PUBLIC HEALTH

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On-site Systems and Groundwater

Washington State Department of Health

February 6, 2014

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Office of Shellfish and Water Protection

Key Groundwater Considerations

- Type and strength of contaminants in wastewater?
- What is the density of on-site systems in the area?
- How suitable are the site specific soils?
- Sensitive Area or Critical Aquifer Recharge Area?
- Effective O&M Requirements?

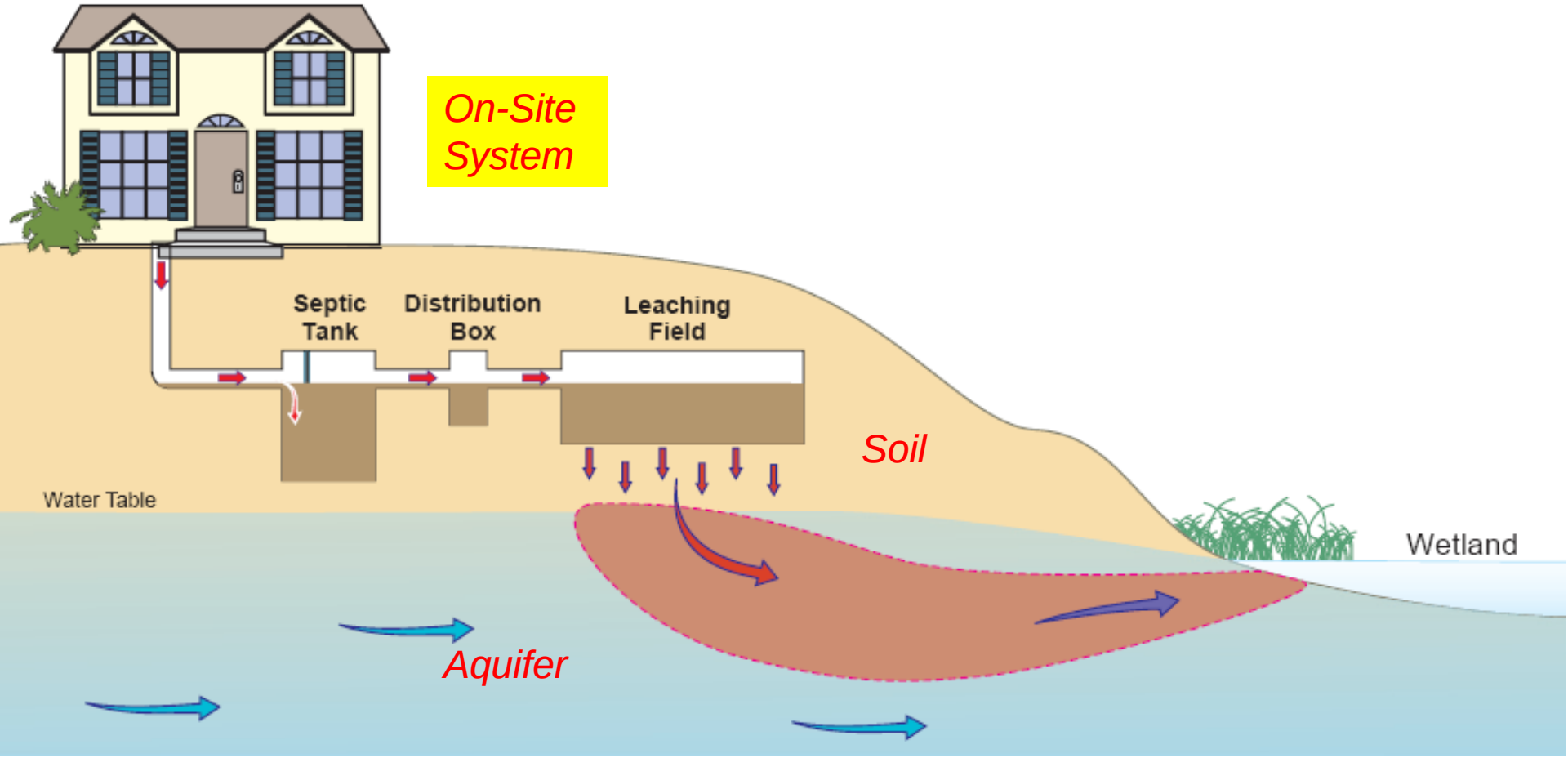
Current County Designations

- Sensitive Area defined in OSS Management Plan –
  - "*Areas where OSS pose an increased public health risk*"

- Critical Aquifer Recharge Area (CARA)
  - Applies to multiple activities including OSS
  - Addresses areas with elevated nitrates
  - Includes wellhead protection areas
  - 3 categories of aquifer sensitivity based on soils & geology
    - Hydrogeology Report
    - Assimilative Capacity Policy for Nitrates
    - Lot Size

- *What is the connection between Mgt. Plan and CARA?*

OSS and Groundwater



OSS Contaminants in Wastewater

- Pathogens - Fecal Coliform
- Viruses
- Household Products
- Pharmaceuticals
- Nitrogen
- Phosphorus

* Focus of Thurston County Management Plan

Septic Tank Waste Strength

- Fecal Coliform – 1,000,000 per 100 ml
- Nitrogen
  - Domestic waste is 60 mg/L
  - Schools can be closer to 100 mg/L
  - RV Parks usually over 100 mg/L

Groundwater Standard

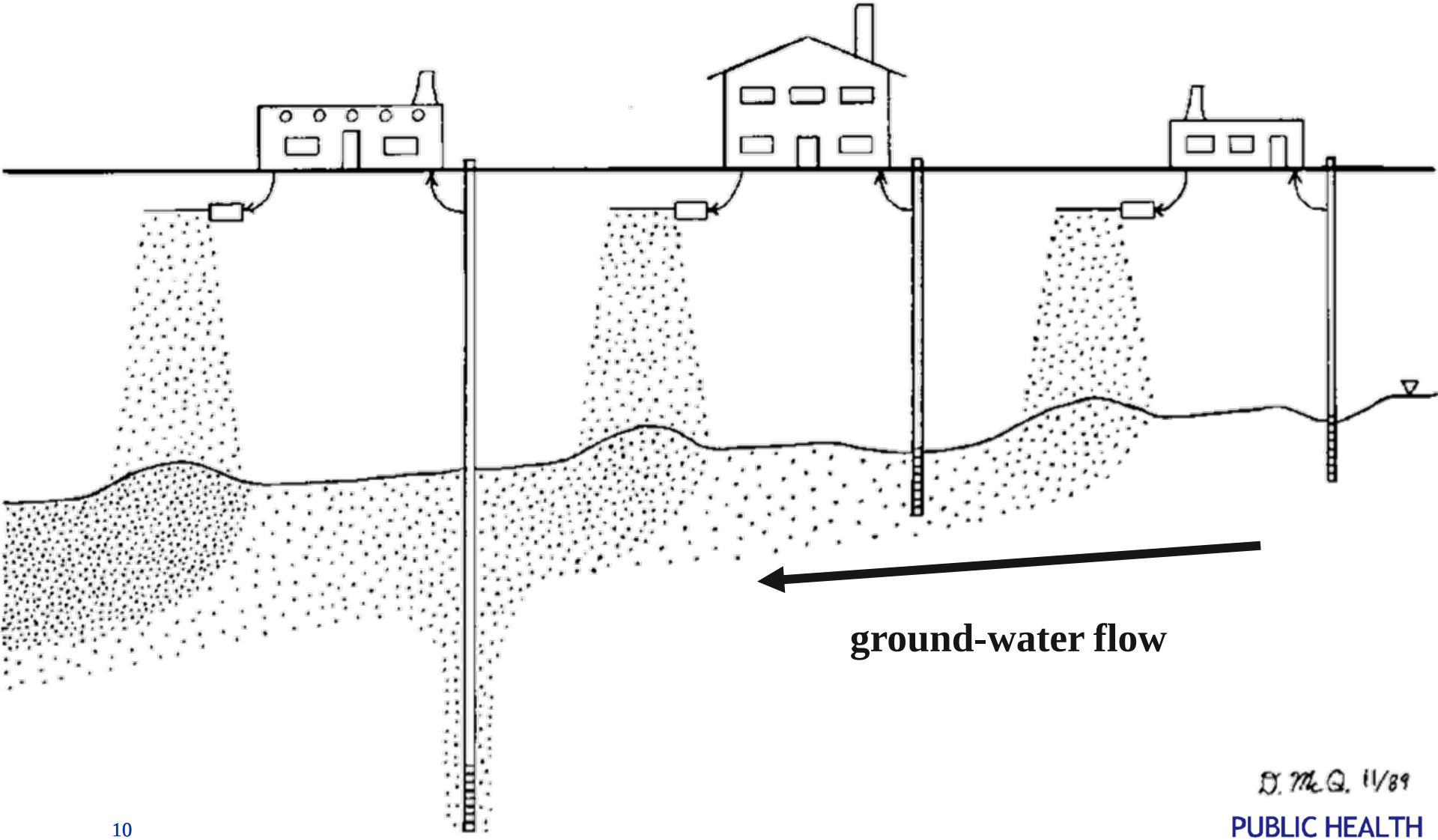
- Fecal Coliform – 1 per 100 ml
- Nitrogen – 10 mg/L

Wastewater Volume - GPD

- 3 bdrm home is 360 gpd
- Tolmie Park Estates (47)–16,920 gpd
- Olympia Country Club – 10,800 gpd
- Hawks Prairie Inn – 9000 gpd
- McLane Elementary - 4800 gpd

On-Site System	Volume gpd	Nitrogen mg/L (estimated)	Nitrogen lbs/yr
Single Family Home	360	60	66
Tolmie Park Estates (47)	16,920	60	3,102
Olympia Golf Club	3145	25	237
Outback RV Park	5800	120	1,392
McLane Elementary	4800	100	1080

Density Matters



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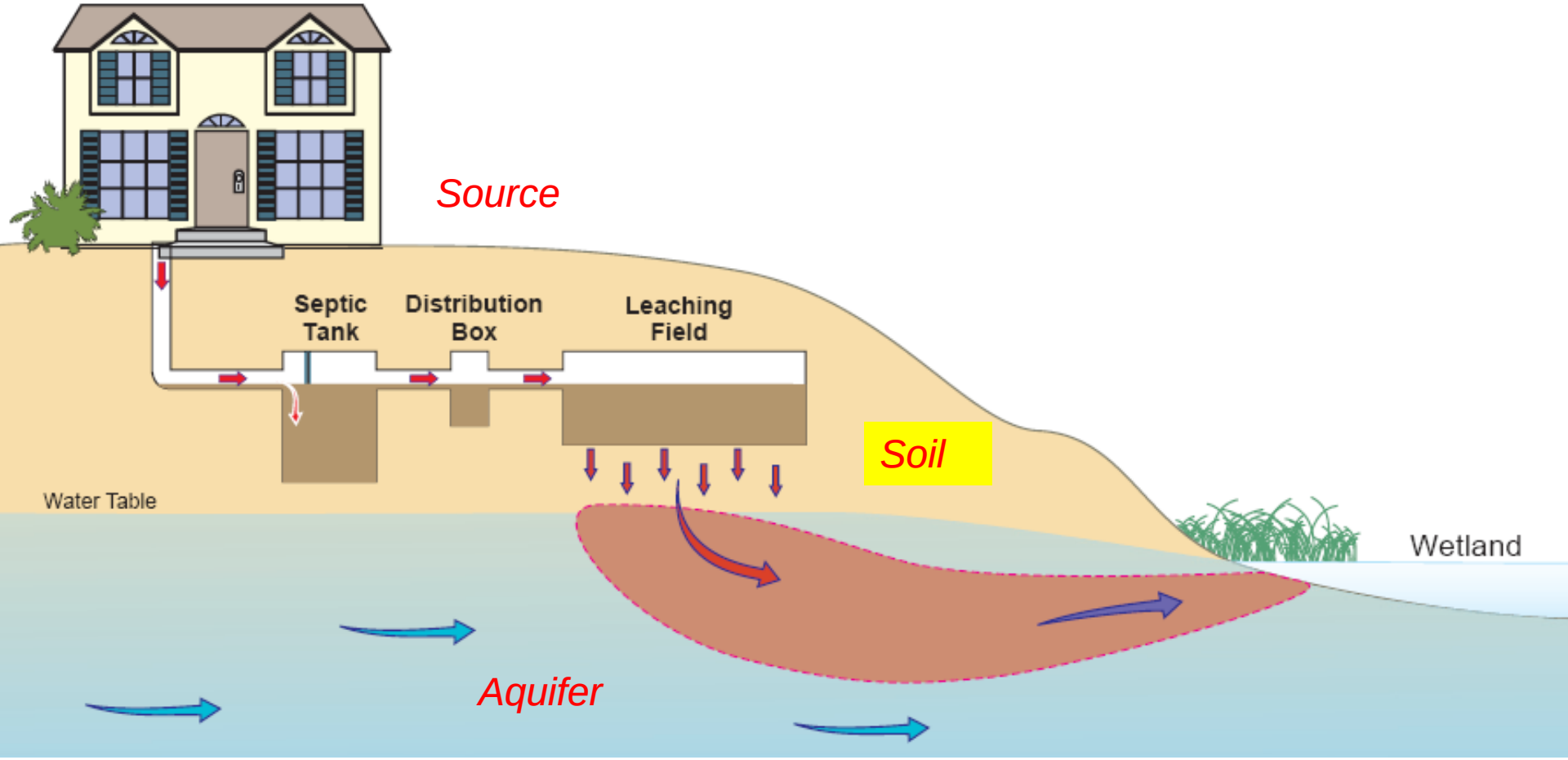
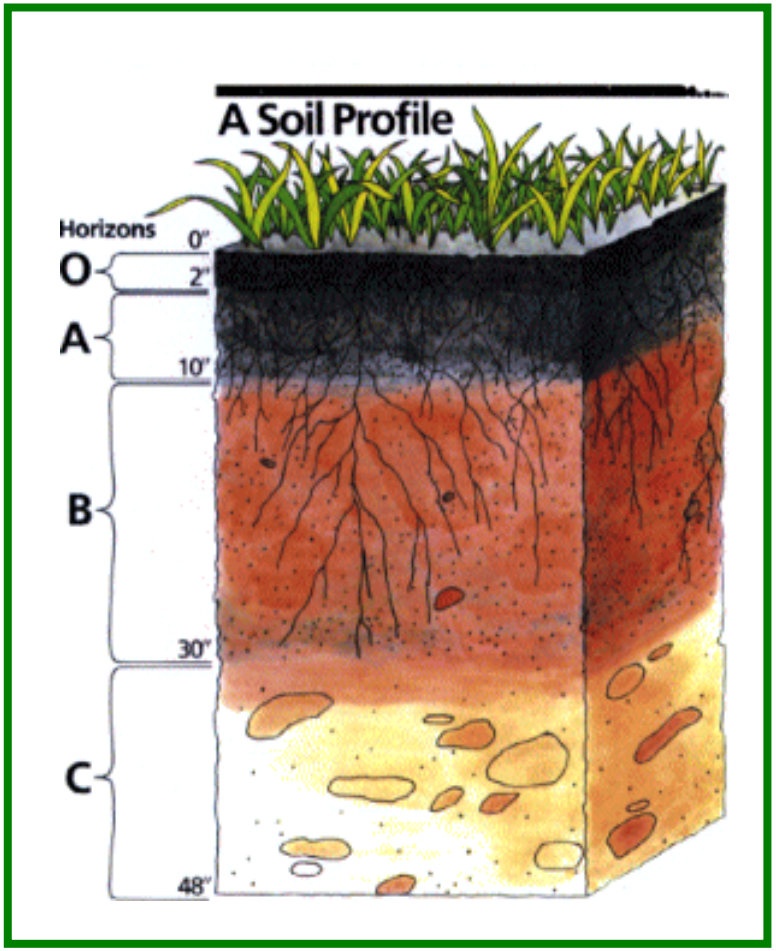

Source
Septic Tank
Distribution Box
Leaching Field
Soil
Water Table
Wetland
Aquifer

Soils and OSS

"The proper functioning of an OSS depends, in large part, on the soils ability to treat the wastewater."



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Favorable Soil Characteristics

- **Depth –** Two to three feet below drainfield
- **Soil Texture** – Loamy soils with low gravel
- **Soil Structure** – Well defined; not compact
- **Drainage –** not excessively or slowly drained
- **Water Content –** Unsaturated soil

* The ideal soil is deep, well drained and medium texture.

How Soils Treat Wastewater

Fecal Coliform

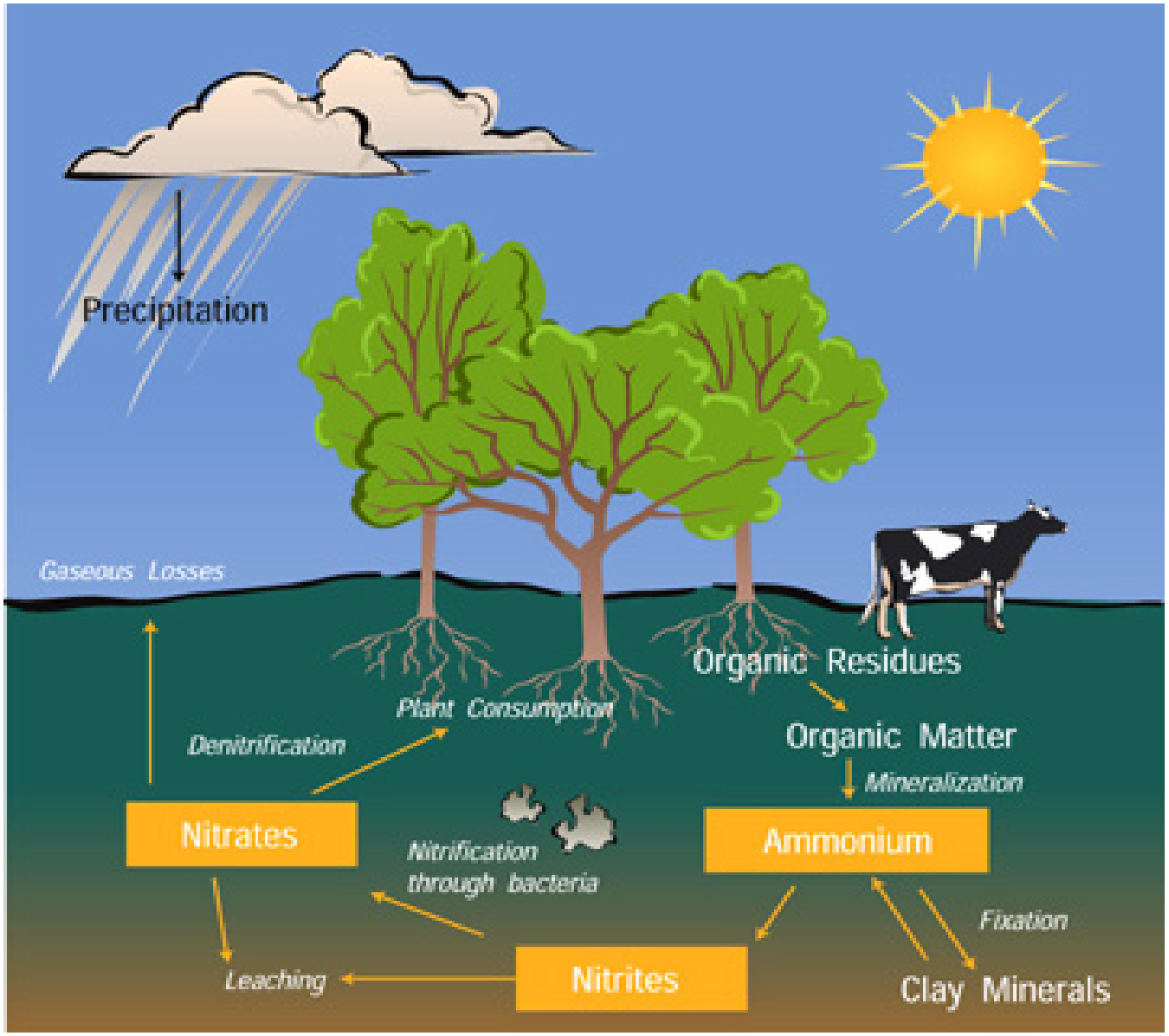
- 2 to 3 feet of dry soil is all that is needed for FC
- Physically trap large pathogens and organic matter
- Natural microbes out-compete pathogens for food
- React with soils by chemical or physical adsorption
- Biomat – forms under conventional drainfield
  - High zone of physical and reactive treatment

How Soils Treat Wastewater (cont.)

Nitrogen

- Some trapped in biomat
  - Some weakly adsorbed on soil (NH_3^+)
  - Most N converted to nitrate (NO_3^-)
    - Not adsorbed by soil
    - Minor plant uptake
    - Minor denitrification (wet conditions)
    - Most leaches to ground water

Nitrogen Cycle



Shallow topsoil over very dense Glacial till provides minimal treatment and disposal.

Deep medium sand

provides good treatment and disposal for fecal coliform

High % rock means good disposal but minimal treatment.

Drainage - Soil colors can mean a slow permeability or a high water table. Saturated soils provide poor disposal and treatment

On-Site Regulations

Soil Type	Soil Type
1	Gravelly and very gravelly coarse sands
2	Coarse sands.
3	Medium sands
4	Fine sands, sandy loams, loams.
5	Very fine sands or silt loams, sandy clay loams, clay loams and silty clay loams with a moderate structure
6	Other silt loams, sandy clay loams, clay loams, silty clay loams.
7	Sandy clay, clay, silty clay, strongly cemented or firm soils

*Soil type determines loading rate Ex. 0.6 gal/sf/day = 350 in/yr

Vertical Separation (unsaturated)	Soil Type		
	1	2	3 — 6
≥12” < 18”	A	B	B
≥18“ < 24”	B	B	B
≥24” < 36”	B	C	E
≥36” < 60”	B	E	E
≥60”	C	E	E

FC = 200

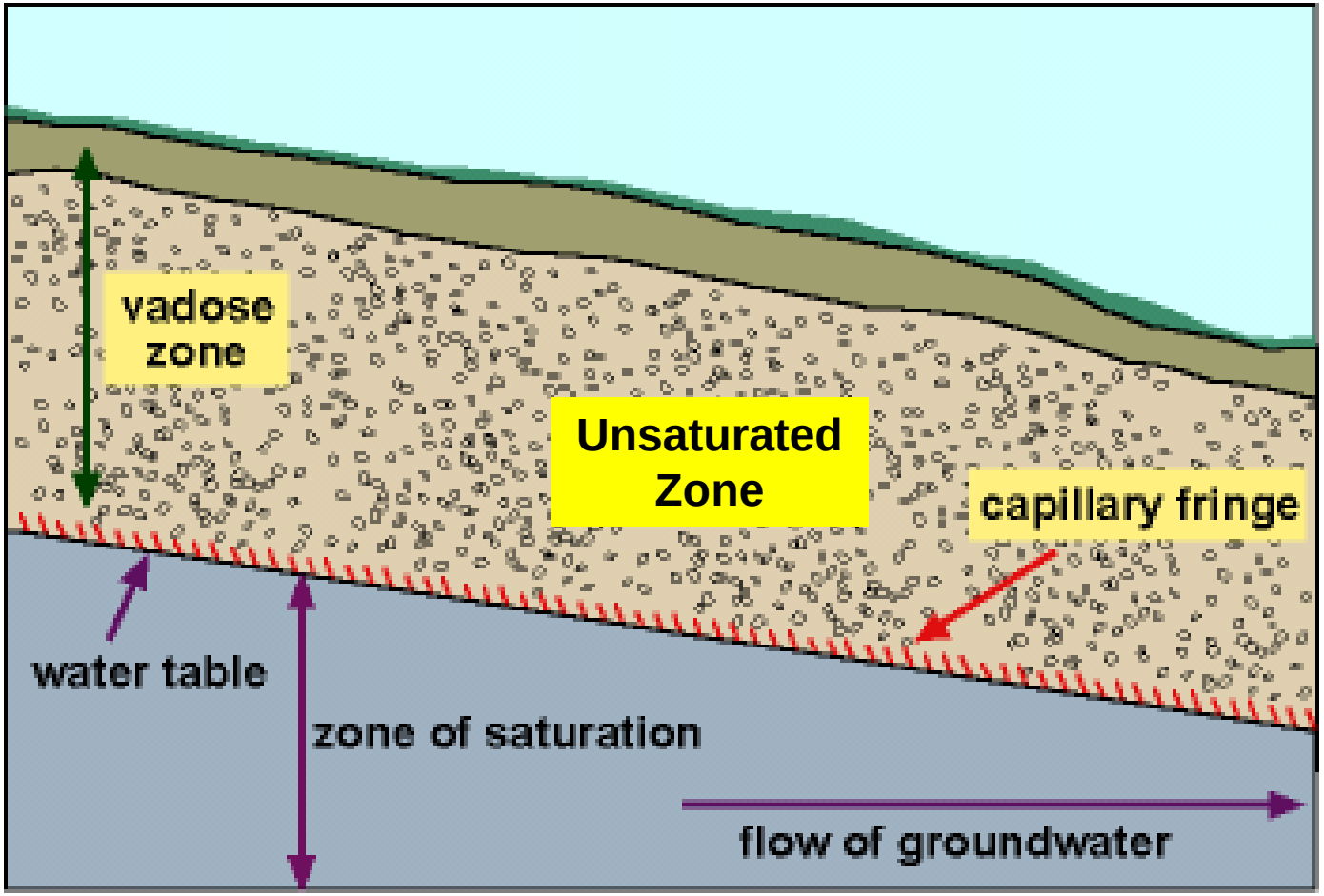
FC = 1000

FC = 50,000

FC = 1,000,000

* Does not address nitrogen

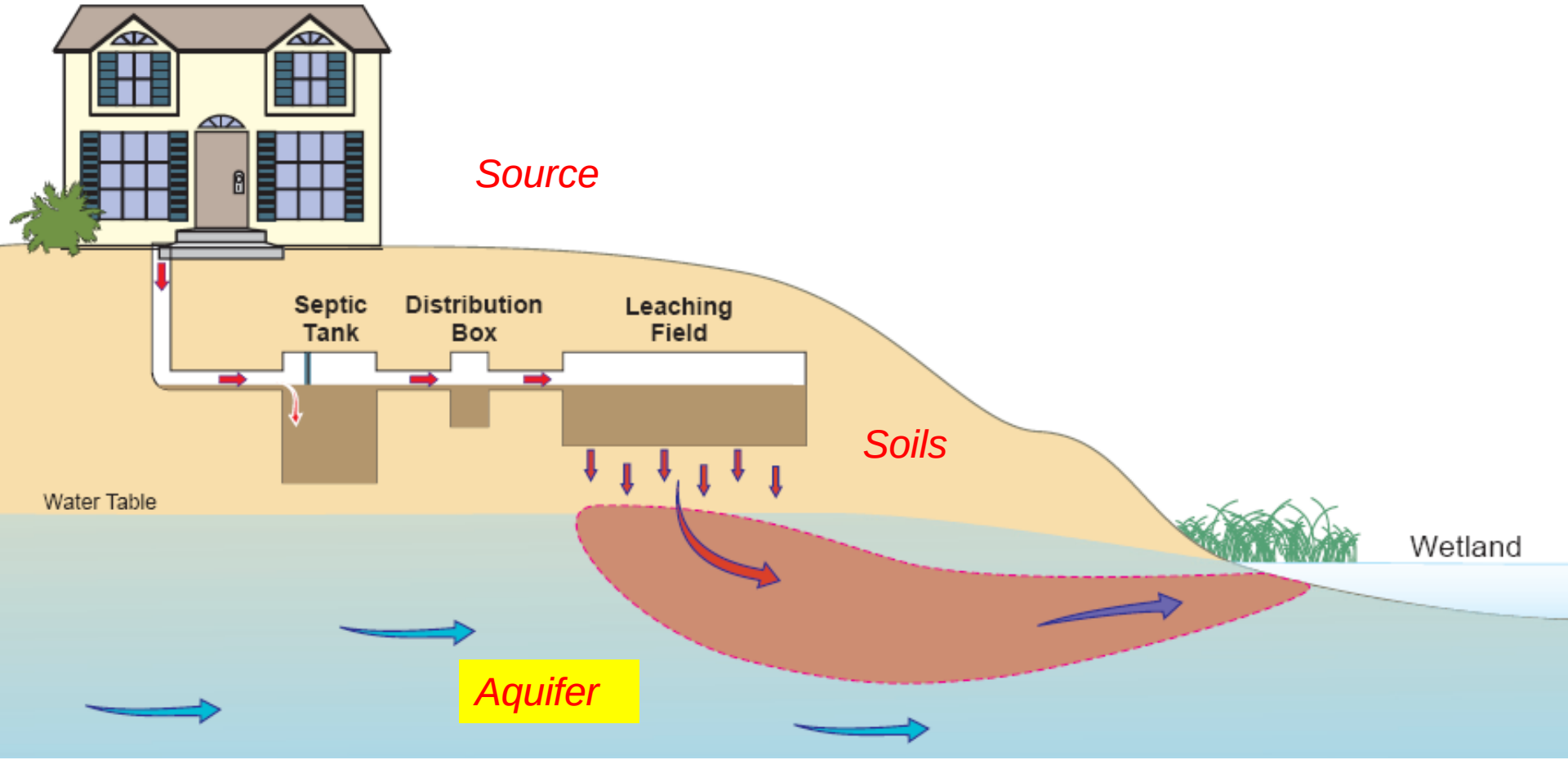
Vadose Zone



Vadose Zone Characteristics

More Protective of Groundwater	Less Protective of Groundwater
Greater than 100 feet deep	Less than 50 feet
Clay, silt, fine sand, bedrock	Coarse sand
Glacial till or other dense sediments “confining or semi-confining layer”	No dense layers
Minimal gravel	High gravel content


Glacial
Till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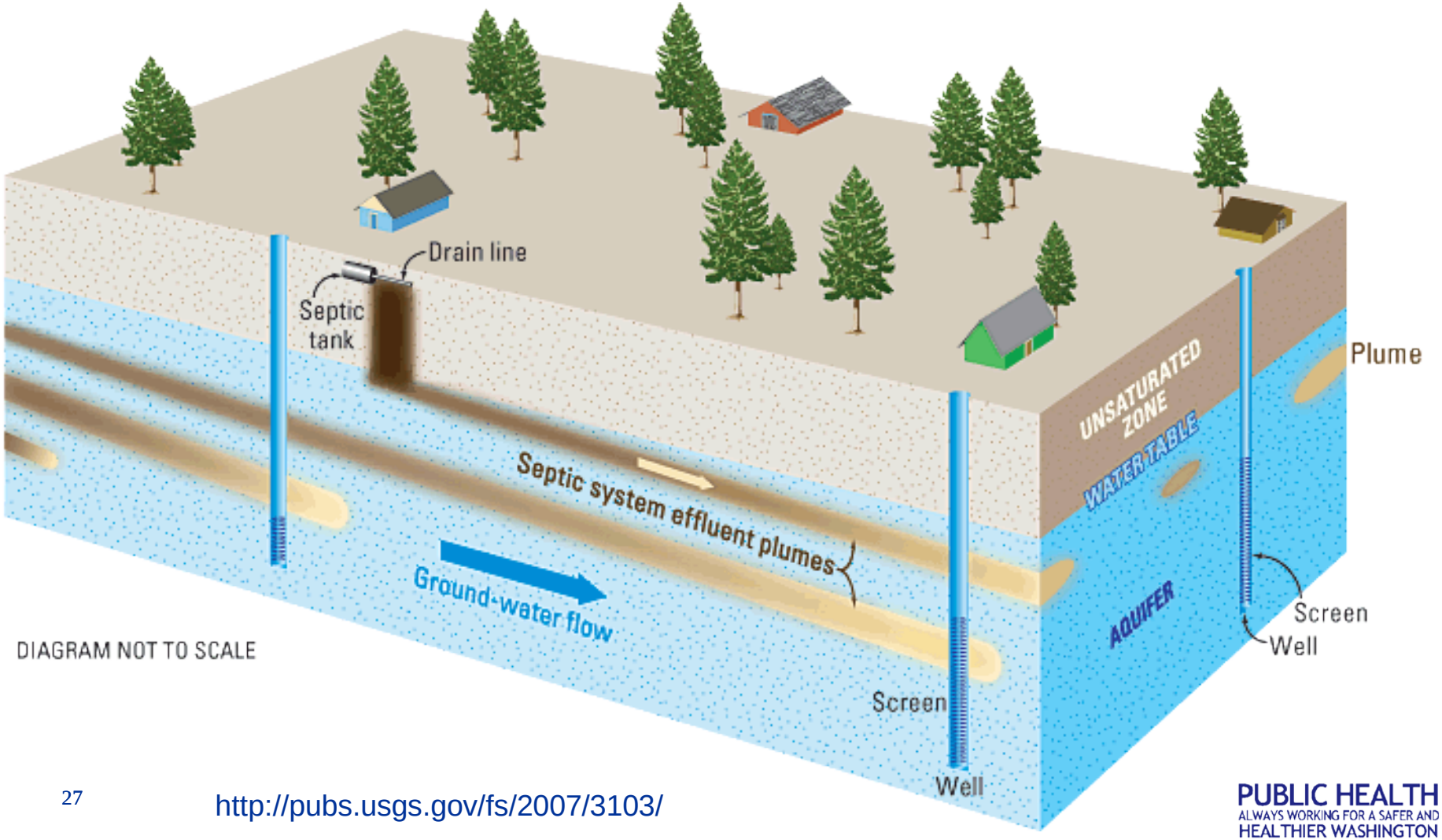
Nitrate Plumes

Minimal Dispersion

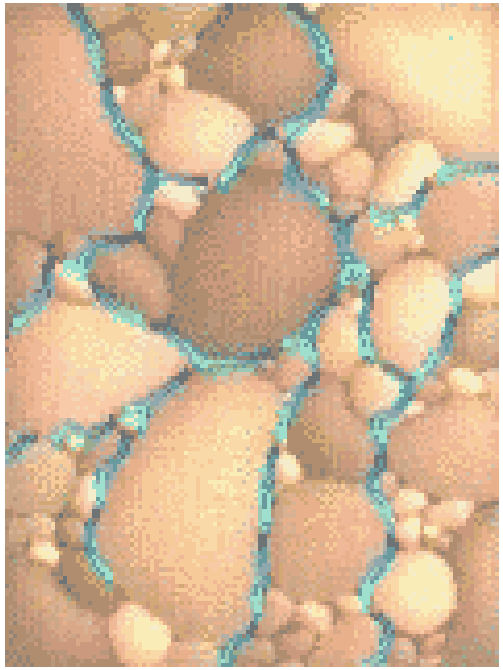


http://pubs.usgs.gov/fs/2007/3103/

Aquifer Hydraulic Conductivity

Hydraulic conductivity is the aquifer's ability to transmit water

High Hydraulic Conductivity = More Dilution



Other Aquifer Considerations

- Aquifer Gradient
- Aquifer “width”
- Background nitrogen
- Current Use (public/private wells)

In Summary…
For Groundwater Protection…

- Address waste strength and density in sensitive areas
- Design drainfields for nitrate reduction
- Apply Critical Aquifer Recharge Area requirements for where applicable
- O&M Requirements

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