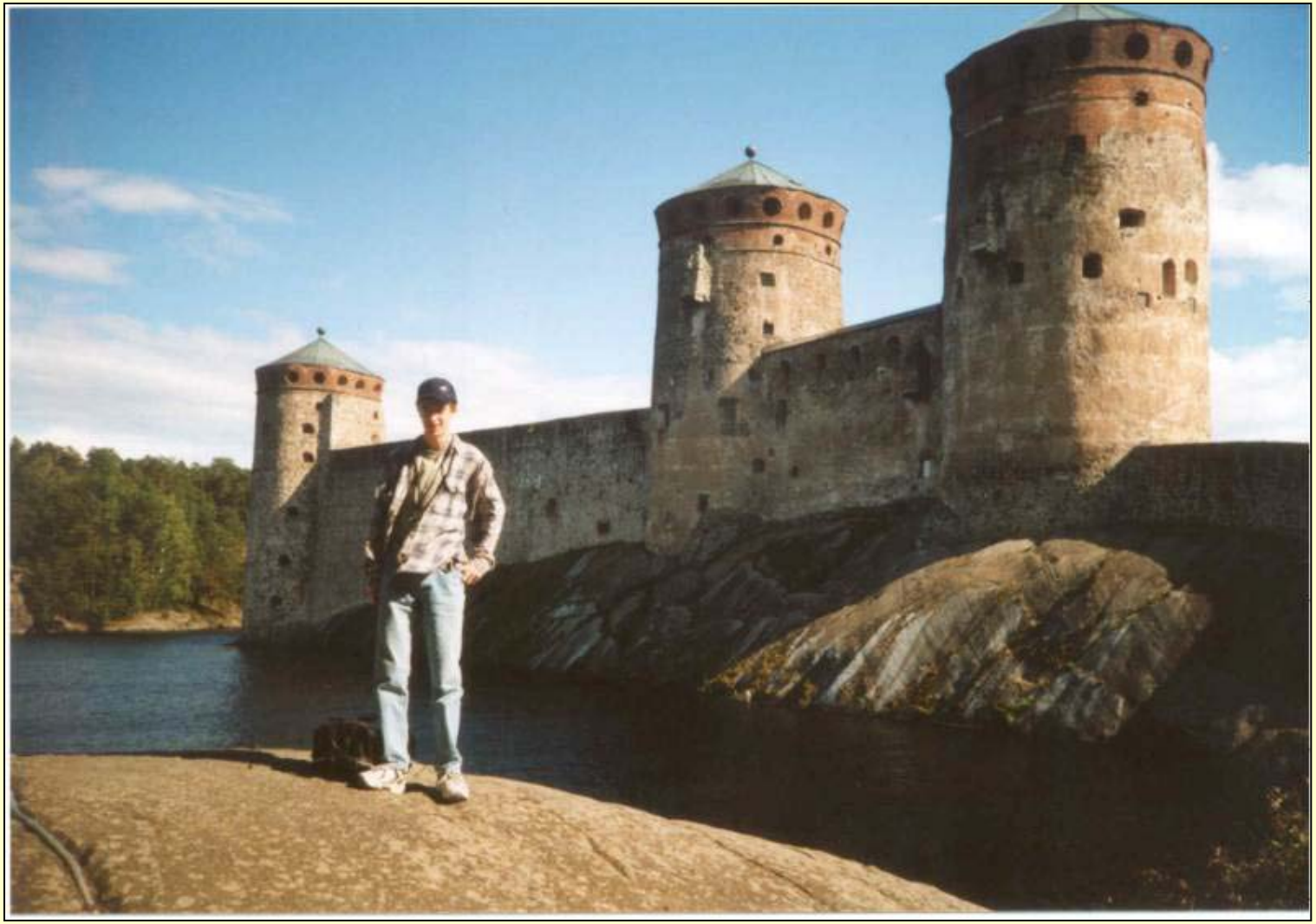


Middle Ages / Dark Ages

- Bay privies



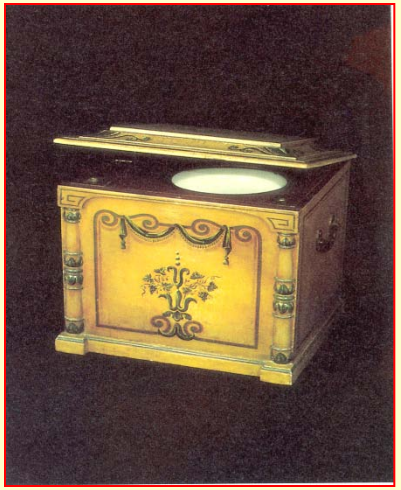
Why you should not swim in the moat!



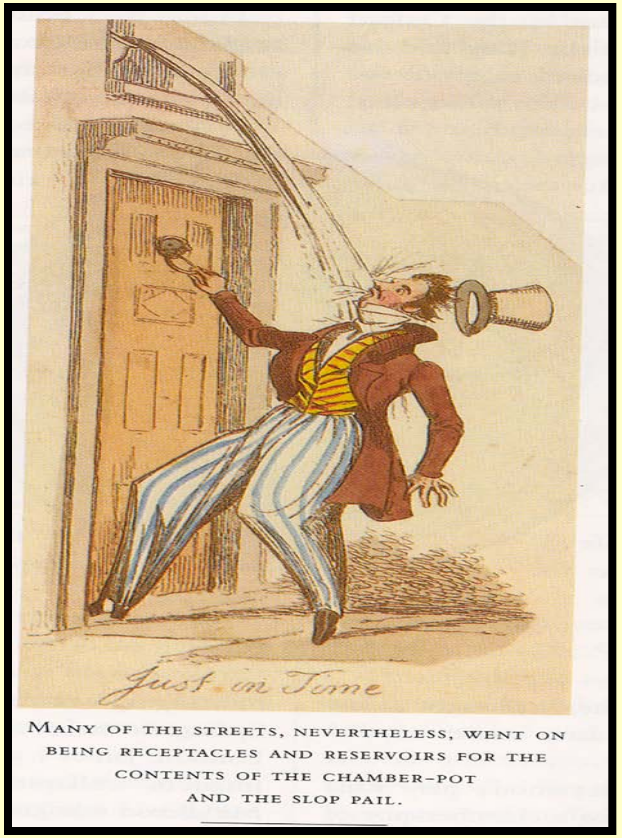
Modern World
Domestic Wastewater Treatment

- Early to Late Modern ~1500 – 1900's A.D.
  - Early modern: Little change in Europe
    - Established infrastructure
  - Similar practices brought to the New World:
    - "Throw wastes outside the fort"
  - Epidemics
    - Occurred primarily in western Europe because of population density
    - Rivers ran with sewers

Laws and Rules in the Modern World



- Law of King Richard II (circa 1800)
  - *Statuto quo nul ject dung*
    - A writ that no one is to dump dung
    - Note: Repealed 1856
- Public Health Act of 1848 (England)
  - Every house shall have sanitary method for sewage disposal (toilet, privy, ash pit)



The Early Years of Sanitation

- Modern World – *terminology*
  - *Plumbing:* from the Latin term *‘plumbus’* for lead.
    - Romans used lead pipe for waste drains (also clay, wood).
  - *Plumber:* skilled worker in lead.
  - *Sewer:* “seaward” in Old English.
    - Open drains became tubular with water supplies to eliminate need for cleaning
    - Flush toilet in Europe

Innovation in the Modern World

Moule's Patent Earth Commode Pat. 1869

Things to be observed:

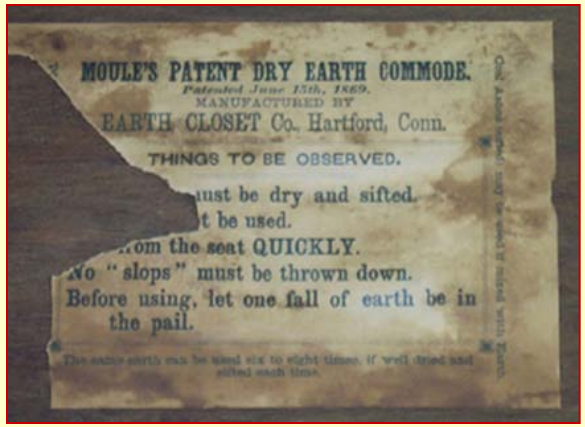
The Earth must be dry and sifted.

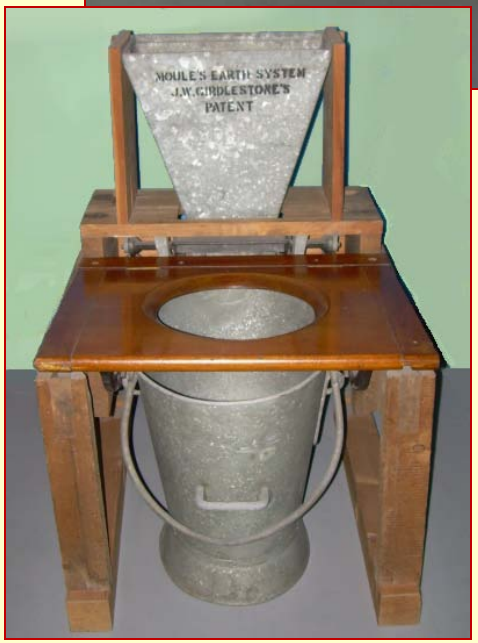
Sand must not be used.

Rise from the seat QUICKLY!

No "slops" must be thrown down.

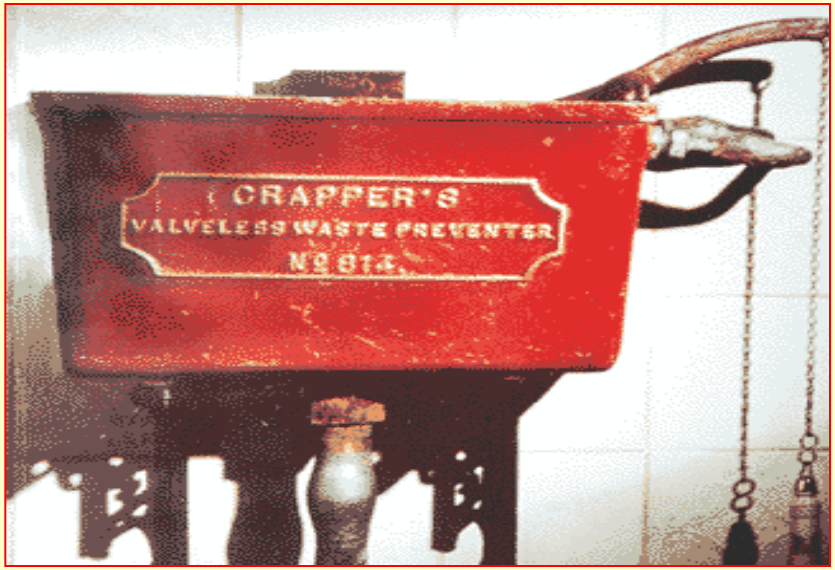
Before using, let one fall of earth be in the pail.





Innovations: the Flush toilet

- Ancient flush toilets
  - Indus valley, Knossos
  - Bahrain, Rome
- Later
  - Sir John Harrington (1596)
    - Toilet for Elizabeth I
  - Alexander Cummings (1775)
    - “S” trap
  - Sir Thomas Crapper (1880s)
    - Siphon flush toilets on Albert Giblin’s design
  - Wm. Elvis Sloan (1906)
    - Flushometer
  - Thomas McAvity Stewart (1907)
    - Vortex flushing bowl



Septic tanks

- Jean-Louis Mouras
  - Developed the "Fosse Mouras" (Circa 1860)
  - Tested at the local parish house
- Improvements
  - Two compartments
  - Gas outlet pipe

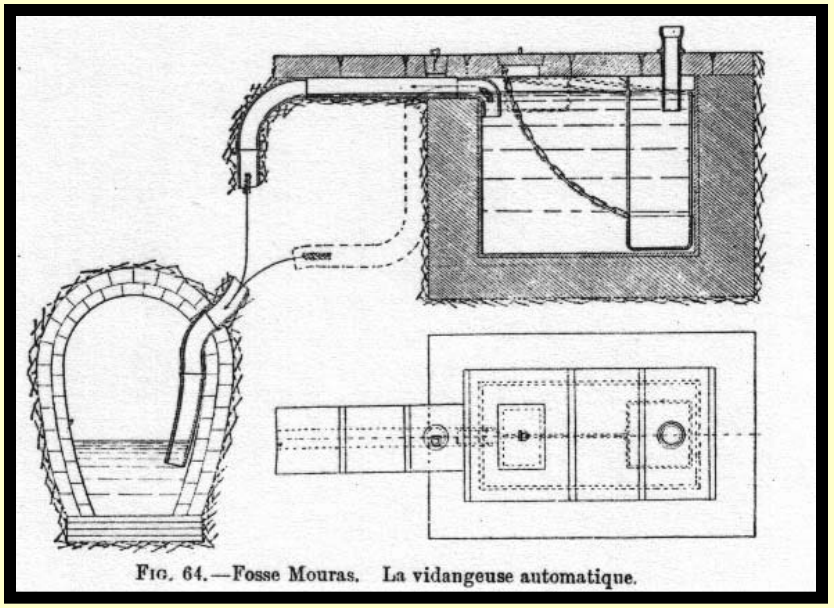


Fig. 64.—Fosse Mouras. La vidangeuse automatique.

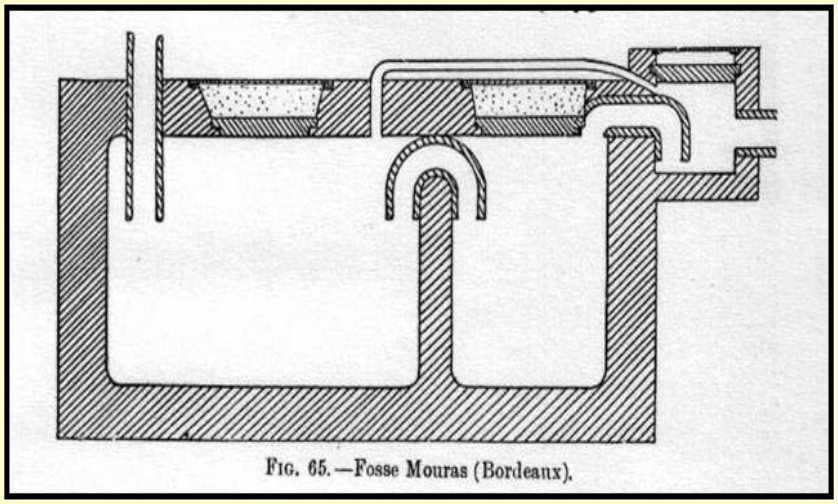
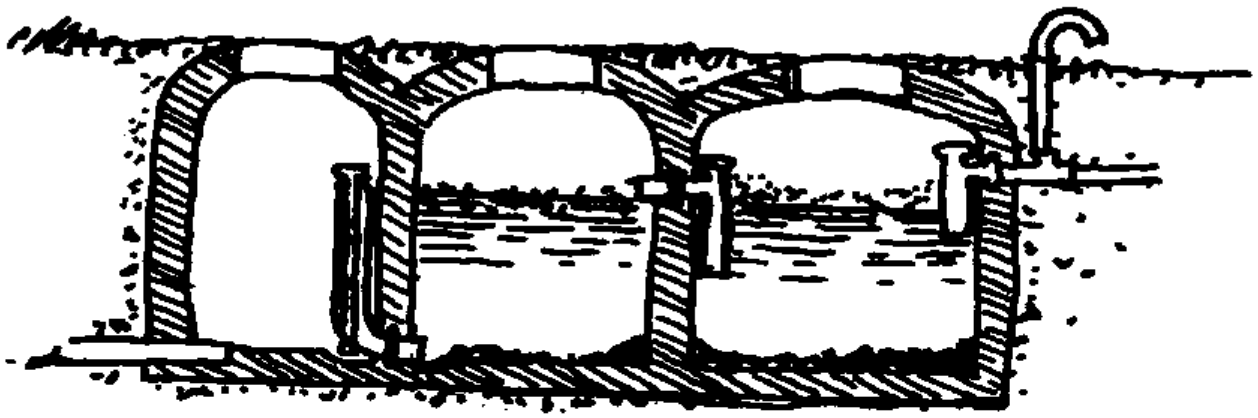


Fig. 65.—Fosse Mouras (Bordeaux).

Septic Tanks

- Edward S. Philbrick of Boston

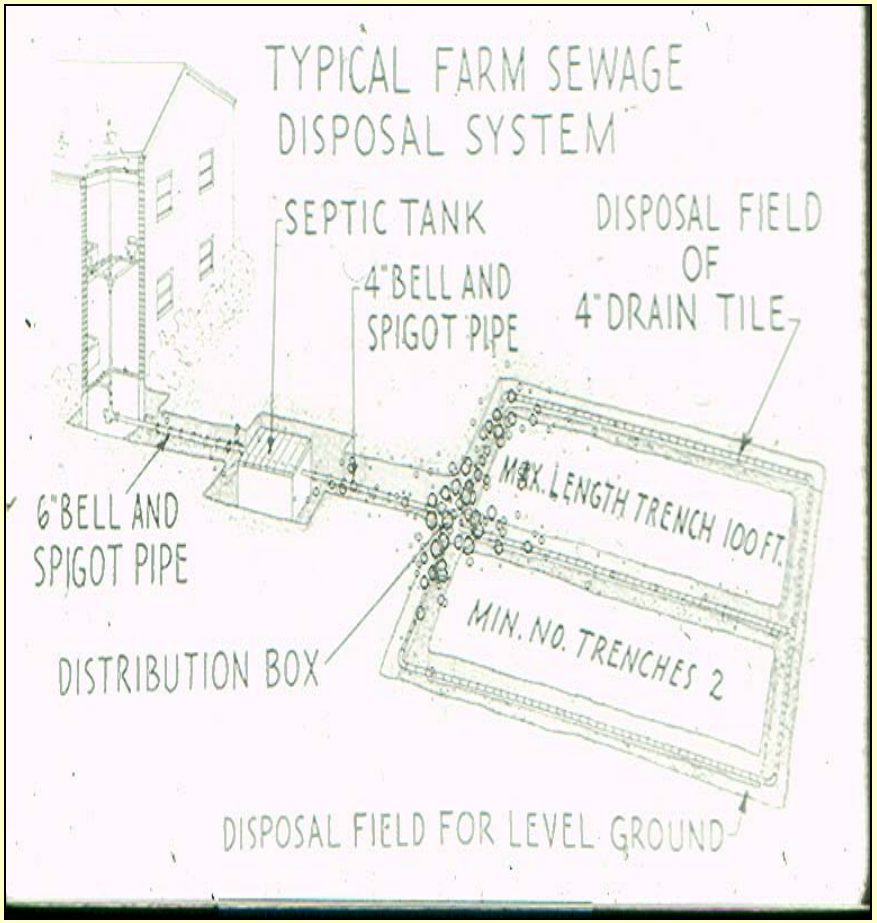


The first septic tanks appeared in the United States about 1883, when a two-chamber, round, vertical tank equipped with a dosing siphon for discharge was designed by Edward S. Philbrick of Boston, Mass.

Moving into the 20th century

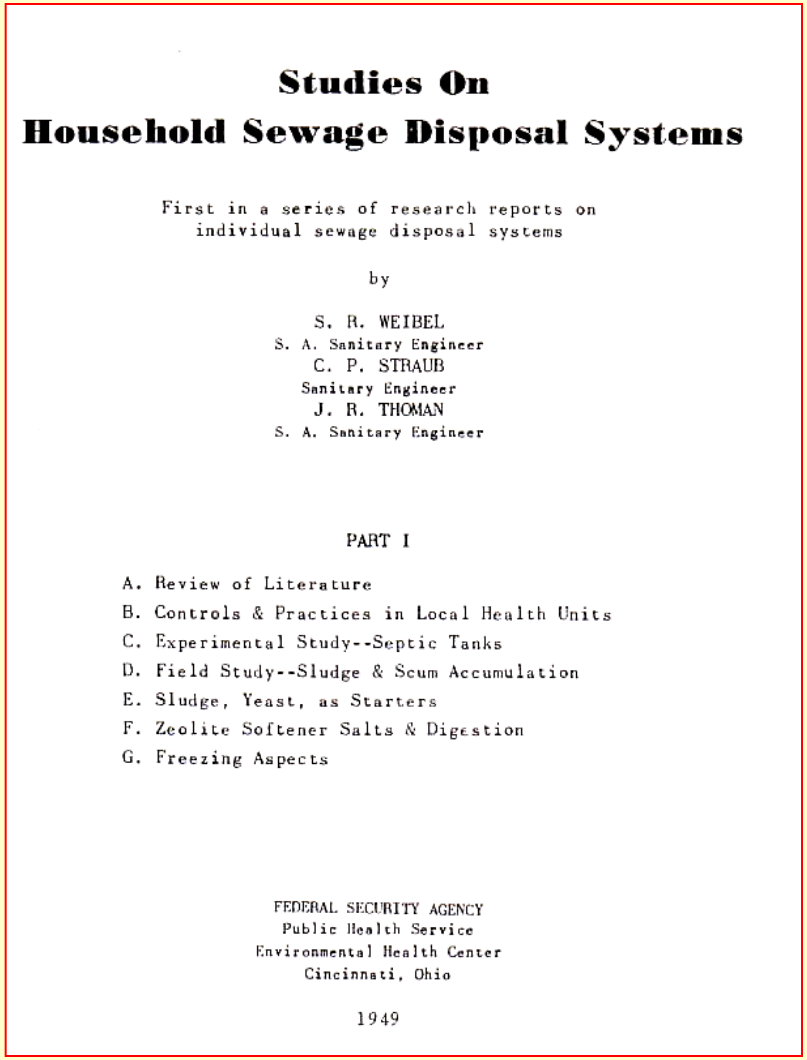
Guidance on Septic Systems

- Pre-WW II
  - 1920's: USDA Rural Sanitation guides
    - Advice on septic system installation



Guidance on Septic Systems

- 1940-50's: USPHS and National Housing Agency
- Basic research on septic systems
- Findings:
  - Homeowners were uninformed about maintenance
  - Most common complaints
    - Seepage to surface
    - Odor nuisances
    - Plumbing stoppages
    - Sewage backing up



Studies On
Household Sewage Disposal Systems

First in a series of research reports on
individual sewage disposal systems

by

S. R. WEIBEL
S. A. Sanitary Engineer
C. P. STRAUB
Sanitary Engineer
J. R. THOMAN
S. A. Sanitary Engineer

PART I

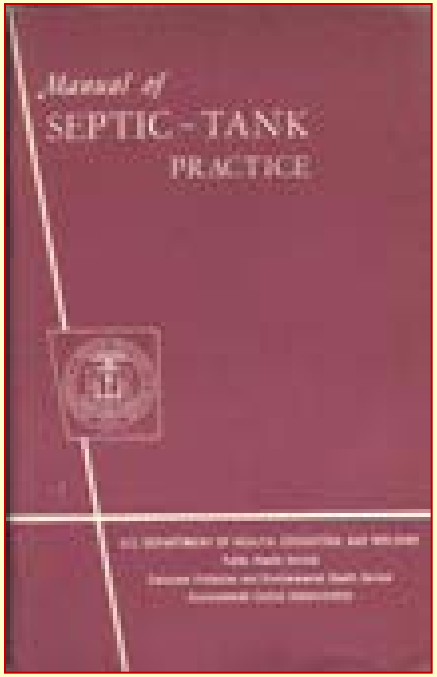
A. Review of Literature
B. Controls & Practices in Local Health Units
C. Experimental Study--Septic Tanks
D. Field Study--Sludge & Scum Accumulation
E. Sludge, Yeast, as Starters
F. Zeolite Softener Salts & Digestion
G. Freezing Aspects

FEDERAL SECURITY AGENCY
Public Health Service
Environmental Health Center
Cincinnati, Ohio

1949

Guidance on Septic Systems

- 1950-60 Manual Of Septic Tank Practice

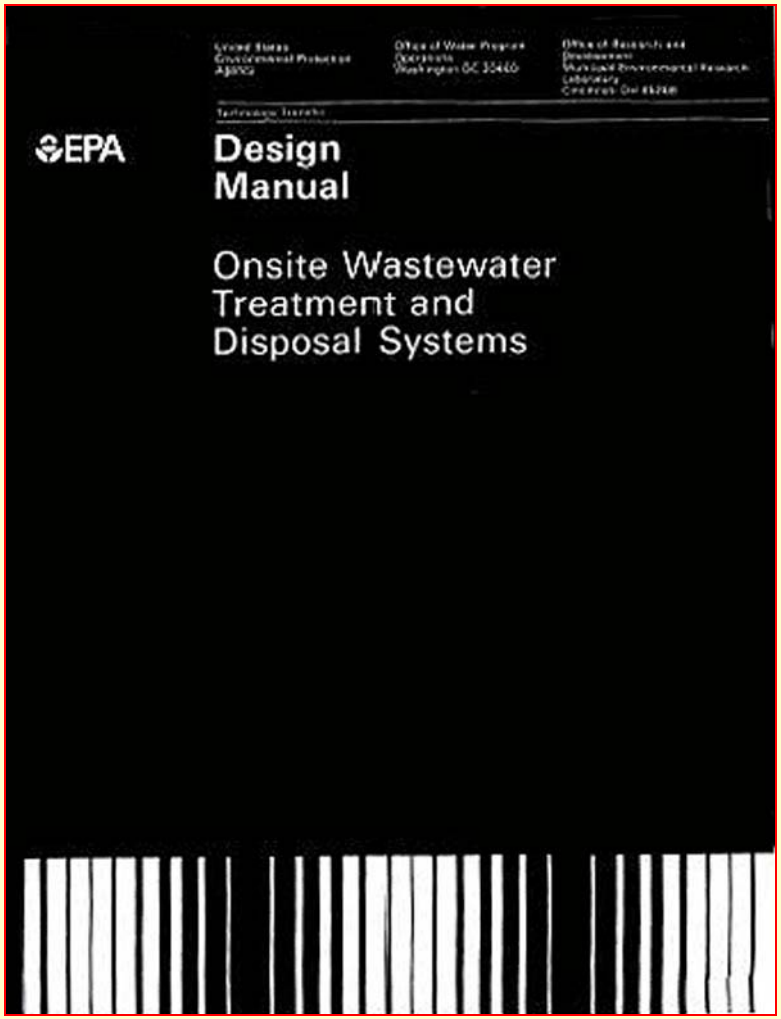


Guidance on Septic Systems

- 1970's
  - Environmental movement
  - Environmental Protection Agency

Guidance on Septic Systems

- 1980 EPA On-Site Wastewater Management Manual
- Ideas used in NC
  - Administrative penalties
  - O&M Guidelines
  - Soil morphology

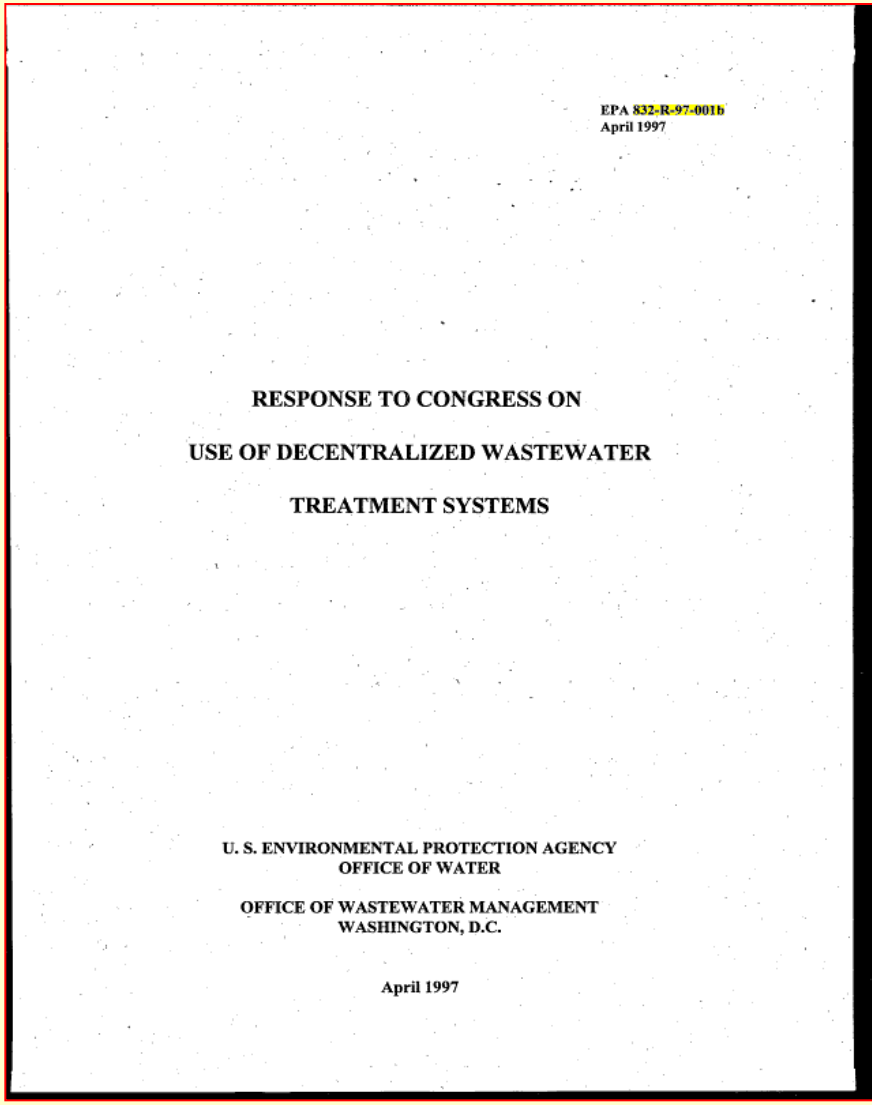


Guidance on Septic Systems

- 2000's EPA Decentralized Wastewater Manual/Web/etc.
- http://www.epa.gov/ORD/NRMRL/pubs/625180012/625180012total.pdf

EPA Endorsement of Septic Systems

- 1997 EPA Response to Congress
  - Adequately managed systems are cost-effective and long-term option
  - Recharge local aquifers and provide reuse opportunities close to point of generation
  - Provide treatment, protect public health and water quality just as well as centralized options



EPA 832-R-97-001b
April 1997

RESPONSE TO CONGRESS ON

USE OF DECENTRALIZED WASTEWATER

TREATMENT SYSTEMS

U. S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF WATER

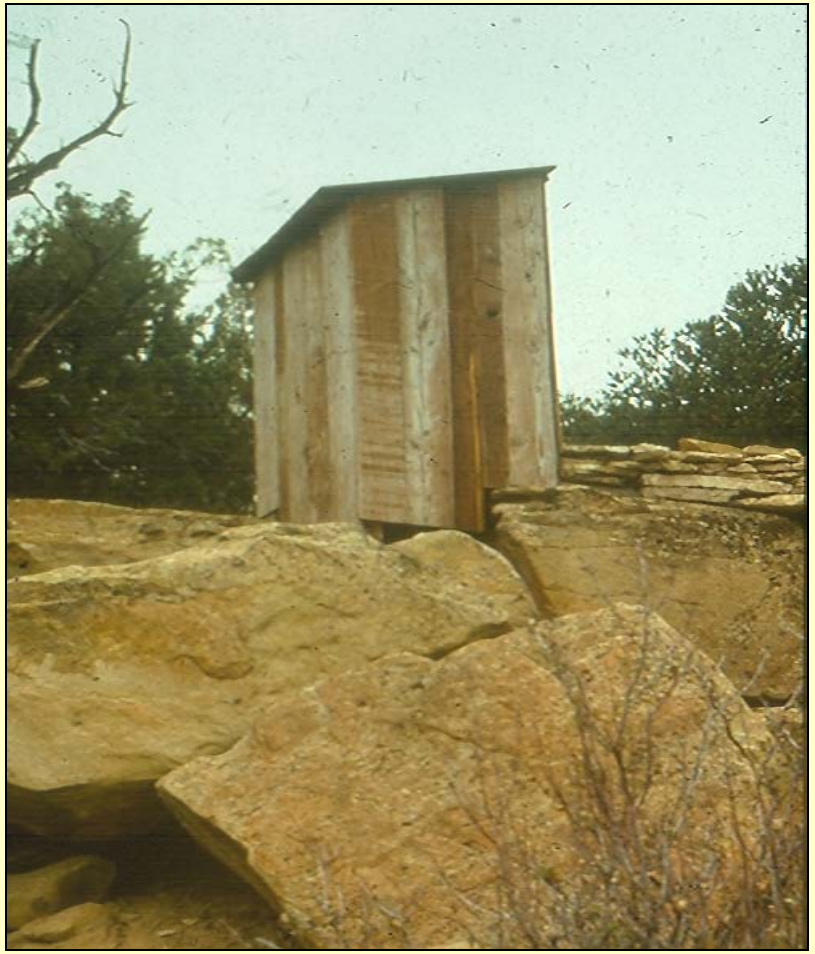
OFFICE OF WASTEWATER MANAGEMENT
WASHINGTON, D.C.

April 1997

History of Onsite Wastewater in North Carolina

The Privy Arrives in NC

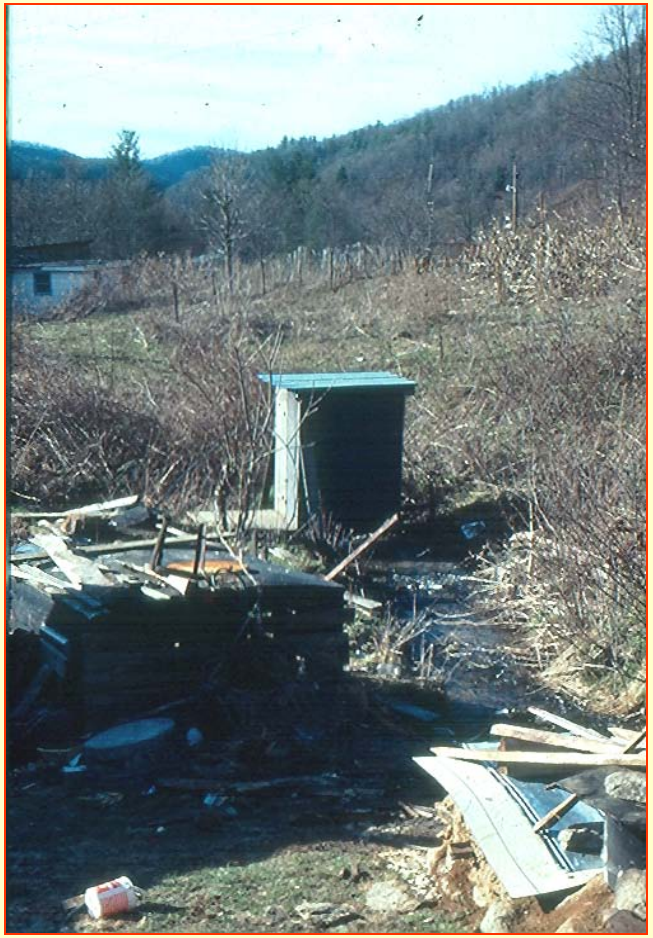
- NC was known as a ‘Rip Van Winkle’ state
- Walter Hines Page brought Rockefeller to NC
- Rockefeller Program (1900’s)
  - A privy at every school
  - Became first public health program in NC
  - The start of LHDs and NC State Board of Health
  - Guilford-1st county health department
- Works Progress Administration (1933-45)
  - Privy Reconstruction



The Privy Law in NC

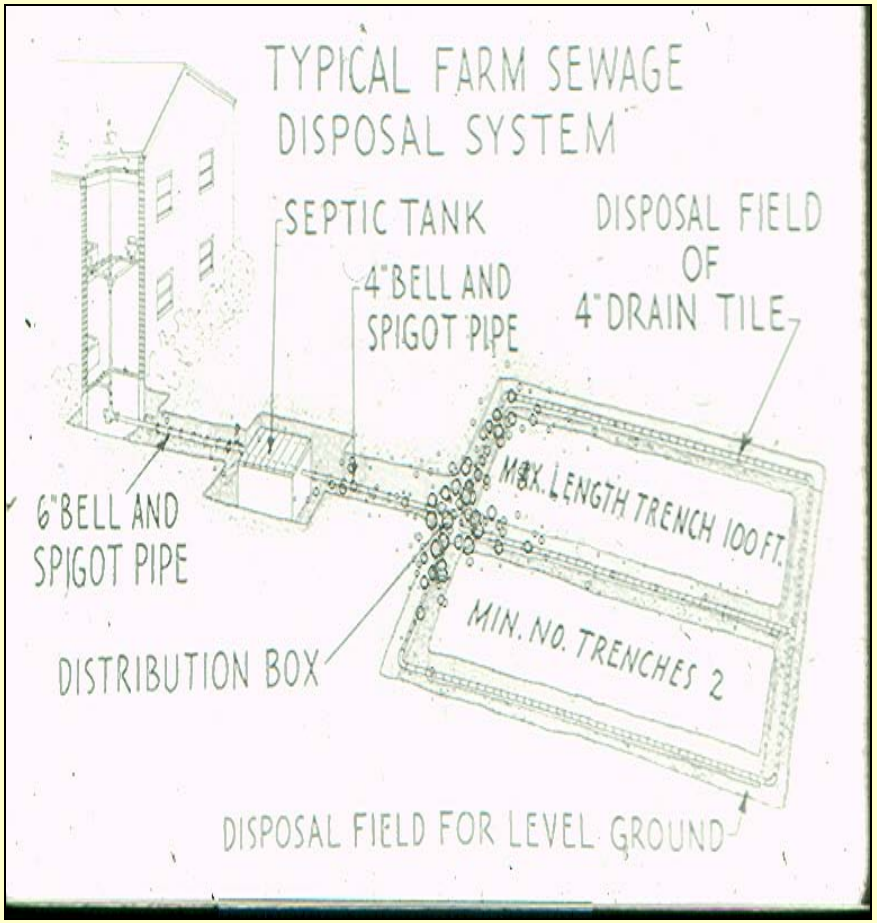
- NC Law (Circa 1919)
  - *"Every residence located within 300* feet of another residence must have an improved privy of a type approved by the NC State Board of Health."*

*How far a hookworm can crawl from the "source"



Rural Sewage Systems in NC

- Pre-WW II
  - No laws or rules
  - 1920's: USDA Rural Sanitation guides
    - Advice on septic system installation
  - No siting or soil criteria.



Rural Sanitation in NC

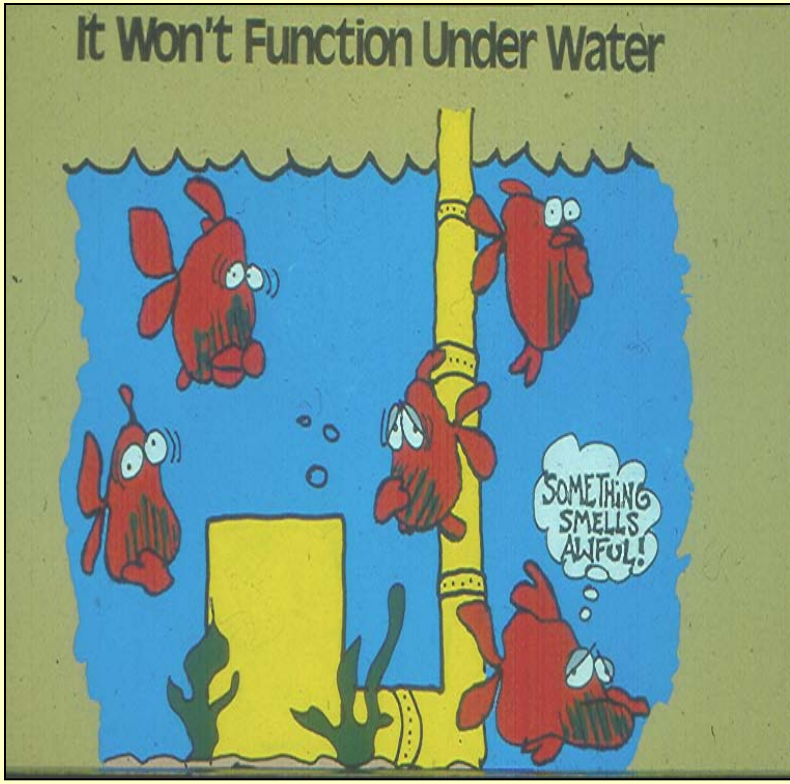
- Rural electrification
  - *Change from water by the bucket-full to electric pumps in wells*
- Indoor plumbing
  - *Bathrooms added to rural homes*
- Water-carried sewage

Early NC Regulatory Program

- 1957 Act
  - Required Local Board of Health to adopt regulations
    - Permit
    - Sewage disposal record
- State Board of Health
  - ‘Perc’ Test

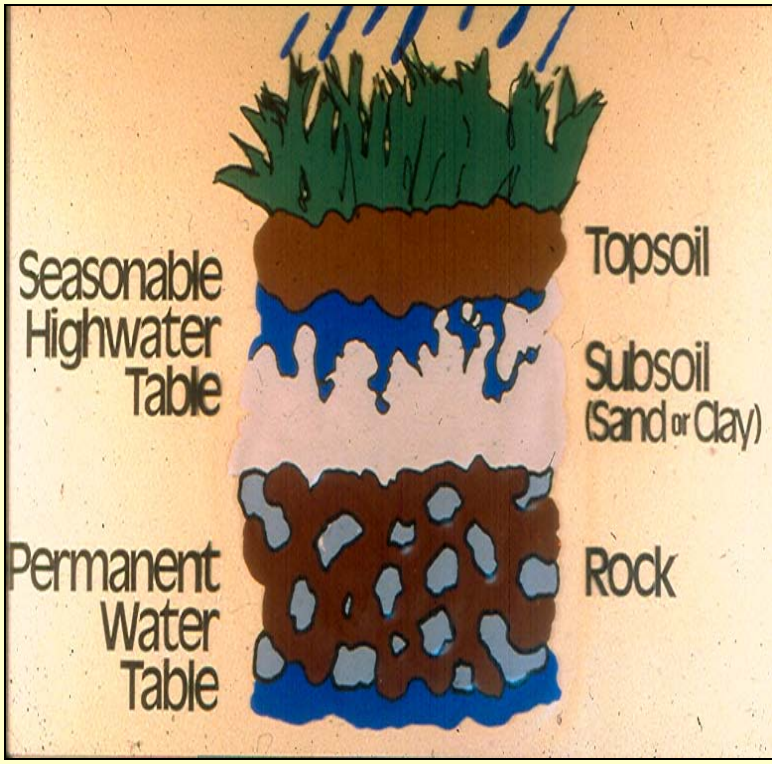
NC Laws for OWTS in the 1970's

- Ground Absorption Act of 1973
  - Site evaluation guidance
  - Permitting
    - Improvement Permit
    - Certificate of Completion
    - OWTS permits required before other construction permits
    - Limit or cut off electricity
- 1976 First full time OSW Program employee
  - *Steve Steinbeck*



NC Rules for OWTS

- "Modern" Era Rules 1 July 1977
  - Site Evaluation (Technical Guide)
  - Using 'Perc' Tests
  - Increased setbacks
  - Suitability Classes (3)
  - LTAR based on site classification:
    - Suitable: 1.5 gpd/sf
    - Prov. Suitable: 0.75 gpd/sf
    - Unsuitable>>reclassified: 0.5 gpd/sf



NC Rules for OWTS

- 1979: Two-compartment septic tank required
  - Solid baffle wall slotted at mid-point
  - Placed so that inlet compartment is 2/3 the liquid capacity
  - Reduced solids and made a stronger septic tank

NC Laws for OWTS in the 1980's

- Ground Absorption Act of 1981
  - Described responsibilities within DENR
    - OSW: Subsurface systems <3,000GPD
    - DWQ: Surface systems and all >3000GPD
  - Management of OWTS
    - System Classification
    - Operation Requirements

NC Laws for OWTS in the 1980's

- Ground Absorption Act of 1981
  - Detailed enabling legislation for rules
  - Legal Remedies
    - Revocation & Suspension of Permits
    - Civil Penalties
    - Injunctive Relief
    - Criminal Misdemeanor
  - Experimental and Innovative Systems

NC Rules for OWTS in the 1980's

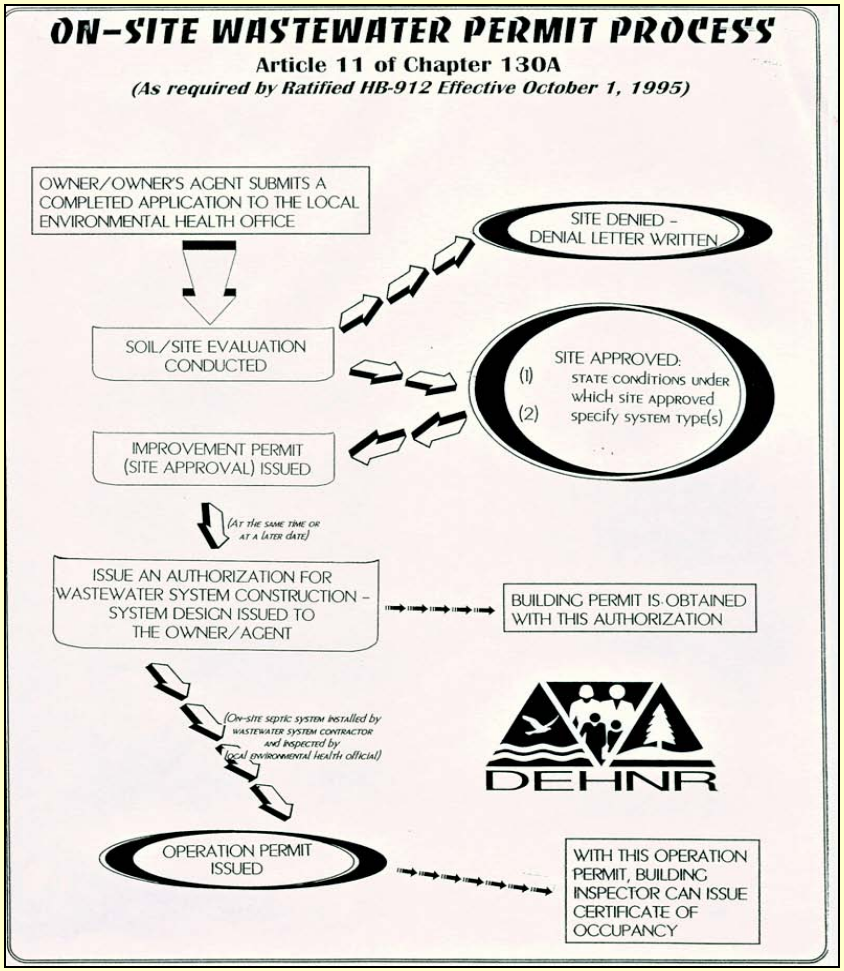
- 1 July 1982
  - Complete rewrite of 1977 Rules
  - No more 'Perc' tests
  - Site evaluation revised
    - More specific soil criteria
  - Repair area required
  - LTAR reduced & based on soil texture (wider range)
  - Design flows reduced
  - LPP system added to rules

NC Rules for OWTS

- Amendments to ‘82 Rules (ongoing)
  - LPP & PPBPS Modified Systems
  - Areal fill systems (new & existing prior to 1977)
  - Aerobic Treatment Units (ATU)
  - O & M required
  - Restrictive horizons clarified
  - Saprolite option
  - Monitoring & modeling for soil wetness (.1942)
  - I & E Systems
  - More forthcoming (accepted systems)

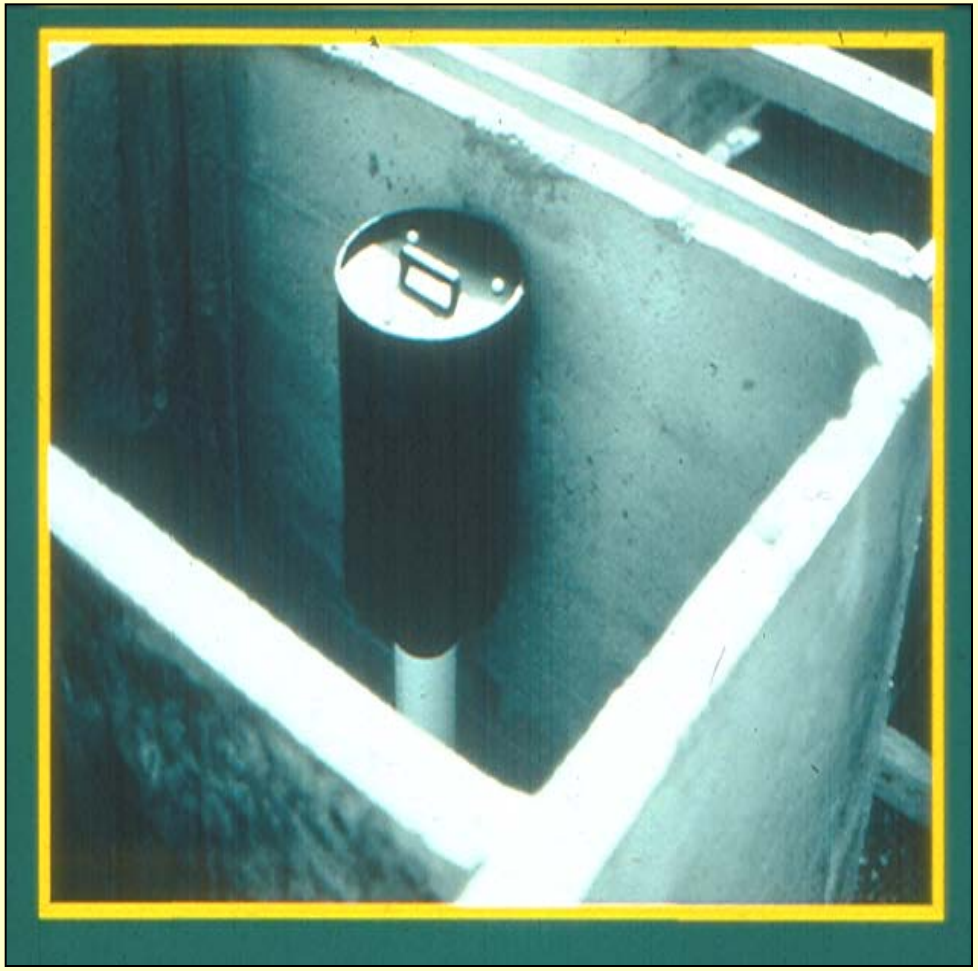
NC Laws for OWTS in the 1990's

- 1995 Amendment
  - Preliminary approvals
  - Three Tier Permit
    - Improvement Permit
      - Site Approval
    - Construction Authorization
      - **Design Approval**
    - Operation Permit
      - Installation Approval
  - Subsurface systems >3,000 GPD
    - Back to "DEH"

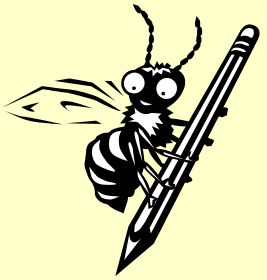


NC Rules for OWTS in the 1990's

- 1999 Effluent screens (filters) and risers required
  - Screen 1/16 in. (solids)
  - Installed to allow routine maintenance
  - Designed to require O & M not less than a 3 year frequency
  - Cast in place T's removed
  - Risers if 6" under
  - Tank tags & markers



NC Rules REWRITE for OWTS



- 2000's
  - Rule revisions
  - MAJOR rules reorganization
  - Rewrite from stem to stern
  - Definitions
  - Tables,
  - Etc…..

Other Laws Affecting OWTS

- 1974: Coastal Area Management Act (CAMA)
- 1983: Septage Program Established In Solid Waste Division (DENR)
- 1985: Office of Administrative Hearings (OAH)
  - Rules Review
  - Hearings

OTHER LAWS

- Wetlands
- Stormwater/Riparian Buffers

OTHER REGULATORY ACTIVITIES

- DWQ/EPA: TMDL's, Basinwide planning, etc.

NC Research, Demonstration and Training

- 70-80's TJ COG
  - Individual Wastewater System Project: Lick Creek Demonstration Site
    - Trench shapes
    - Push for solutions for marginal soils
- 80's
  - LPP and Mound Studies
  - Early Fate and Transport studies on pathogens and nutrients
    - First Onsite Conference
  - NC Septage Management study

Research, Demonstration and Training

- 1990's
  - Establishment of more training and demonstration centers
  - Beginning of NPS in Onsite
- 2000's
  - Fate, Transport, Transformation
  - Indicators, Systems, Emerging Contaminants , Tracking…..

NC Legislation: 2000's

- 2009
  - Licensed contractors and system inspectors
- 2011 Budget
  - DEH moved to DHHS
  - Support staff gone
  - Positions eliminated
    - WaDE program
    - Quality Improvement Team
    - Private Wells
  - Fiscal justification for new or amended rules

Future of OWTS?

- Law and Rule Amendments
  - Enhanced O & M
  - Tort Reform
  - Performance vs prescriptive
- Better training and education
  - This takes money
- Funding for research
  - Traditionally scarce
  - Worse now

Remember …

1. Every day above ground is a great day.

2. Live each day so that when you are gone your life will have mattered.

SJS