Septic Systems

Classification, Operation and Maintenance

Outline of Presentation

- History of Septic Systems
- Wastewater Treatment defined
- Types of Septic Systems/Terminology
- Classification of Septic Systems
- Operation and Maintenance of Septic Systems
- Trouble Shooting when things go wrong
- Q & A

Septic System History

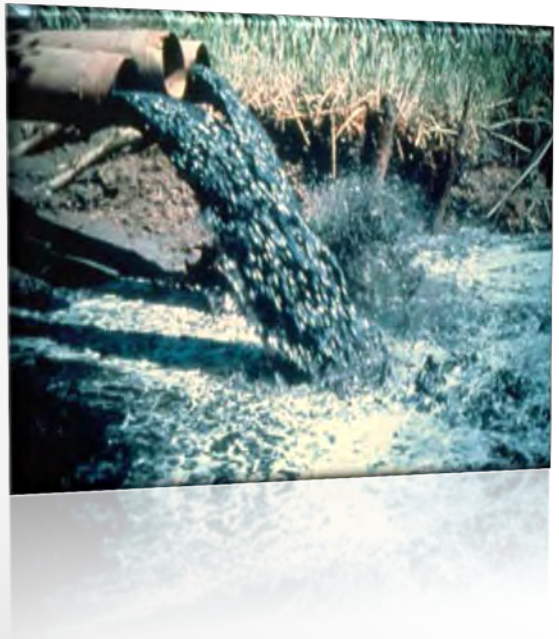
Believe it or not!

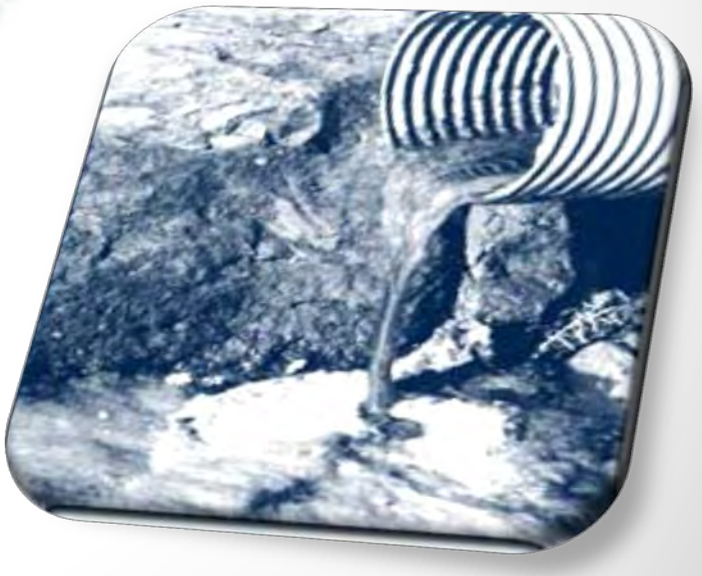
Sewage Treatment is a relatively new concept.

Not that long ago guess what cities did with their wastewater... ?


WELCOME TO
SEPTICS
101

History





Yummy!

Disease Causing Organisms

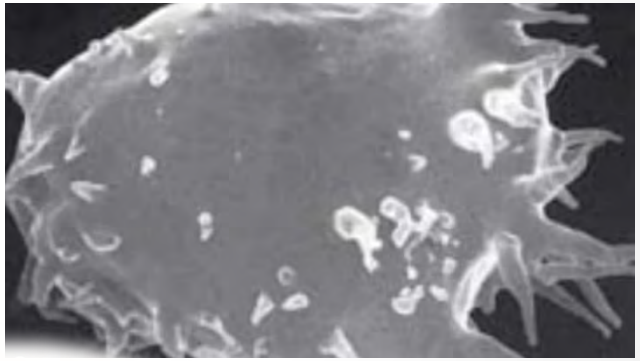
Pathogens

- Parasites, viruses and bacteria exist in everyone's gut. healthy adult got used to most of these little critters

- People with week Immune systems risked illness.
- The Young and the Elderly most vulnerable

History Cont'd

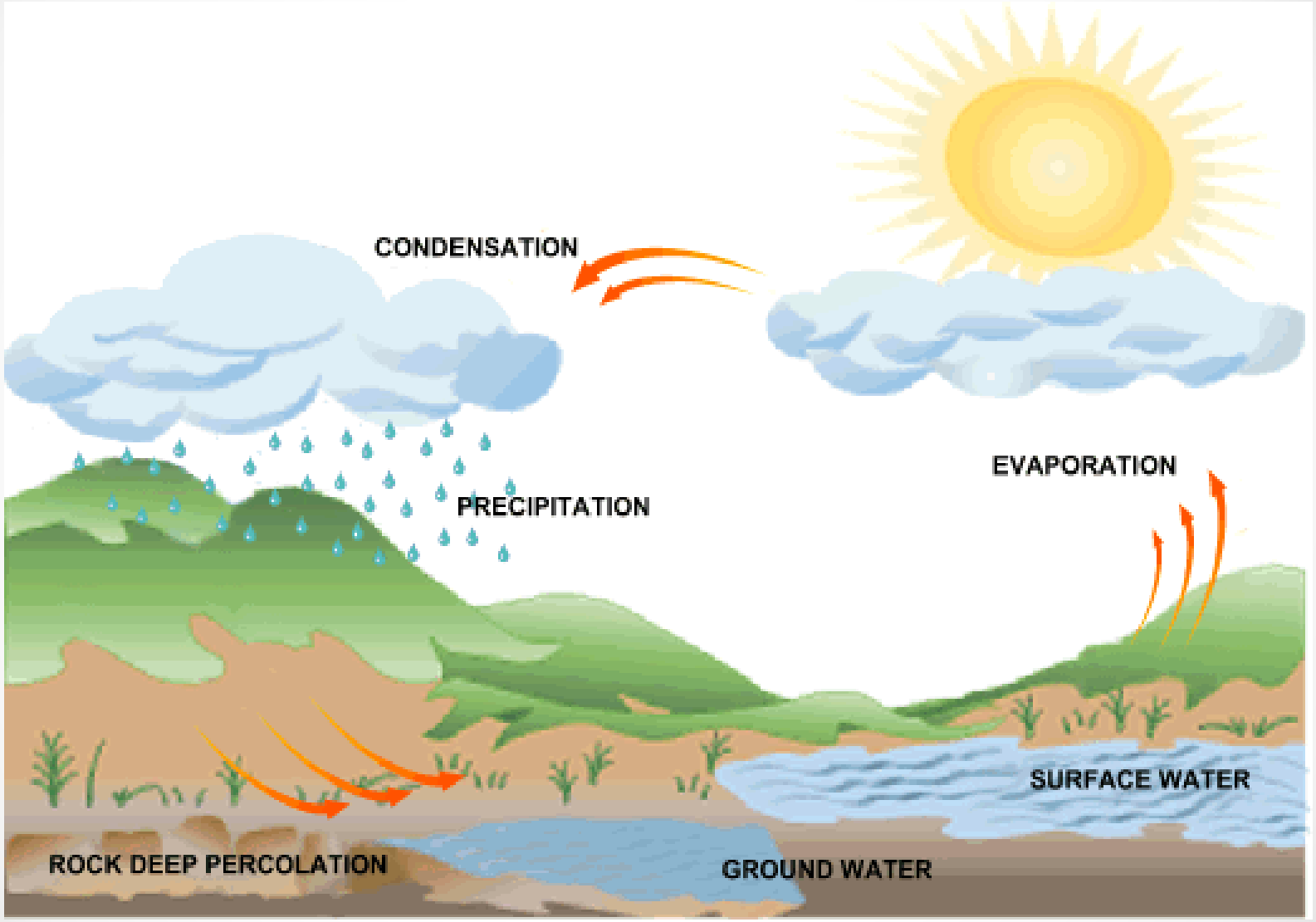
In the Year 1900 , the average North American died at the ripe old age of 47 largely because of the pathogens they consumed in their contaminated drinking water such Bacteria, Viruses, protozoa and worms



History Cont'd

SCIENTISTS SAY ONE OF THE GREATEST ADVANCES IN MODERN TIMES WAS THE ADVENT OF **SEWAGE TREATMENT.**

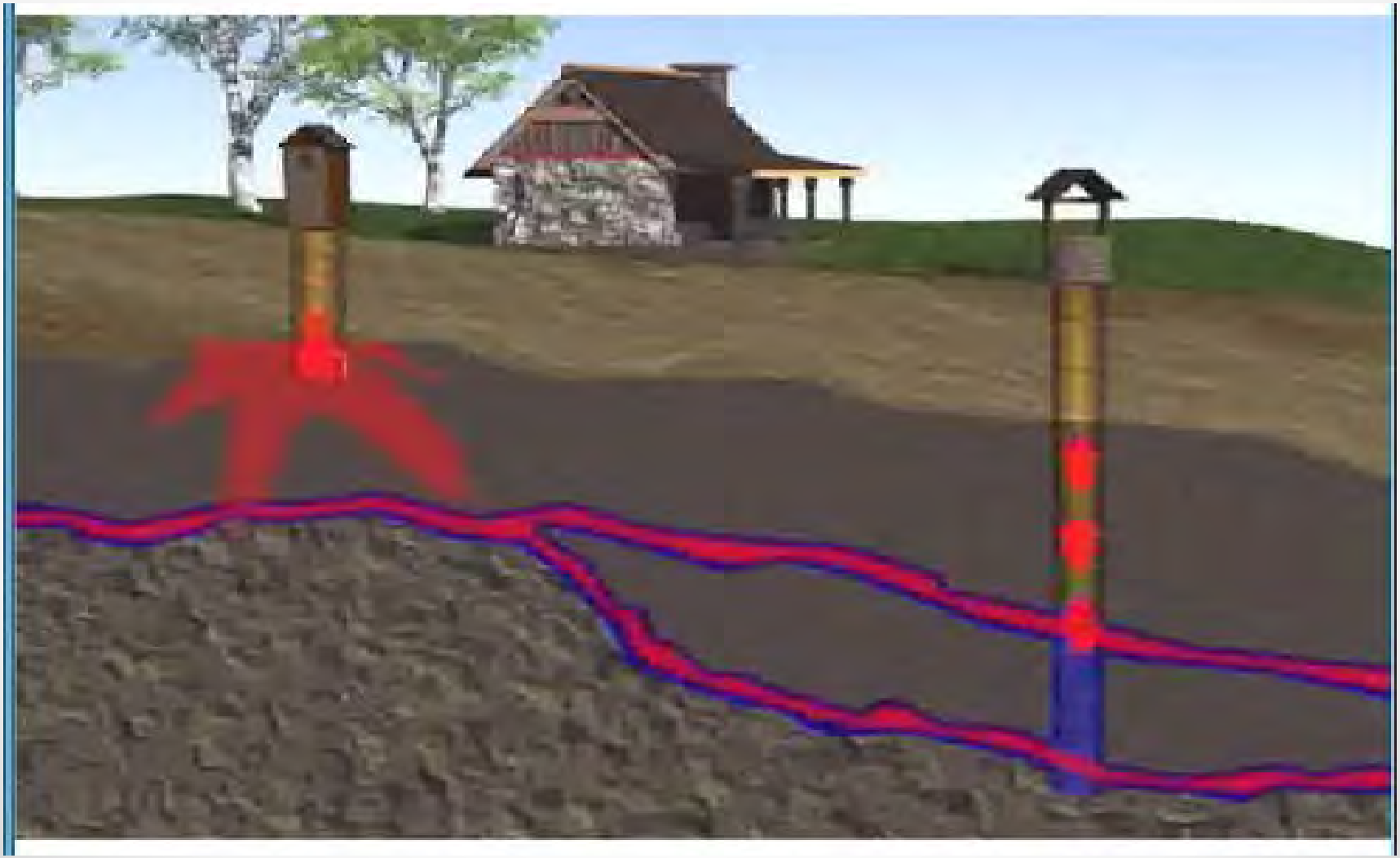
Understanding the water cycle



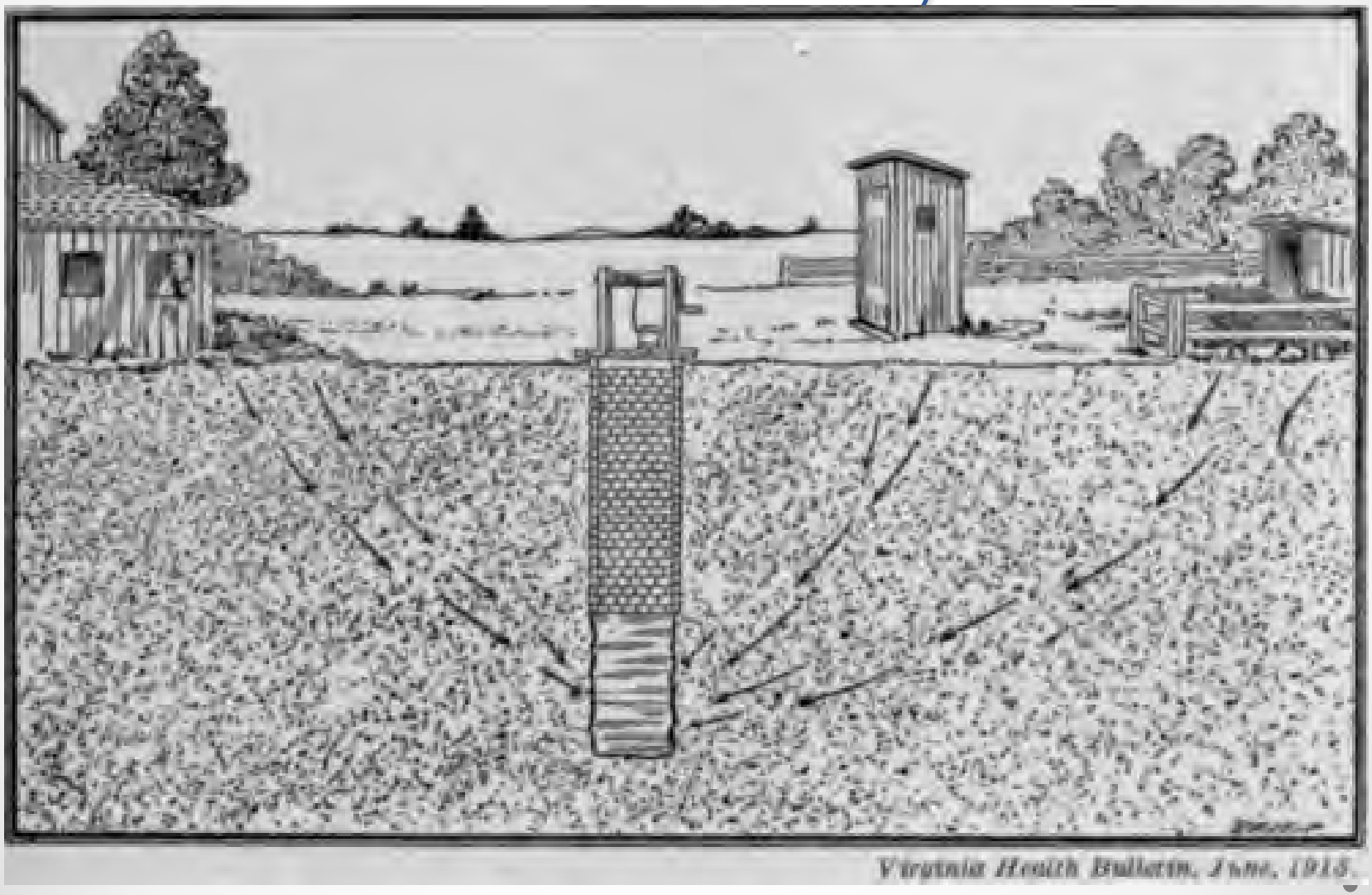
In the old days…

- When people built a house they also needed water and a place of "business".

In the old days…

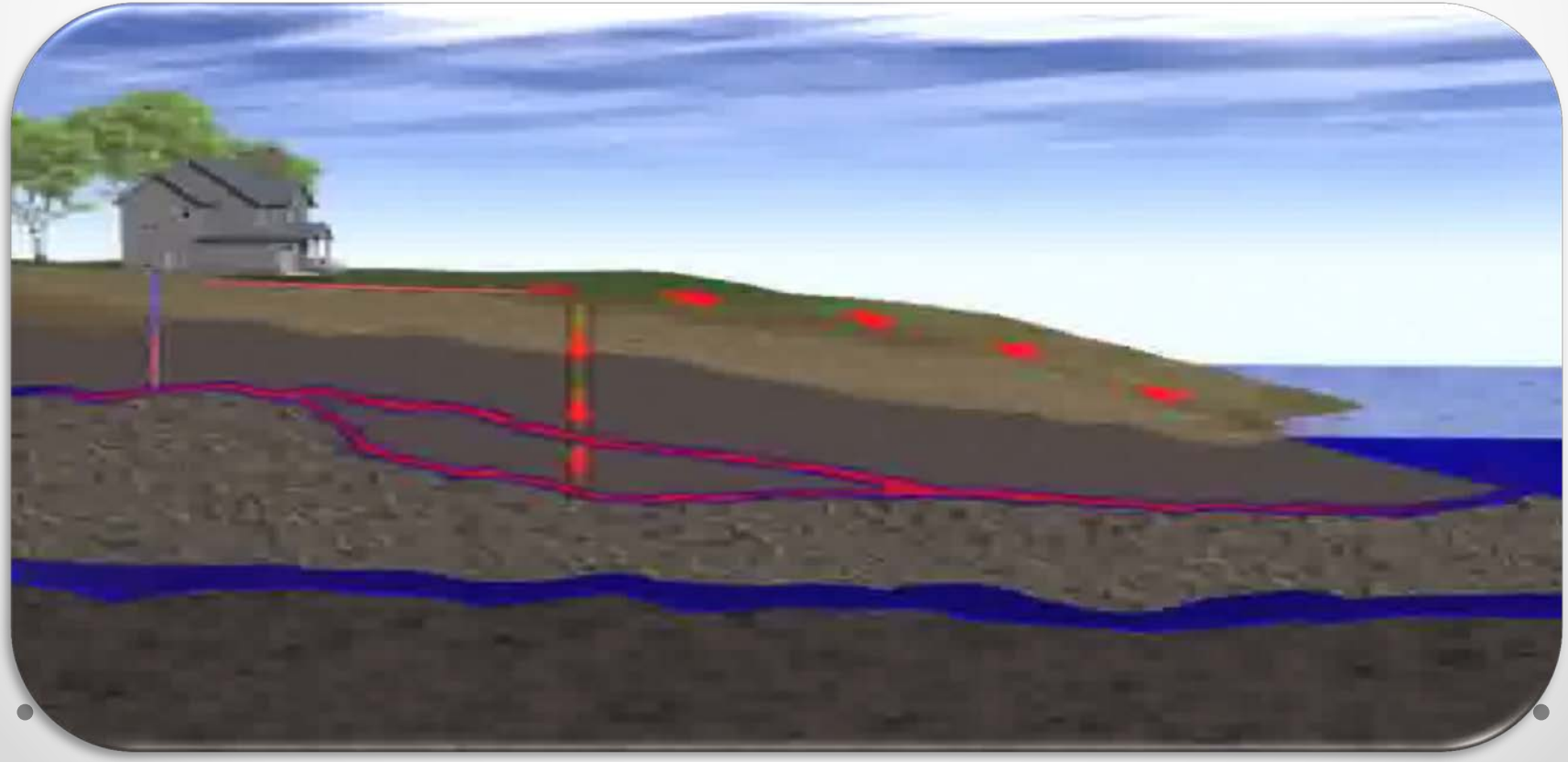


In the old days…



In the old days…

- IN THE EARLY 1900'S THE WAY PEOPLE USED WATER CHANGED DRAMATICALLY WITH THE ADVENT OF INDOOR PLUMBING.



Older Piping Systems

- Up till now people were using water by the bucket, modern bathrooms/kitchens allowed people to use water by the barrel.
- Getting the water in the house was easy
- Getting rid of it posed a real problem
- Many ran a straight pipe out to a ditch, river, lake,
- Still hundreds if not thousands of these straight pipe systems out there.

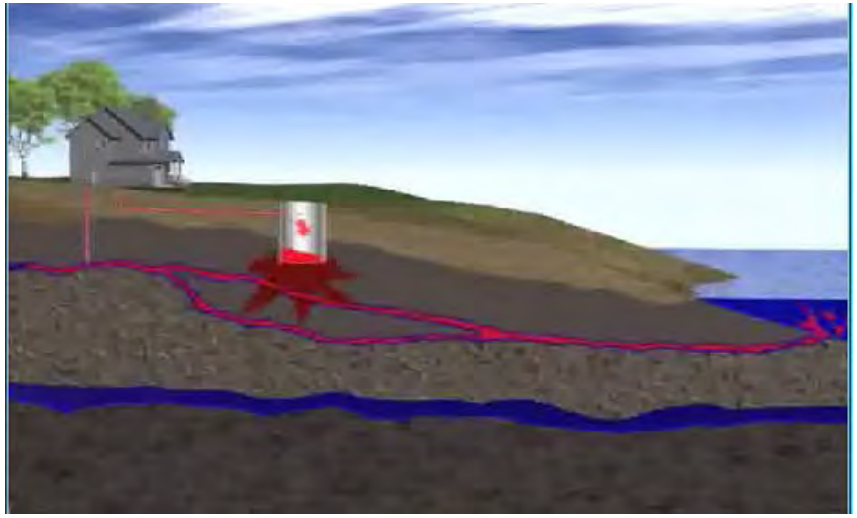
Negatives of Older Piping Systems

- Pools of sewage were dangerous to people/animals
- Breeding grounds for mosquitoes (more people have died from mosquito spread diseases than all of the wars combined).
- Sewage is high in nutrients (human waste, soaps) and nutrients in surface water promotes excess plant and algae growth.
- Old wells rarely decommissioned properly resulting as direct conduit to the underground drinking water supplies.
- They stunk!

Outhouses/Cesspools

The Cesspool

- ✓ Cesspools are pits dug near the house



- ✓ Wastewater was flushed into the cesspool where it leached down through the bottom and out through the sidewalls.
- ✓ The deeper this cesspool was the more wastewater it could handle.

Cesspool Effects on Surface Waters

- Cesspools/Outhouses sometimes were deep
- Often dug right into shallow water tables
- Sewage Cross Contaminated Groundwater
- Called Non-point pollution
- Shallow water tables feed the surface waters

Purpose of Septic Systems?

- *"Ask most people what the purpose of a septic system is and they will say, "To dispose of your wastewater"*

University Research

- Universities of Minnesota and Wisconsin conducted much of the research on improving existing sewage treatment systems

Why Improve?

- Public Health
- Economics of Tourisms
- Water Quality Deterioration = Potential Tourism Reduction = Loss of Revenues
- Improving onsite wastewater systems became a priority

Improving WWT

- Types of soils
- Excellent mechanical filters
- Removal of solids
- Discovered bacteria in top- soils performed another valuable service
- Consumptions of Parasites and viruses present in excrement.
- Key was to keep the systems shallow.

Mother Nature to the Rescue

- *Mother nature naturally treats animal feces by putting bacteria in the top soil.*
- *Pickup a tablespoon of dirt from your yard and there are more than 4 - 5 million bacteria*
- *Bacteria eat harmful nasty organisms in feces*
- *A septic system harnesses mother natures way of cleaning up after animals by utilizing those bacteria and assisting the treatment process just under the surface.*

Typical 1970's Septic System Design

Comprised of 2 parts:

- The Tank
- The Drain field

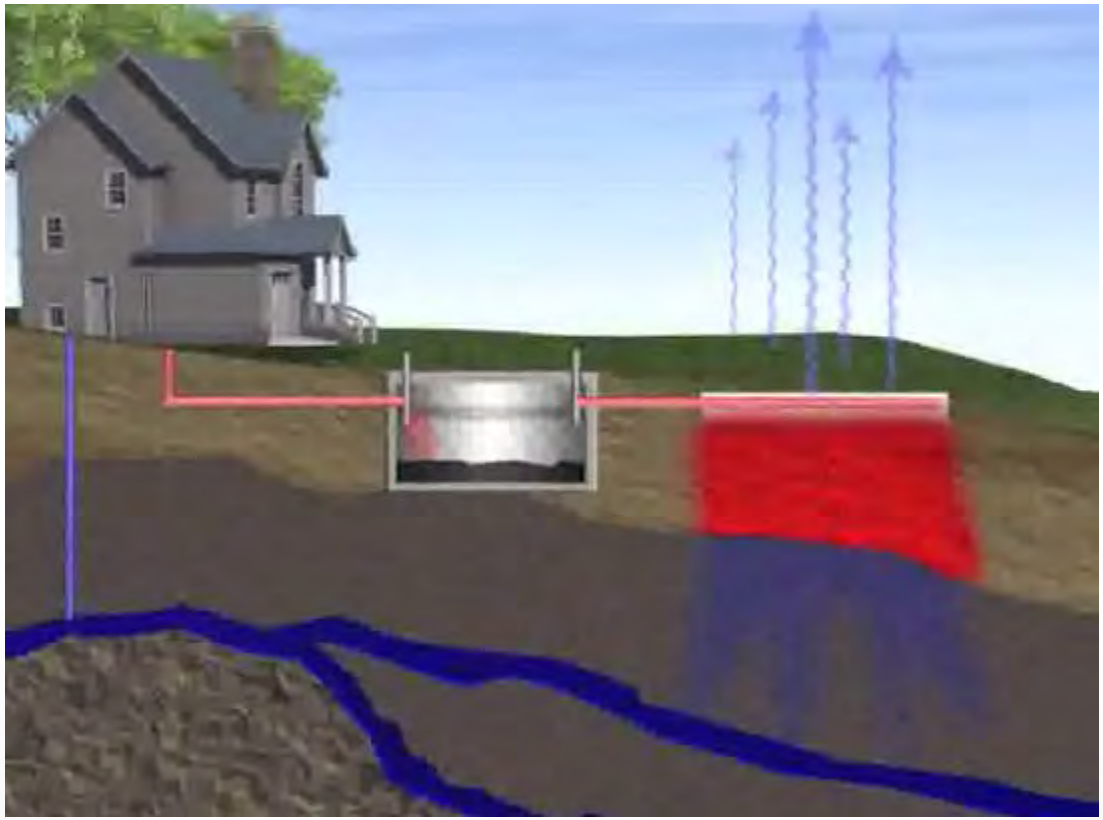
Septic System Piping and Tank

- Piping is the transportation conduit for wastewater to travel through each treatment process
- Tanks
  - Allows settling of solids
  - Separation of solids
  - Storage of solids.

Septic System Drain Field

- The typical Drain field is a trench (or bed)
- 15 cm (6”) to 90 cm (36”) of gravel
- Plastic pipe is then placed on top of the gravel.
- More gravel is placed over the pipe and covered with a permeable barrier to prevent topsoil from migrating down and clogging the gravel.

Septic System



Septic System Design Limitations

Older Septic System Designs worked well under ideal conditions

- Not all sites were ideal.
- High water tables
- Slow soils that won't perk
- Soils that perk too fast (effluent needs to move through the soil slowly for adequate treatment to take place)
- Lack of soil
- Nearby body of water where more through nutrient removal was necessary

Design Limitations were Resolved

- Necessity being the mother of invention
- Solutions for the problems were developed
- The Mound systems resolved issues such as
  - High water tables
  - Slow perking soils.

Limitation Solutions

- Different materials used for Systems
- Sand Filters
- Peat Filters
- Aerobic systems
- Shallow drip irrigation
- Constructed wetlands provides necessary treatment when the existing site won't.

Alternative Systems

- Cost more than basic systems
- Still far cheaper than building a sewage treatment facility
- Hook-up fee may be thousands of dollars
- New septic system generally costs $10,000 to $20,000 and $150 to $300 a year to run

Modern System Issues

- Many abandoned Cesspools were never filled in
- Not a question of if they are going to collapse (concrete doesn't last forever), it is when they are going to collapse,
- Someone happens to be standing over it when it gives away there is a chance they will not get out alive.

Modern System Issues Cont'd

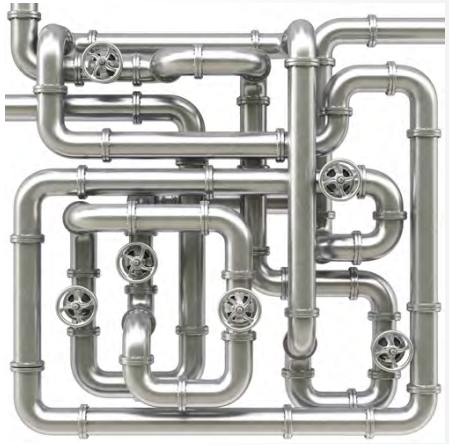
- Cesspools still in use waiting for that big pipe.

- Fall into an active cesspool and your chances of getting out alive go down considerably
- Codes and Bylaws
- Grandfathering old systems. "Don't worry about that old septic system...it is grandfathered in so you never need to upgrade it."

Modern Wastewater Treatment

Over view

- Greater than 70 municipal Wastewater Treatment Technologies available today
  - * Septic Systems
  - * Conventional Wastewater Treatment
  - * Membrane Bioreactor
  - * Rotating Biological Contactors, etc.



- Industrial Wastewater Treatment Technologies

- Agricultural Wastewater Treatment

Wastewater Treatment Vs Water Reclamation

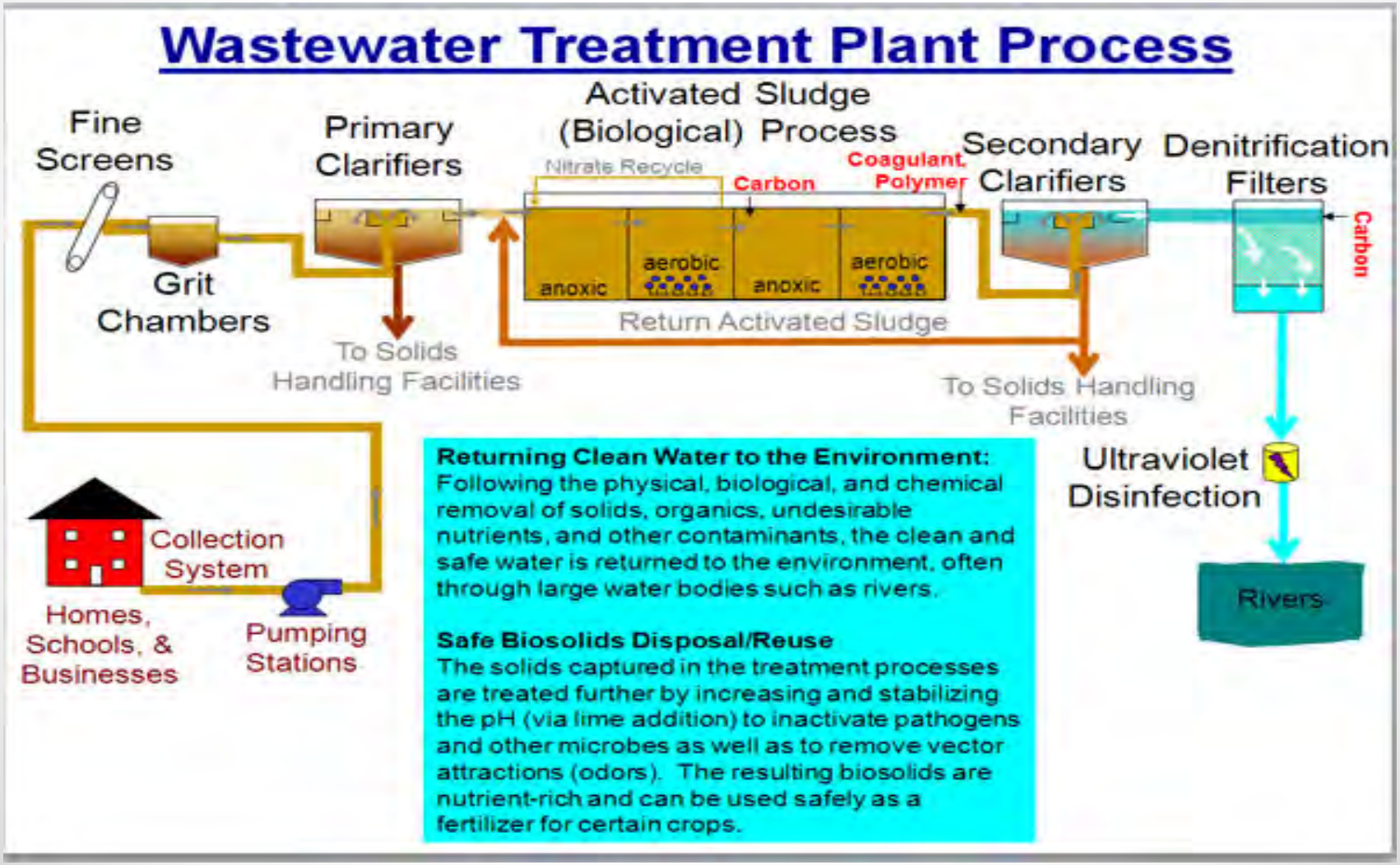
- ✓ The phrase “Wastewater Treatment” is outdated and is being phased out.
- ✓ “Water Reclamation” is the latest term used to describe the desired end result.

Wastewater Treatment Defined

Wastewater Treatment

- Process that modifies wastewater characteristics such as its Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), pH, etc., to enable it to meet effluent standards

Typical WWTP Process



Wastewater Treatment Systems

- In Canada
- Approximately 28,800 Section 95 homes on reserves
- These are Band-owned and operated
- Many homes are privately owned
- Some homes are connected to WWC → WWTP where Wastewater Treatment Plants are available.

Wastewater Treatment Systems Cont'd

- ✓ Some homes will have individual Septic Systems where they are they sole domestic wastewater contributors.
- ✓ Some homes will discharge their wastewater to a communal septic system which are those with more than one home discharging their wastewater to a common system.

Septic System Sewage

- For septic tank systems serving dwellings, sewage is defined as waste of domestic origin, which is
- human body waste, toilet or other bathroom waste, waste from other showers and tubs, liquid or
- water borne kitchen waste or laundry waste,

Septic Systems

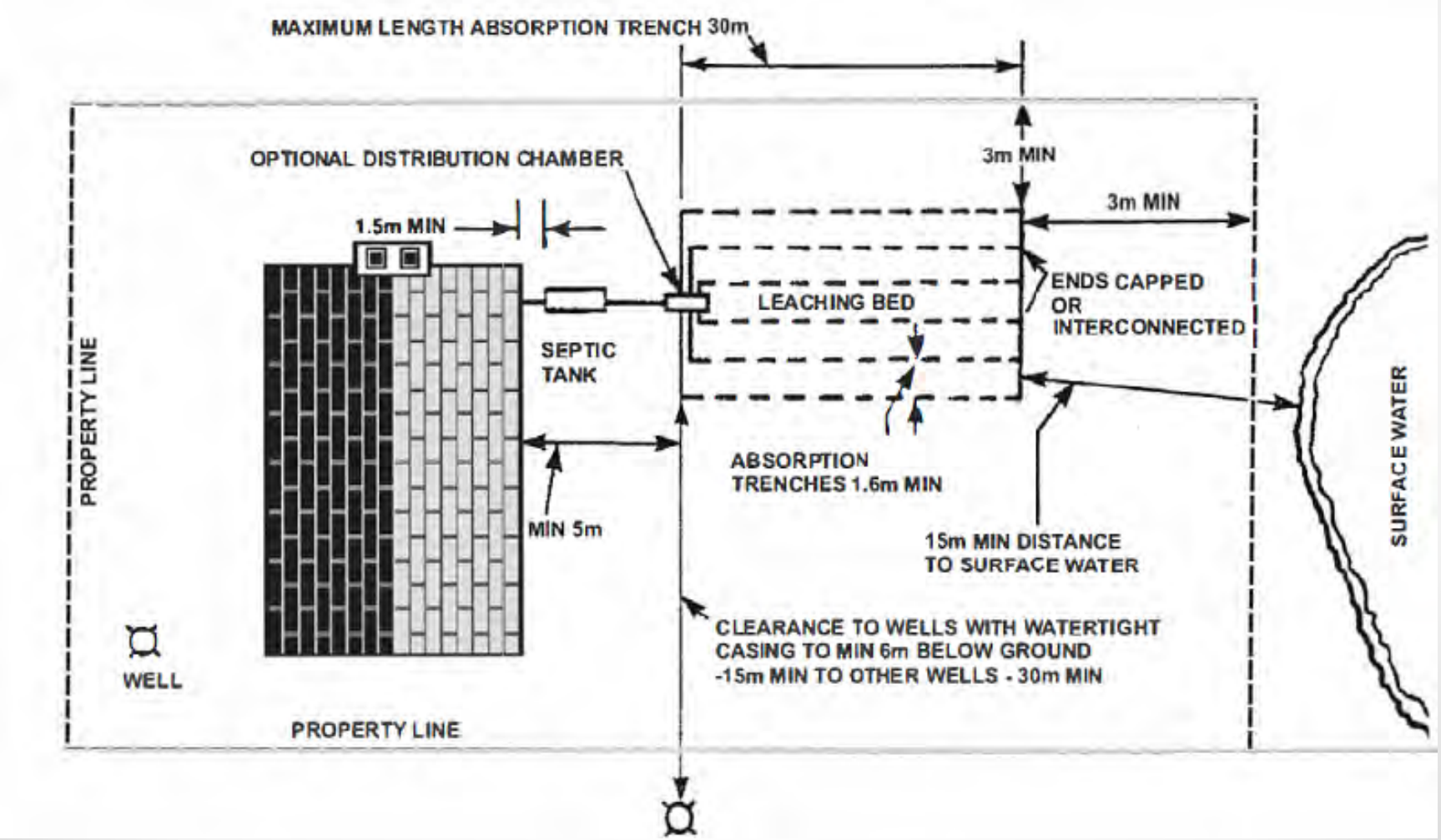
- Different than Wastewater Treatment Plants
- A Septic Tank produces a polluting effluent which must be discharged to a drainage field for further treatment.
- Septic systems do not require day to day servicing
- Mechanical construction and Process

Septic Systems

- A Wastewater Treatment Plant produces a clean, non-polluting effluent which can be discharged directly to a stream, ditch or other watercourse, or to a marshland.

- Wastewater Treatment Systems require daily, weekly, monthly and annual maintenance.

Typical Septic System Layout



Terminology Refresher

Septic Tank:

- A watertight pre-treatment receptacle receiving the discharge of sewage from a building sewer or sewers, designed and constructed to permit separation of settle able and floating solids from the liquid, detention and anaerobic digestion of the organic matter, prior to discharge of the liquid.

Terminology

Drain field (conventional):

- Drainage bed or seepage bed or leach field
- An area in which perforated piping is laid in drain rock-packed trenches, or excavations (seepage beds) for the purpose of distributing the effluent from a wastewater treatment unit.

Terminology

Gray water

- or grey water or graywater – that portion of the wastewater stream that originates in sinks, tubs, showers, laundry; i.e. all portions excluding toilet wastes.

Blackwater or Septage

- waste carried off by toilet and urinal.

Terminology

Capacity of a Septic System:

- Volume of wastewater (blackwater or greywater) which an onsite septic system must be capable of handling. Typically capacity, described as daily volume of wastewater in liters or gallons, is a function of the number of building occupants using the facility, adjusted for other building activities such as laundry, garbage grinders, or other site activities.

Terminology

Centralized Septic System

- Onsite wastewater disposal system which collects waste from multiple buildings or facilities for treatment and disposal at a single site or facility. Centralized septic systems may serve an entire community or a large group of homes such as townhouses or elder complexes. Centralized wastewater and septage disposal systems are generally associated with large treatment requirements such as for an entire community.

Terminology

Cluster Septic System:

- Type of *centralized septic system* serving as few as two homes, or just a few homes.
- Clustered septic systems may be used in a development of new homes in which small groups of two or three homes are served by individual wastewater treatment systems.

Terminology

Effluent:

- Septic effluent is the clarified, partially treated liquid which leaves a septic tank. Large solids have been separated by settlement, by floating to coagulate in a grease and scum layer, or by filtration or other methods. Septic effluent moves out of a septic treatment tank into an absorption system (or other effluent treatment system) for further treatment and ultimate disposal or discharge to the environment.

Terminology

Grinder pumps:

- A macerating pump capable of grinding up sewage, including the solid waste, so that the waste product can be pumped at pressure to a treatment system.
- Grinder pumps are used with "force main" septic systems to move waste products uphill to a private onsite wastewater treatment facility or in larger installations, to move sewage or "blackwater" or waste products to a centralized treatment facility. Force mains used to carry sewage prepared by a grinder pump will generally be of smaller diameter than waste lines which work by gravity

Terminology

Infiltration

- the flow or movement of water into the interstices or pores of a soil through the soil interface.

Infiltrative Surface

- In drain fields, the drain rock-original soil interface at the bottom of the trench; in mound systems, the gravel-mound sand and the sandoriginal soil interfaces; in sand-lined trenches/beds (sand filter), the gravel-sand interface and the sand-original soil interface at the bottom of the trench or bed.

Terminology

Influent:

- Wastewater, partially or completely treated, or in its natural state (raw wastewater), flowing into a reservoir, tank, treatment unit, or disposal unit.

Installer

- a qualified person approved by a local health officer to install or repair on-site sewage systems or components.

Terminology

Lift pump

- A lift pump is used to move liquid effluent from a lower pumping chamber or effluent tank to a higher level tank or possibly out of an effluent tank up to a mound system, sand bed, or other elevated effluent treatment system.

Terminology

Mound (sand mound)

- A disposal component in which a specific sand media is placed upon the ground surface, after the ground surface has been properly prepared. Effluent form a treatment component is discharged into a bed above the sand, is treated by flowing downward through the sand and is discharged directly into the underlying soil where it is disposed of (with some additional polishing).

Septic Systems

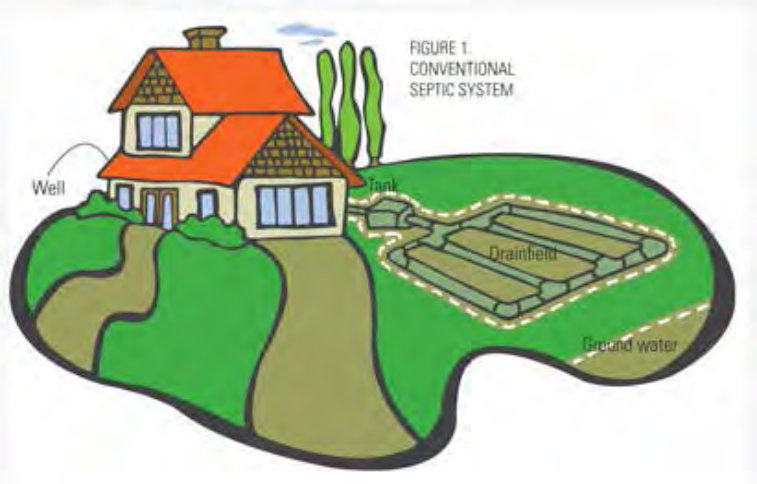
Three Main Types of Septic Systems

- There are three broad types of septic systems:
  - Conventional gravity systems,
  - Mound systems and
  - Advanced treatment systems.

Types of Septic Systems

Most common

- Conventional Septic System
  - Also referred to as a Tile Bed
  - Leaching Bed or Leach Field



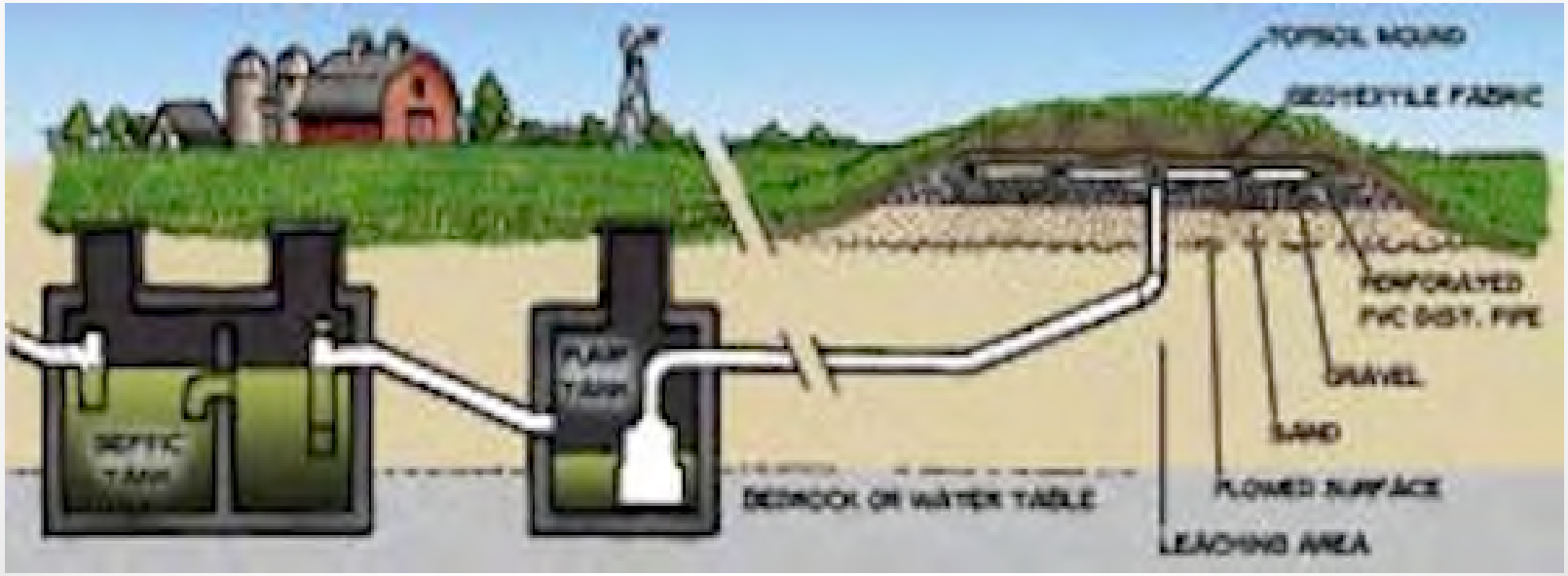
Conventional

Gravity Systems

- Waterborne waste flows to the tank by gravity, and effluent (the liquid part of wastewater) exits the tank to the drain field (or leach field) by gravity.
- No pumps, electricity or mounds. (A drain field is a series of perforated underground pipes through which effluent is dispersed so that it can gradually seep into the subsoil.) This all goes on underground.
- Soil purifies the effluent and returns clean water to the water table.

Mound Systems

- Large man-made, aboveground mounds of sand and gravel are installed when conventional drain fields won't be adequate.
- This system is run by electrical pumps.



Mound System Cont'd

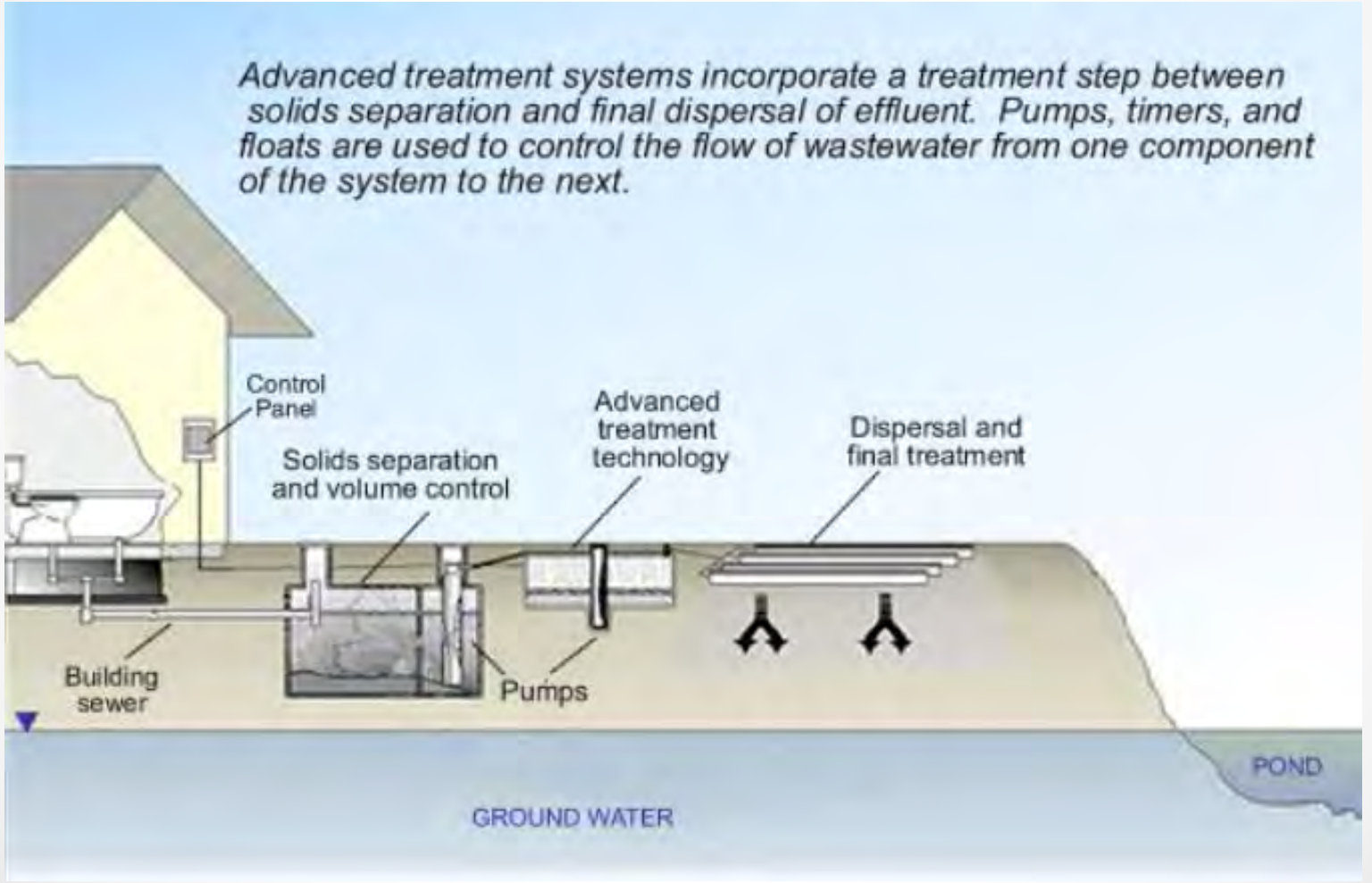
Downside to Mounds

- Mounds are expensive,
- Use a lot of resources,
- Don't work when the power is off,
- More prone to failure.

Advanced Treatment Systems

- Wide range of systems or additions to conventional systems,
- Sand filters,
- Aerobic units
- Trickling bio filters.

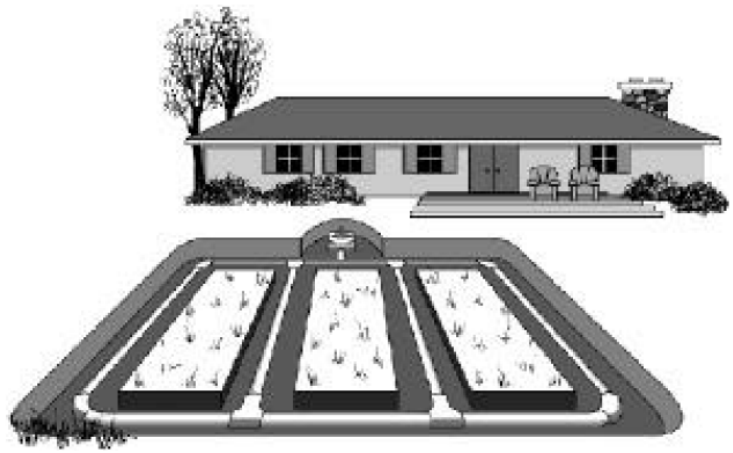
Advanced Treatment Systems Cont'd

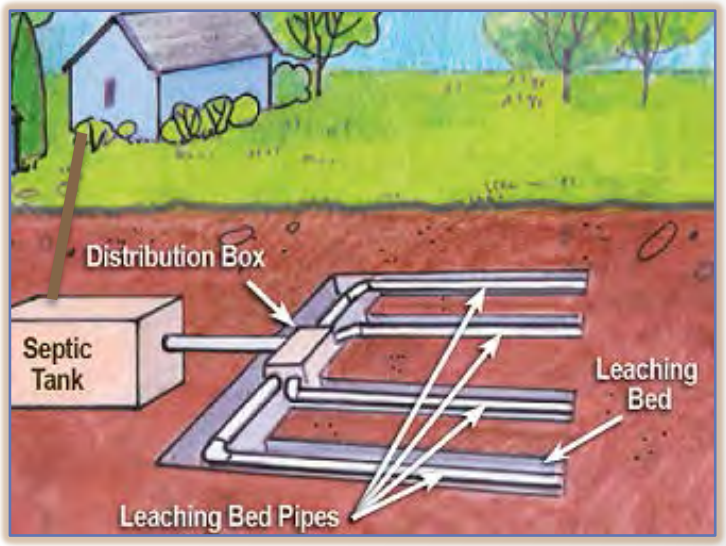


Advanced Treatment Systems Cont'd

- Continuum of less expensive options between a gravity system and the most advanced systems.
- If something goes wrong with a gravity system, it doesn't mean you have to automatically go to a mound or other high-tech replacement.
- There are steps that can be taken to fix a gravity system without paying big bucks to replace it.

Common Septic Systems





Septic System Laws and Regulations

- Passage of *Services Improvement Act*, 1997
- Proclamation of Schedule B to that Act into law on April 6, 1998
- Transferred the Regulation of Smaller Septic Systems from Part VIII of the *Environmental Protection Act* to the *Building Code Act* (1992).

On Reserve Septic Systems

- On-reserve wastewater treatment systems are designed and operated in accordance with the Ontario Building Code Specifications
- Wastewater System Effluent Regulations developed under the Fisheries Act in 2010
- Canada and other applicable provincial/territorial requirements apply
- Most stringent regulations govern

Septic System Regs

- ✓ Ontario Building Code (OBC) has been revised
- ✓ Part 8 Regulates Installation and Operation of Septic Systems.
- ✓ Smaller Septic Systems have a Design flow < 10,000 litres a day (10 m3/day)
- ✓ System is located wholly on the lot of the building which the system serves.

Septic Systems Regs Cont'd

- Prior to Part 8 of the OBC regulatory provisions relating to septic sewage systems were administered by Boards of health of Regional and District health units.
- Also Previously Enforced by Boards of health of Regional and District health units.
- Today Municipal Chief Building officials and their Inspectors Enforce the Regulation.

Septic Systems Regs

- Legislation now has a requirement for the testing and licensing of installers of sewage systems.
- Prior to the enactment of new provisions in Part 2 of the building code there was no requirement or regulation of installers of Septic's.
- Septic System were previously installed by anyone who knew how to operate a backhoe
- Now an Examination must be Passed to obtain a Licence to be an installer

Septic Systems Regs

- Part 8 of the building code sets out 5 different classes of septic systems in a uniform and detailed fashion

- The regulations describe those systems and make provision for such matters as:
  - Clearances of systems from bodies of water
  - Depth requirements
  - Anchorage of septic tanks and holding tanks,

Septic System Regs

- New requirements of training for inspectors of Sewage systems
- Plus Requirement for the testing and licensing of installers and a more regulated regime to govern Septic Systems under the building code provides greater protection for ground and surface waters today more so than ever before

Classification of Septic Systems

- Ontario Building Code Part 8 sets out 5 different classes of septic systems;

8.1.2.1. Classification of Systems

- (1) All sewage systems shall be classed as one of the following:
- (a) Class 1 — a chemical toilet, an incinerating toilet, a recirculating toilet, a self-contained portable toilet and all forms of privy including a portable privy, an earth pit privy, a pail privy, a privy vault and a composting toilet system,

Classification of Systems Cont'd

8.1.2.1. Classification of Systems

- (b) Class 2 — a greywater system,
- (c) Class 3 — a cesspool,
- (d) Class 4 — a leaching bed system, or
- (e) Class 5 — a system that requires or uses a holding tank for the retention of hauled sewage at the site where it is produced prior to its collection by a hauled sewage system.

Classification of Systems Cont'd

- *Building Code Act* allows municipalities to enter agreements with upper tier municipalities
- Allows agreements with certain agencies such as conservation authorities or health boards to have those other bodies administer the provisions of the building code as to sewage systems,
- Province mandated that this be done in Northern Ontario.
- Section 2.15.1.1 has been added to the OBC designating particular Northern health boards and a conservation authority as the responsible bodies.

Septic System Operation & Maintenance

WHAT YOU NEED TO KNOW

- The way you treat your septic system will influence
  - How long the system lasts
  - How well it functions
- If you own or rent a property served by an on-site sewage system, you need to think about how your actions affect the system.
- You need to be careful about what substances you flush down the drain/toilet

Septic System Operation & Maintenance Cont'd

- Consider how often your septic tank is cleaned out and inspected.
- Decisions impact the effectiveness of septic system
- Bad decisions can lead to expensive and time consuming problems.
- May result in harm to the natural environment or public health by polluting lakes or contaminating drinking water supplies.

O & M Cont'd

- In order to avoid the inconvenience and cost associated with the repair or replacement of a failed septic system, you should know how to properly operate and maintain your septic system.

When Things Go Wrong!

Common Septic System Problems

- Toilets or drains which are backed up or run more slowly than usual
- Foul odours in the house or drinking water
- Sogginess in the ground around the septic tank or leaching bed area
- Surface flooding of sewage or septic tank effluent around the septic system

Common Septic System Problems Cont'd

- ☐ Activated alarm signals (lights or bells) on special treatment units
- ☐ Dosing pumps which run constantly or not at all (Note: not all systems have pumps)
- ☐ Unusually green or thick grass growing in or around the leaching bed area
- ☐ Significant algae growth in or around nearby lakes or water bodies
- ☐ High levels of nitrates, bacteria or other contaminants in well water

Toilets and Drains are NOT Garbage Cans!

- Some items you flush down a toilet or pour down a drain can significantly reduce the ability of the beneficial bacteria in a septic system to break down and treat domestic sewage.

Toilets and Drains are NOT Garbage Cans!

- Harmful chemicals and substances will kill bacteria and render a septic system useless and having to have your system pumped out.

Septic Systems are not Garbage Cans Cont'd

- Bulky or hard-to-break down products can clog pipes, quickly fill septic tanks and decrease the effectiveness of the system.

- Septic tank additives/starters may be harmful to septic systems and are not necessary to begin or continue septic tank operation.

Septic System Don'ts

NEVER put the following items or substances into a septic system:

- ☐ Fats, oils and grease, (Moose, Deer or any wildlife)
- ☐ Gasoline, antifreeze,
- ☐ Varnishes, paints and solvents,
- ☐ Caustic drain and toilet bowl
- ☐ Cleaners,
- ☐ Photographic solutions,
- ☐ Bleach, pesticides,

Septic System Don’ts Cont’d

- Nail polish remover,
- Cat box litter,
- Tampons, sanitary napkins,
- Diapers, paper towels, facial
- Tissues, condoms, plastics,
- Coffee grounds, egg shells and
- Other kitchen waste or
- Cigarette filters.

Septic System Do's

TIPS ON MAINTAINING SEPTIC SYSTEMs

- Conserve water and reduce waste flow into the system by installing water saving features in plumbing fixtures,
- Use dishwashers and laundry machines only with full loads,
- Take shorter showers rather than full baths,
- fix leaky faucets
- Avoiding the use of garbage disposal units —

"Too much water will overload a septic system"

TIPS on Maintaining Septic Systems Cont'd

- ✓ Ensure septic tanks are inspected at least every two years by a qualified person and
- ✓ Pump tanks out at least every 3 - 5 years (or sooner since frequency depends on tank/household size). These actions can be combined
- ✓ Do not impair access to the septic tank so that proper maintenance and servicing can occur
- ✓ Reduce the use of phosphate-based detergents, soaps and cleaners to minimize algae growth in nearby lakes and rivers. Phosphates can impair water quality and fish habitat

The End

Chi Miigwetch!

Questions?

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