# Small Scale Wastewater
# The View from the Trenches



Baynes Sound/ Lambert Channel EcoForum

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**Hydrogeology Studies**
**Well/Soil Evaluations**
**Wastewater System Designs**
**Instructor for ROWP Course**

# Current State of Small Scale Wastewater Industry

- Overall authority is Ministry of Health (< 22.7 m³/day)

- Systems can only <u>legally</u> be installed by a Registered Onsite Wastewater Practitioner (ROWP) or under supervision of a P.Geo. or P.Eng. Or homeowner under supervision

- ROWPs Under authority of: Applied Science Technologists & Technicians of BC (ASTTBC). <u>Currently, no inspections required.</u>

- Some Regional Districts require filing before building permit, some do not.

# Homeowners

- Homeowners <u>by law</u> must:
    - ensure system is planned, installed and maintained by an <u>authorized person</u>
    - keep records of maintenance for system
    - ensure their system does not create a health hazard
    - ensure their sewage is discharged into either a public system, a permitted holding tank or a private sewage system that is in compliance with the SSR

    - They must be pushed to do any of these things.

# Costs for Installation

- **Vary from place to place and installer to installer**

- **Basic best case scenario - $12,000-$15,000**

- **Depending on access, complexity, area, and size could be as high as $50,000. Generally, around $25,000**

- **If Professional needed, add 50%.**

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# Contaminants of Concern

- <u>Pathogens</u> – *E.coli* bacteria, viruses – recently, Covid 19 tracking in wastewater

- <u>TDS and BOD$_5$</u> – Total Dissolved Solids & Biochemical Oxygen Demand

- <u>Nutrients</u> such as nitrogen and phosphorus can cause algal blooms and anoxic zones within embayed waters

- <u>Endocrine Disrupting Chemicals</u> (EDCs) from pharmaceuticals, anti-bacterial soaps, etc. – have been found at low concentrations (ppb) to feminize fish near outfalls   "*concentration of 5ng /L caused total collapse of fish species (Kidd, 2007)*"

*5 ng = 5 parts per billion*

# Basic wastewater system
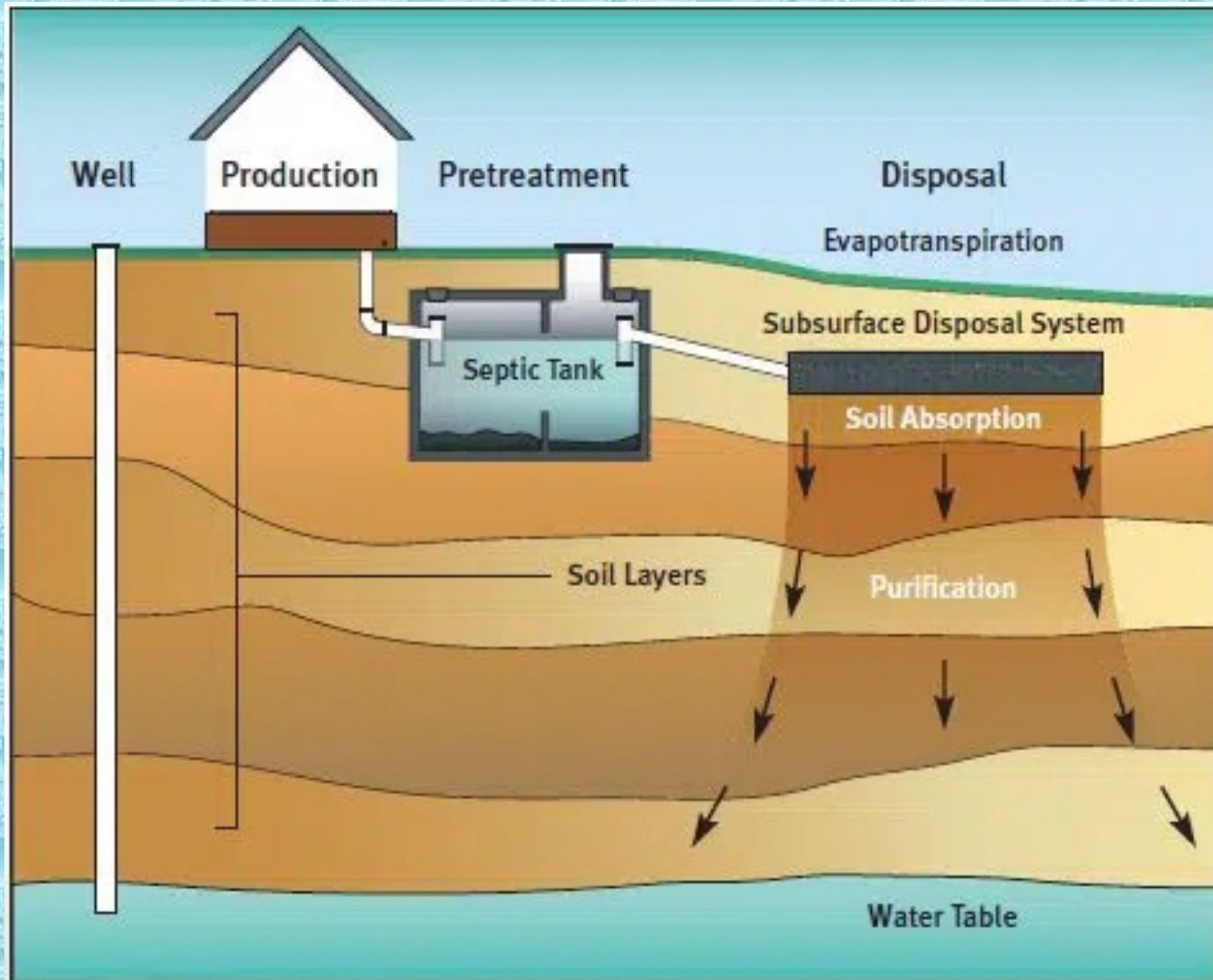
**A quick tour of the building of a seepage bed dispersal field…**

# Excavate and scarify area of field

# Place engineered sand

# Place aggregate on top of sand

# Place drilled piping

# Cover piping with more aggregate

# Cover piping with geotextile cloth

# Backfill with sandy topsoil and done!

# Trench system with sand below

# Wastewater Treatment Levels

**Depend on output concentrations of :**

- **5 day biochemical oxygen demand**
- **Total Suspended Solids**
- **Pathogens/Viruses**

Effluent from septic tank is usually:

- $BOD_5$ = 150-300 ppm
- TSS = 50-80 ppm
- Fecal coliform = $10^5$-$10^7$ CFU

# TREATMENT LEVELS

- **TYPE 1** – Septic tank treatment with effluent transferred to a dispersal field.

# TYPE 1 EXAMPLES



03/06/2005

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# TREATMENT LEVELS

## TYPE 1 – Single use facility

# When is higher level treatment needed?

- Poor soils
- High water table
- Environmentally sensitive area
- Lot size restraints
- Outfalls





Date & Time: Mon Apr 30 12:25:58 PDT 2018
Position: 049.293804°N / 124.765159°W
Altitude: 239m
Datum: WGS-84
Azimuth/Bearing: 196° S16W 3484mils (Magnetic)
Elevation Grade: -032%
Horizon Grade: +002%
Zoom: 1X
area 6 last pit

- **TYPE 2** – Septic tank, treatment plant followed by a dispersal field. Dispersal field size may be reduced by up to 30%

- **TYPE 3** - Package treatment unit followed by a ultraviolet light unit to kill bacteria, or additional thickness of engineered sand. Septic field size can be 60% smaller. Design by Professional only.

- Type 6 treatment – not allowed

# In-Ground Effluent Treatment

- 30 metre setback for wells has no strict scientific basis

- Majority of bacterial pathogens are consumed within 10 metres of dispersal treatment field

- Nitrogen and phosphorus can be reduced within the treatment train BUT ARE MOBILE WITH GROUNDWATER.

# Failure of ground-based system

- "Failure" by MoH definition is effluent breaking out at the surface. Failure is deemed a Health Hazard.

- When MOH identifies failure the property owner can be placed in a pump and haul mode until a repair has been carried out by an authorized person.

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# Failure of system outfall

- Real time Total Dissolved Solids meter alarm
- Weekly/Monthly sampling required by permit or registration fails to meet requirements

# FAILURE

# Failure

# Failure with overland flow

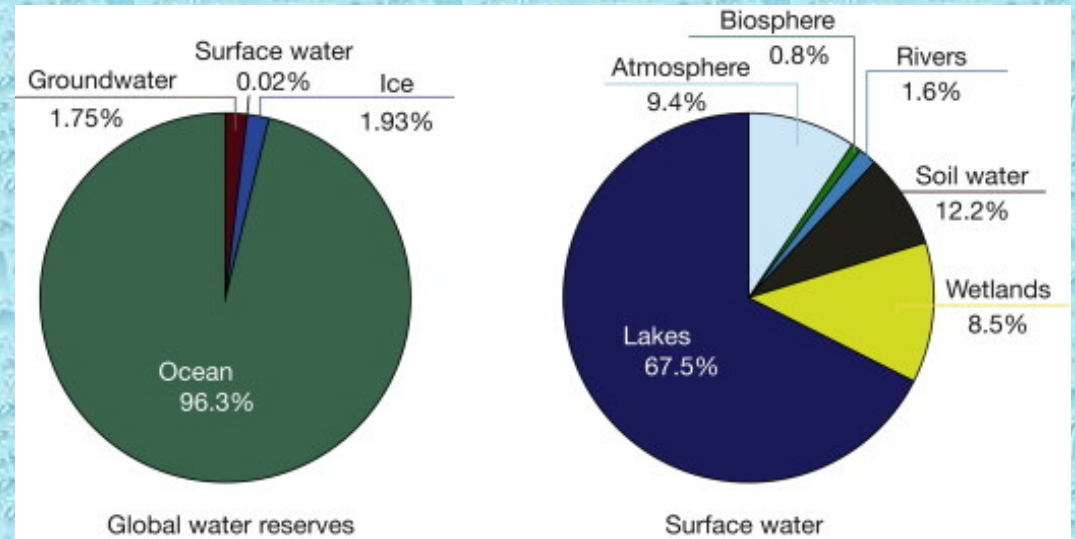# Trench failure in perforated pipe
# This is why we pump septic tanks



Height of perforations
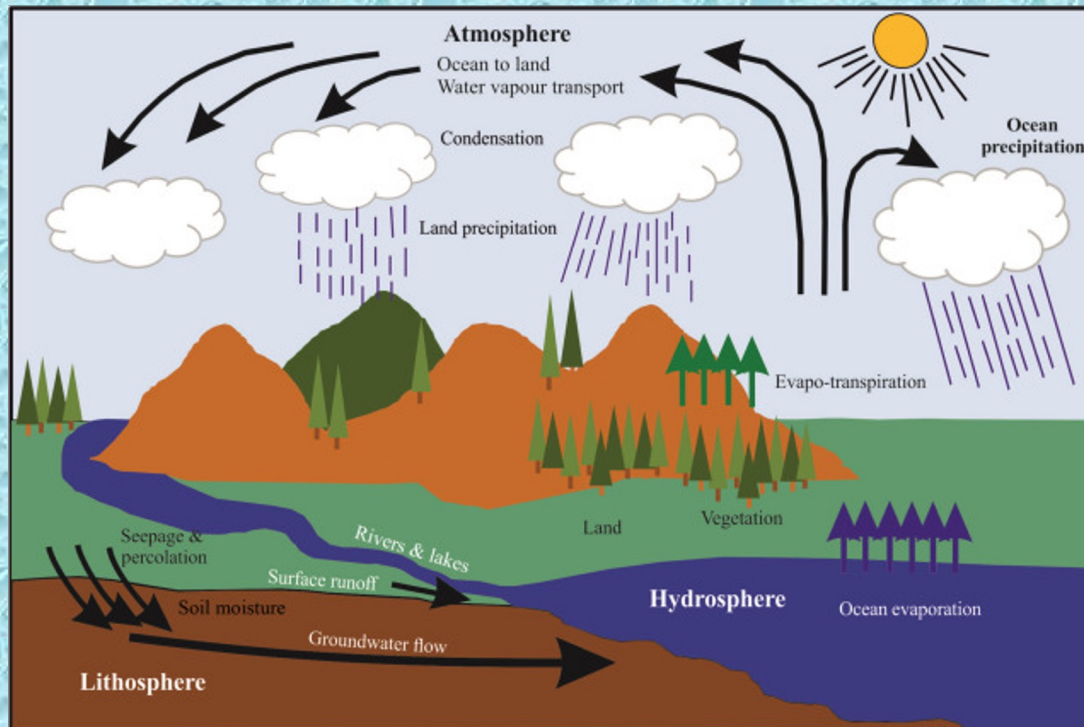
# Failure of a different type

# Outfalls and Dispersal to Ground

# Global Water Distribution



Global water reserves

Surface water

# Surface Water Distribution

# Simple Hydrologic Cycle

# Water in the Biosphere

| From Table 1-1 in Wetzel | Volume (Thousands of km³) | % of Total | Renewal Time |
|---|---|---|---|
| Oceans | 1,370,000.0 | 97.61000 | 3100 y |
| Glaciers | 29,000.0 | 2.08000 | 16,000 y |
| Groundwater | 4,000.0 | 0.29000 | 300 y |
| Freshwater lakes | 125.0 | 0.00900 | 1-100 y |
| Saline lakes | 104.0 | 0.00800 | 10-1000 y |
| Soil moisture | 67.0 | 0.00500 | 280 d |
| Rivers | 1.2 | 0.00009 | 12-20 d |
| Atmosphere | 14.0 | 0.00090 | 9 d |

Renewal time = residence time

## Outfall

- Single use of groundwater

- Even with dilution, can contaminate local marine waters

- Late stage warnings of treatment failure

- Mining groundwater, lengthy, non-human scale renewal time back to aquifer

## In-ground Dispersal

- Not-quite-infinite re-use of groundwater

- Soil is the best treatment for polishing effluent

- Early warnings of potential failure

- Human scale renewal time back to aquifer storage

# Areas of Overall Concern

- **Illegal systems.**

- **New rural homeowners who don't care where the water comes from or where it goes**

- **Old systems that are failing without surfacing effluent. "Shortcutting" subsurface flow to beach or other down gradient location**

- **Ground based systems for large flows require large areas of empty land**

# Education Opportunities

- **Inform public concerning signs of deteriorating systems, importance of regular maintenance**

- **Incentivization of maintenance by homeowner grants for upgrades and replacement systems**

- **Maintenance regulation bylaws, i.e. – CRD**

- **Inform public regarding illegal systems and non-ROWPS installing systems**

# More Education Opportunities

- **Inform realtors to recommend wastewater system inspections/feasibility before property purchase**

- **Research when outfalls are not strictly necessary**

- **Inform RDs/municipalities to require filings for permits**

# At the end of the day, this is what matters…



Thank you.