

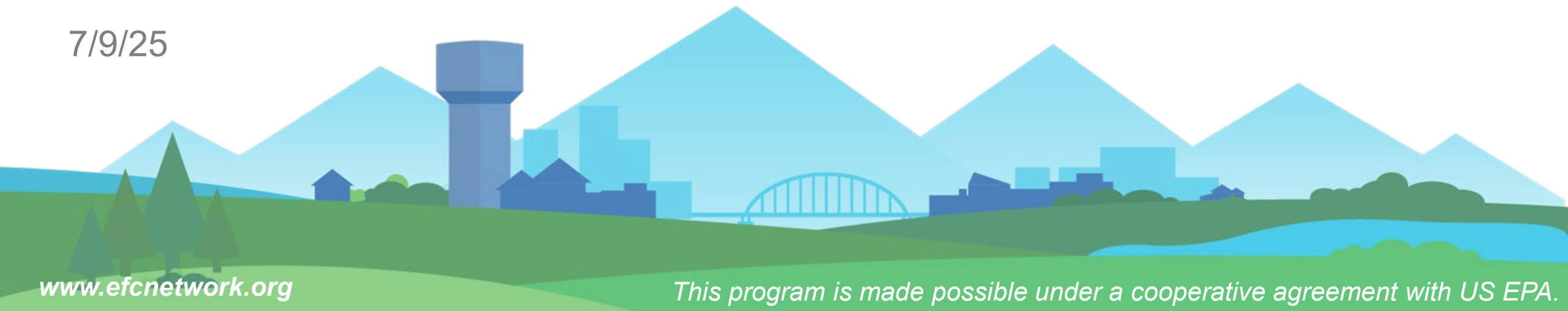


SOUTHWEST
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US Territories Drinking Water Operator Training Series

Session 2: Drinking water system overview

7/9/25



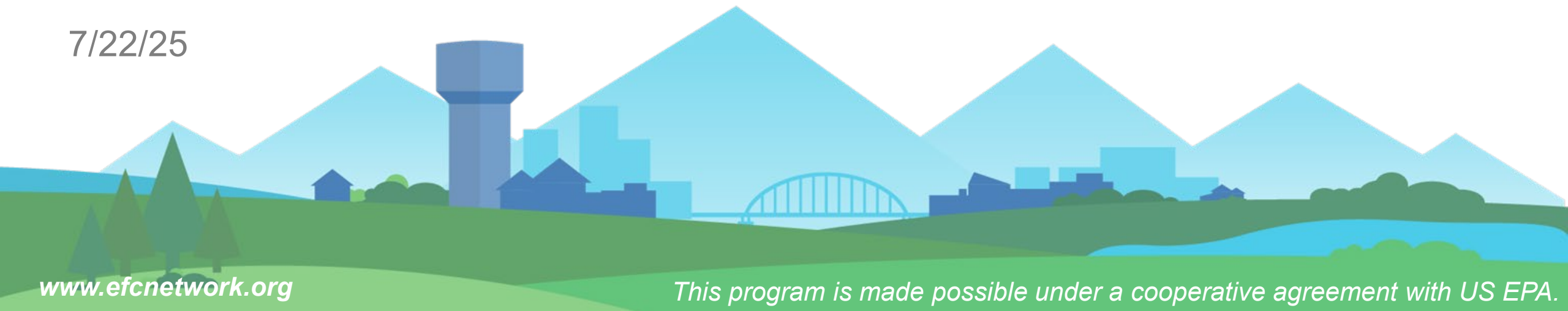


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US Territories Drinking Water Operator Training Series

Session 3: Basic Water Math

7/22/25



Tucker Colvin
Research Scientist
tcovin@unm.edu



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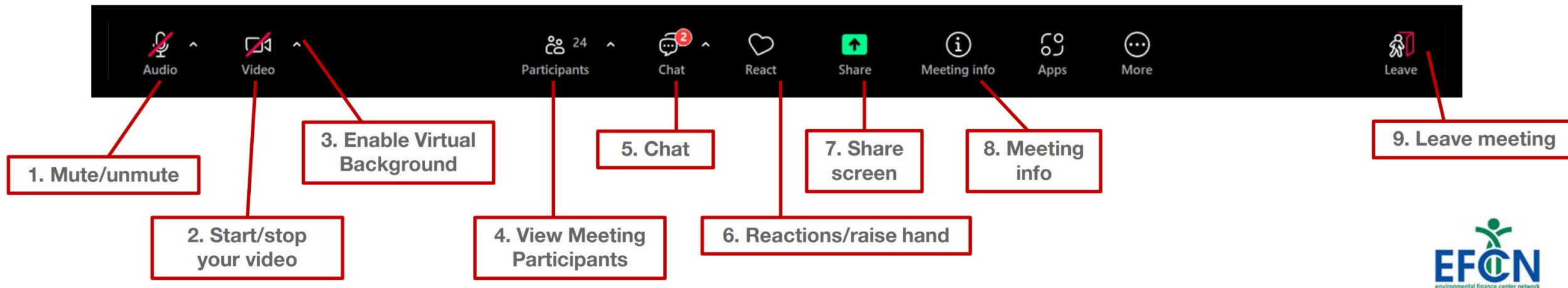
SCHOOL OF
ENGINEERING



This training series is funded by the EPA

Attendee Meeting Controls

- Locate your control bar
- All attendees will see a black horizontal bar on their screen
- If your control bar is not visible, it may be hidden
 - Move your cursor to the screen's bottom (or top) to reveal this control bar.



Schedule for 2025:

Date	Topic
6/25/25	Program Overview, Test Format, Study & Test Tips
7/9/25	Drinking Water System Overview - (Source, Treatment, & Distribution)
7/23/25	Basic Operator Math (+, -, /, x, Exponents and basic algebra)
8/6/25	Applied Operator Math (e.g. Areas, Volume, Flow Rates, Detention Time, Pressure/Hydraulic Head)
8/20/25	Drinking Water Regulations
9/3/25	Source Water Characteristics
9/17/25	Surface Water Intake Components, Well Components, and O&M
10/1/25	Disinfection 1: Chloramines, UV, Chlorine Dioxide, Chlorine
10/15/25	Disinfection 2: Chlorine Disinfection Application for Sodium Hypochlorite and Gas Chlorine (including storage and safety)
10/29/25	Disinfection 3: Distribution System Application, Residual Measurement, Evaluation & Adjustment,
11/12/25	Disinfection 4: Chlorine Disinfection Math
12/3/25	Surface Water Treatment 1: Coagulation, Flocculation, Sedimentation (including chemistry, process controls, operations)
12/17/25	Surface Water Treatment 2: Filtration

https://swefc.unm.edu/home/op-cert-trainings/



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Pacific Island Territories Operator Certification Trainings

This page is a repository of Wastewater and Drinking Water Operator Certification (Op Cert) Training Webinars offered by the SW EFC for systems in the Pacific Territories. Below you will find the **training webinar schedules (wastewater, then drinking water)** followed by a **training webinar recordings library**.

Jump to Wastewater Trainings

Jump to Drinking Water Trainings

Wastewater Training Schedule

Please note all times are local to CNMI and Guam. The times in American Samoa are one day earlier at 11 am.

Session	Date	Training Topic & Link to Recording (click to view)	Supporting Materials (click to download)
1	6/25/2025	Program Overview, Test Format, Study & Test Tips	PPT slides
2	7/9/2025	Treatment Overview	
3	7/23/2025	WW Math Part 1 (Areas & Volumes)	
4	8/6/2025	WW Math Part 2 (Flow Rates & Detention Times)	
5	8/20/2025	Collection Systems – Gravity systems	
6	9/3/2025	Collection Systems – Pumping & Force Mains	
7	9/17/2025	Collection System Maintenance	
8	10/1/2025	Operator Safety/OSHA/Chemical Safety & Inventory	

Drinking Water Training Schedule

Please note all times are local to CNMI and Guam. The times in American Samoa are one day earlier at 11 am.

Session	Date	Training Topic & Link to Recording (click to view)	Supporting Materials (click to download)
1	6/26/2025	Program Overview, Test Format, Study & Test Tips	PPT slides
2	7/10/2025	Drinking Water System Overview	
3	7/24/2025	Basic Operator Math (+, -, /, x, Exponents and basic algebra)	
4	8/7/2025	Applied Operator Math	
5	8/21/2025	Drinking Water Regulations	
6	9/4/2025	Source Water Characteristics	
7	9/18/2025	Surface Water Intake Components, Well Components, and O&M	
8	10/2/2025	Disinfection 1: Chloramines, UV, Chlorine Dioxide, Chlorine	
9	10/16/2025	Disinfection 2: Chlorine Disinfection Application for Sodium Hypochlorite and Gas Chlorine	
10	10/30/2025	Disinfection 3: Distribution System Application, Residual Measurement, Evaluation & Adjustment,	
11	11/13/2025	Disinfection 4: Chlorine Disinfection Math	
12	12/4/2025	Surface Water Treatment 1: Coagulation, Flocculation, Sedimentation	
13	12/18/2025	Surface Water Treatment 2: Filtration	
14	1/8/2026	Alternative Treatment Processes (e.g. flouridation, ion exchange, RO...)	
15	1/22/2026	Drinking Water Treatment Math & Concept Review	
16	2/5/2026	Safety Program Basics	
17	2/19/2026	Lead & Copper Rule, Corrosion Control	
18	3/5/2026	Distribution Systems 1: Hydraulics, Pipe Types, Selection, Installation, and Water Quality	
19	3/19/2026	Distribution Systems 2: Valves, Hydrants, Meters, and Service Connections	
20	4/2/2026	Distribution Systems 3: Storage and Booster Pumping	
21	4/16/2026	O&M: Pumps, Main, and Appurtenance Maintenance	
22	4/30/2026	O&M: Cross Connection Control	
23	5/14/2026	O&M: Distribution System Math and Concept Review	
24	5/28/2026	Sampling & Lab Procedures/Analysis/Interpretation	

What is a Public Water System?

Public Water System:

15 service connections or serves an average of at least 25 people for at least 60 days a year.

May be publicly or privately owned.



PWS Types



Community (C) – Serves at least 15 service connections or at least 25 residents year-round



Non-Transient Non-Community (NTNC) – Serves at least 15 service connections or 25 of same people (not residents) for at least 6 months in the year (might not be year-round)



Transient Non-Community (TNC) – Serves at least 15 service connections or 25 people (not the same individuals) at least 60 days of the year

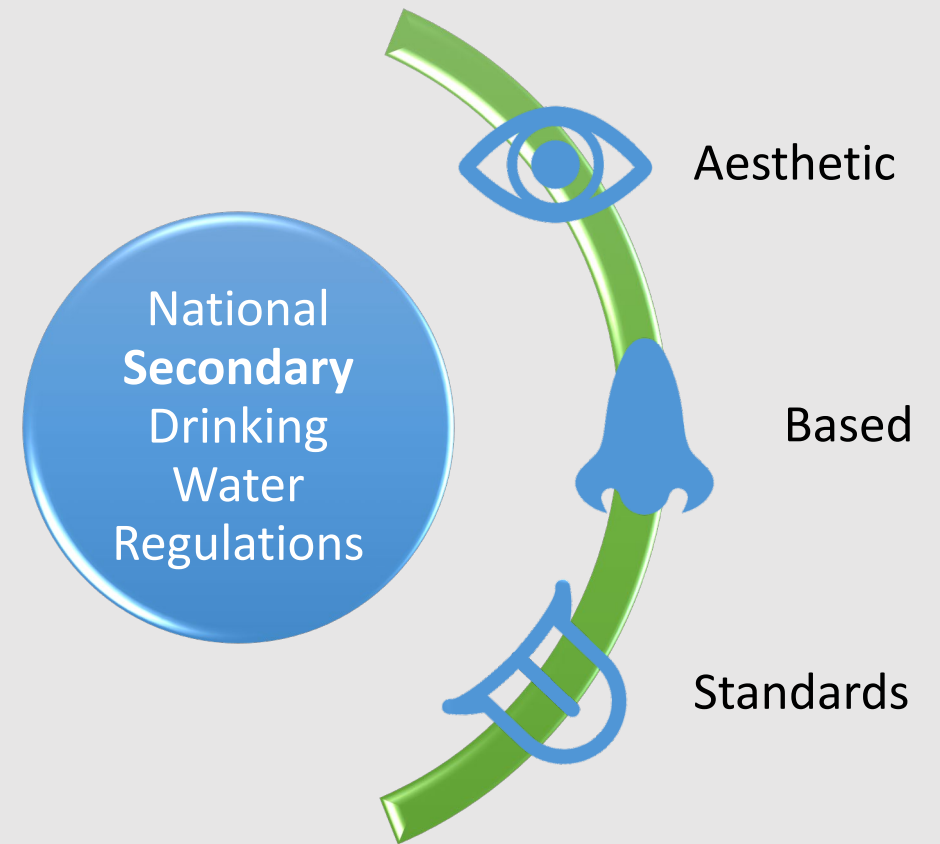
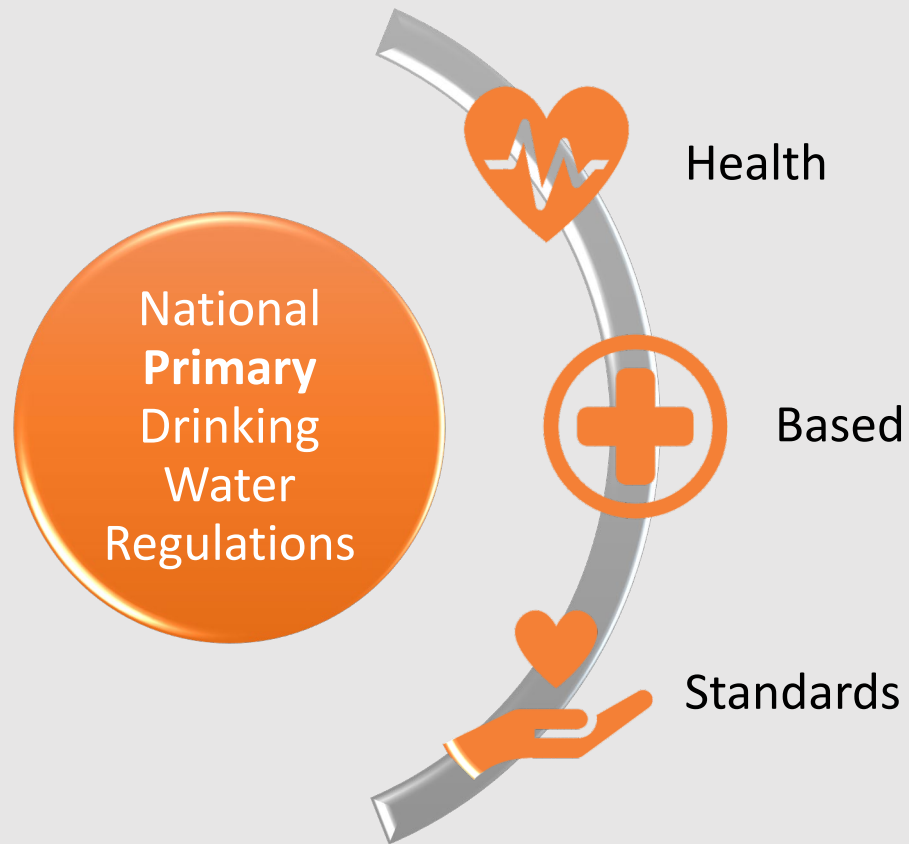
Safe Drinking Water Act

Original in 1974

Amended in
1986 and 1996

- Arsenic rule
- Chemical contaminant rules
- Lead and copper rule
- Radionuclides rule
- Variance and exemptions rule
- Per- and Polyfluoroalkyl Substances (PFAS) rule
- Ground water rule
- Stage 1 and stage 2 disinfectant/disinfection byproducts rule
- Surface water treatment rules
- Total coliform rule and revised total coliform rule
- Consumer confidence report rule
- Public notification rule
- Unregulated Contaminant Monitoring Rule

Drinking Water Regulations



Maximum Contaminant Level (MCL)

National Primary Drinking Water Regulations



Contaminant	MCL or TT ¹ (mg/L) ²	Potential health effects from long-term ³ exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L) ²
 Acrylamide	TT ⁴	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/ wastewater treatment	zero
 Alachlor	0.002	Eye, liver, kidney, or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops	zero
 Alpha/phton emitters	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation	zero
 Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	0.006
 Arsenic	0.010	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards; runoff from glass & electronics production wastes	0
 Asbestos (fibers >10 micrometers)	7 million fibers per Liter (MFL)	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits	7 MFL
 Atrazine	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops	0.003
 Barium	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits	2 13

National Secondary Drinking Water Regulations

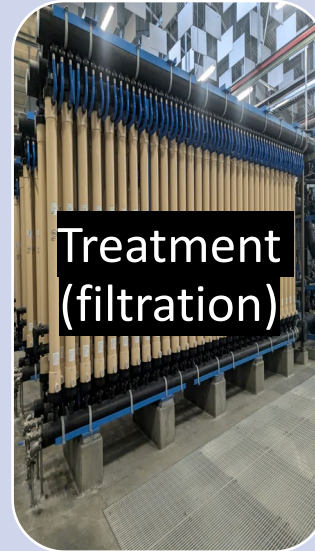
NATIONAL SECONDARY DRINKING WATER REGULATION

National Secondary Drinking Water Regulations are non-enforceable guidelines regarding contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, some states may choose to adopt them as enforceable standards.

Contaminant	Secondary Maximum Contaminant Level
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1 mg/L
Corrosivity	Noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

Not enforceable by EPA

Water system overview



Water Sources

Surface Water vs. Groundwater vs. GUDI



Surface Water Advantages

Can be less likely to have dissolved contaminants

Can be more accessible (no need for groundwater surveys and drilling)

Groundwater Advantages

Less suspended solids

Less living organisms present

No log removal requirement

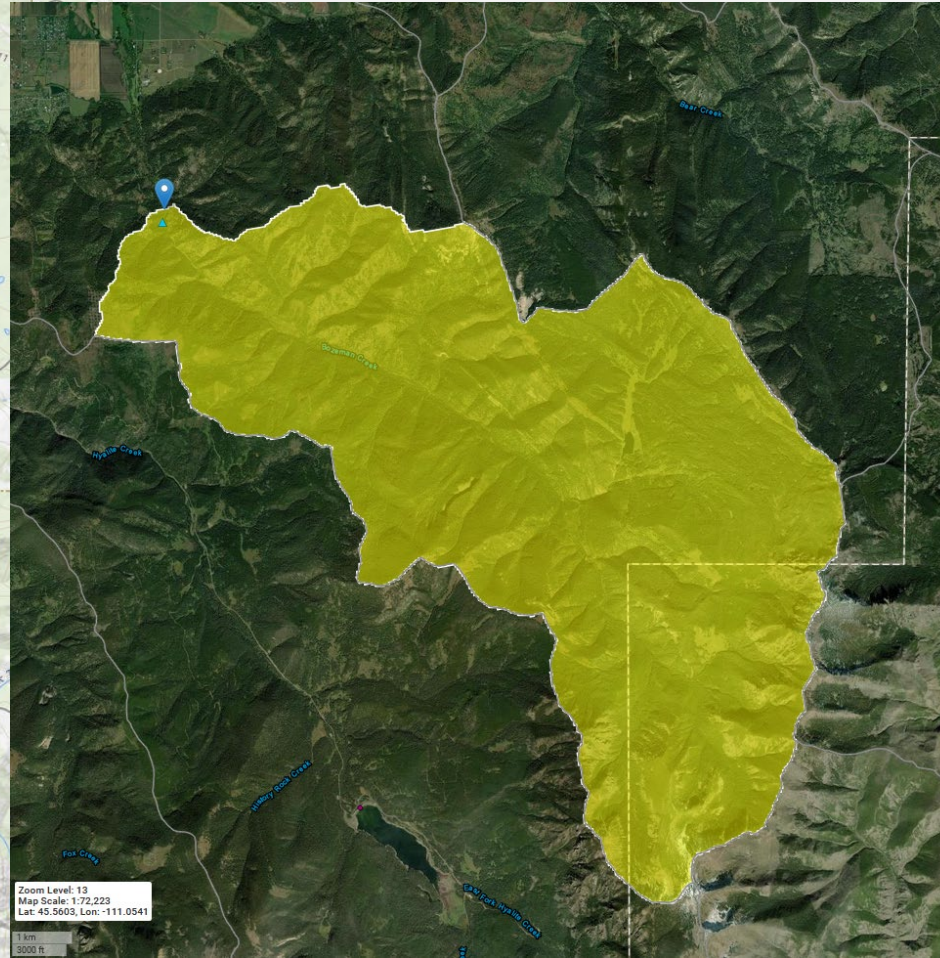
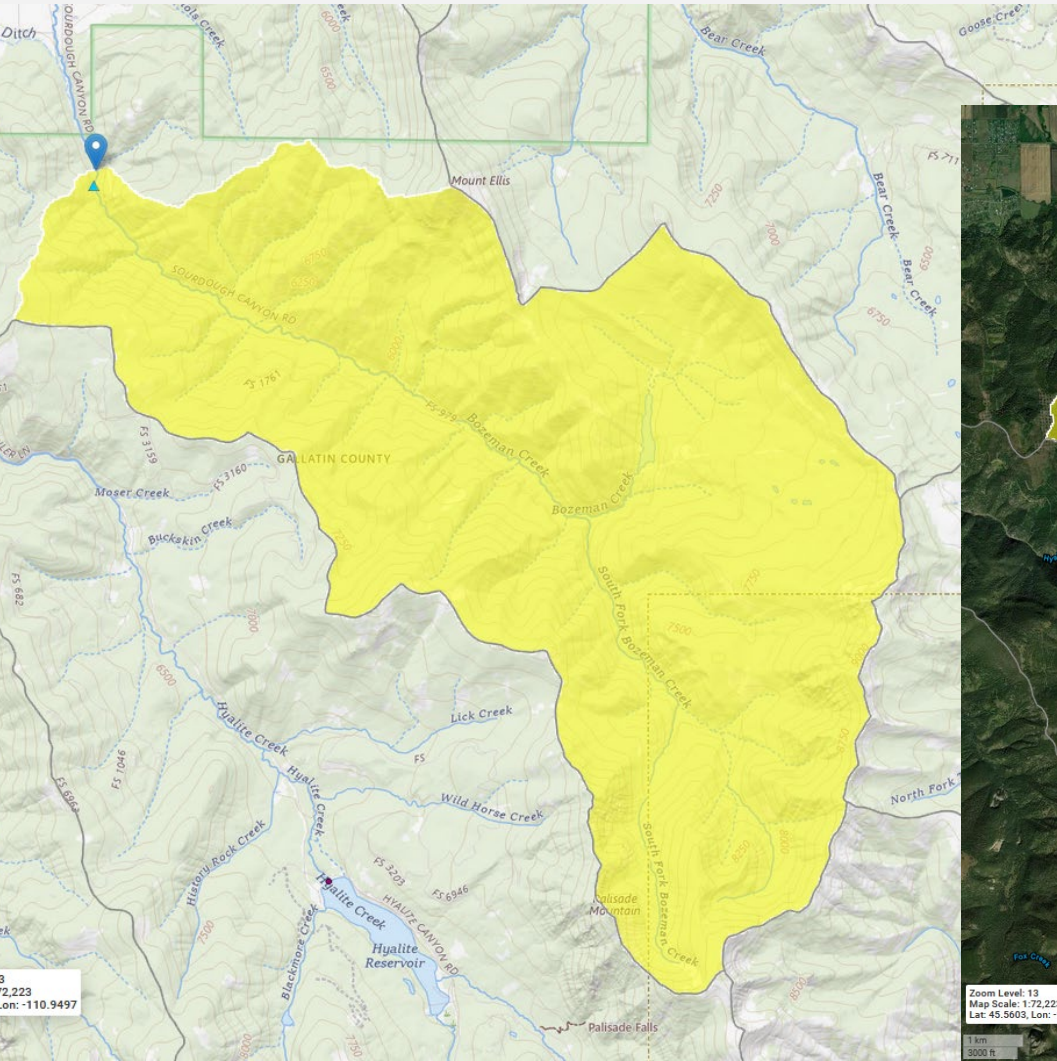
Potentially cheaper treatment

Less seasonal variability

Less yearly variability

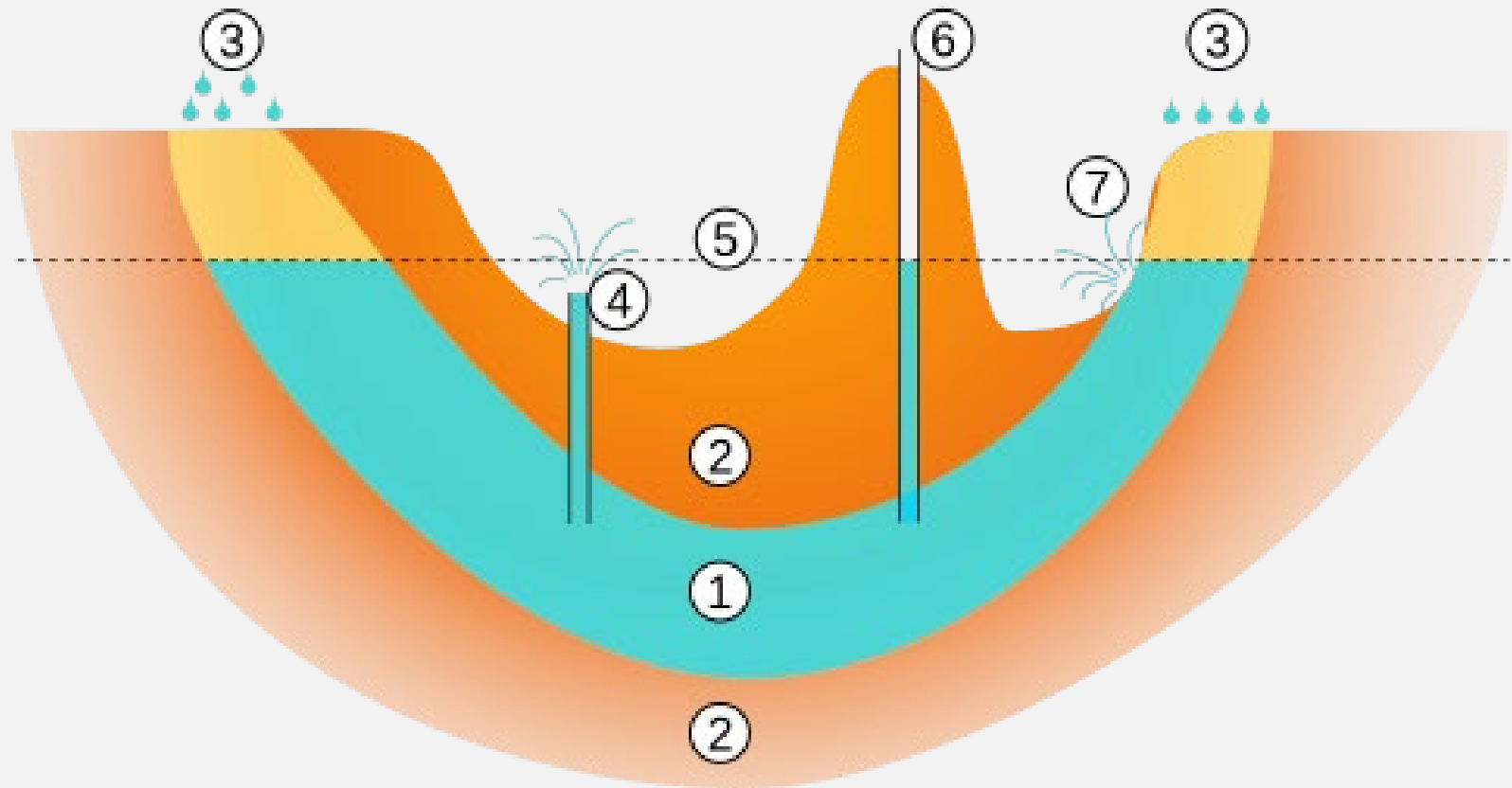
Surface Water - Rivers & Streams

Watershed

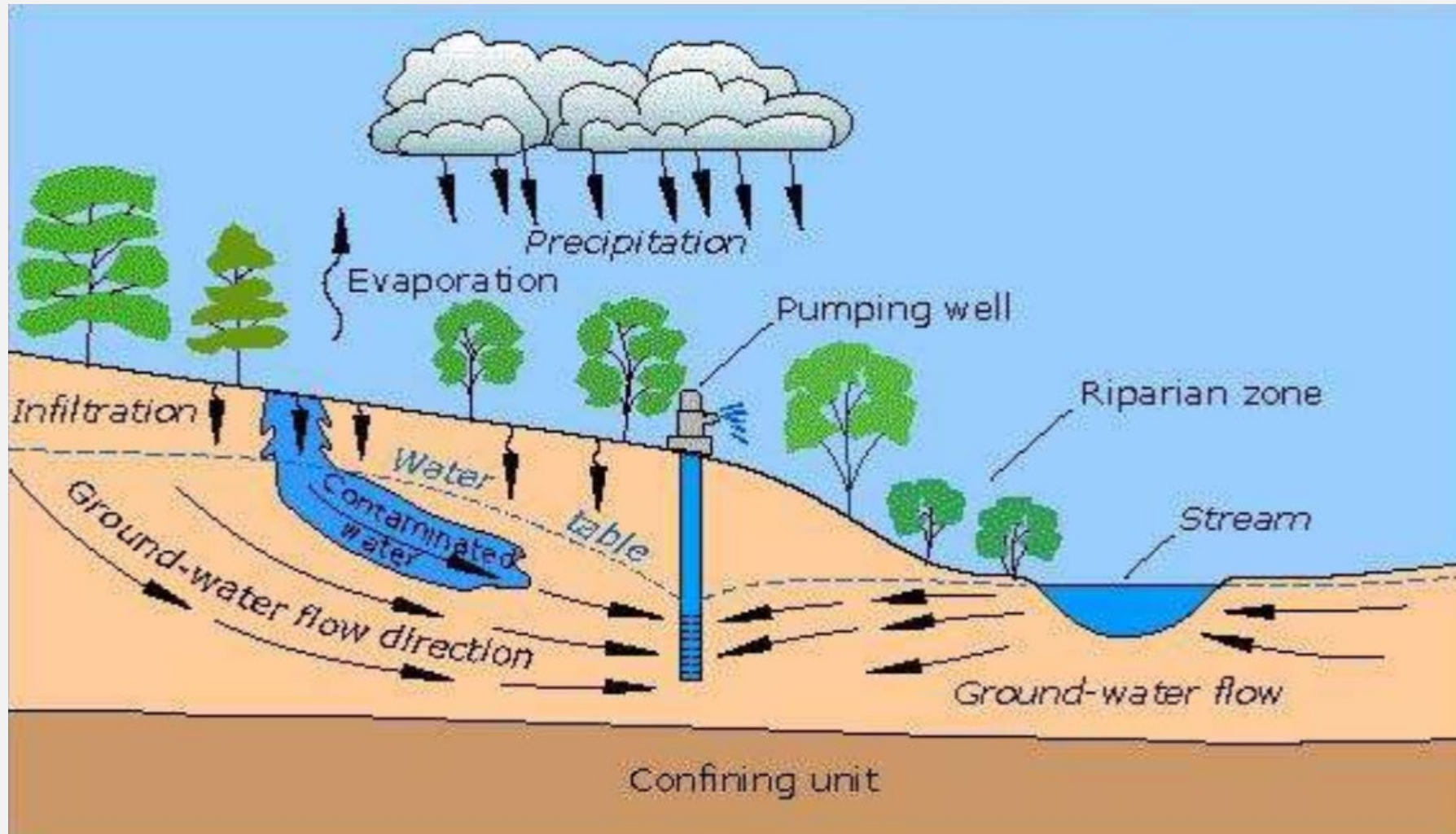


Groundwater - Accessed via well or spring

- 1) Aquifer
- 2) Impervious strata (aquiclude)
- 3) Infiltration
- 4) Artisan well
- 5) Saturation level
- 6) Well
- 7) Spring



GWUDI (Groundwater Under Direct Influence of Surface Water)



Water Treatment

Purpose of treatment

- Turbidity reduction
- Removal of suspended solids (TSS)
- Removal of dissolved solids (TDS)
- Removal or inactivation of organisms and viruses



Log removal

1 log removal = 90%

2 log removal = 99%

3 log removal = 99.9%

4 log removal = 99.99%

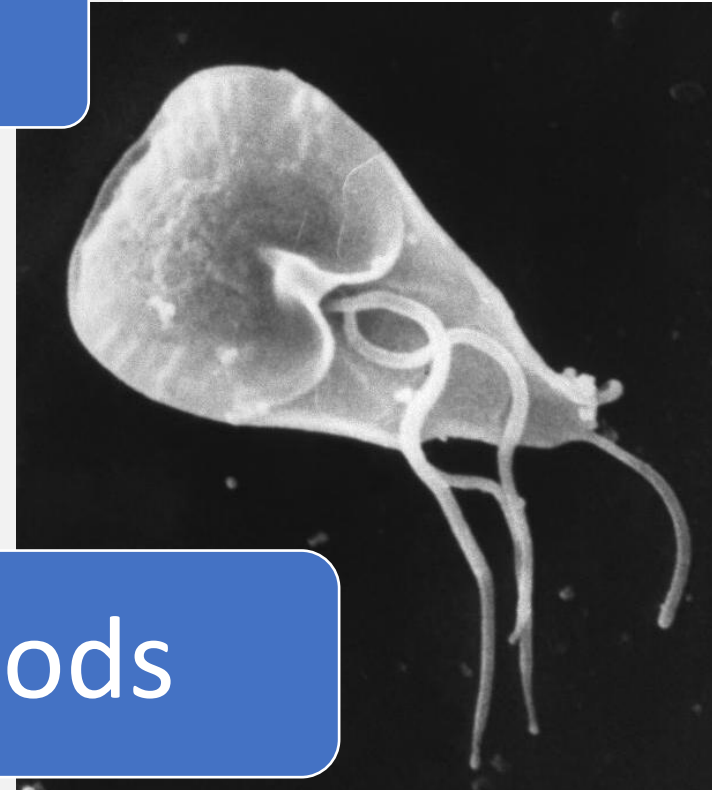
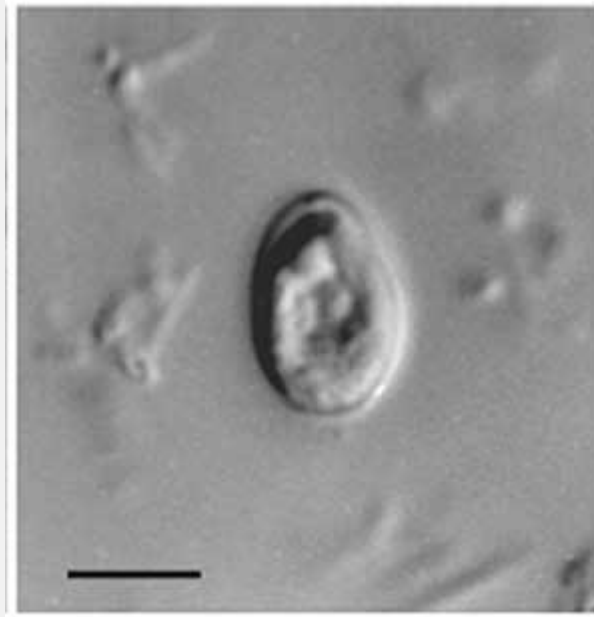
Etc.

Cryptosporidium

Giardia

Bacteria

Viruses



Credits for treatment methods

Water treatment steps



Source



Grit
removal



Chemical
addition



Rapid
mix



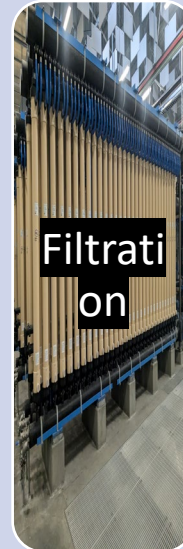
Coagul
ation



Floccul
ation



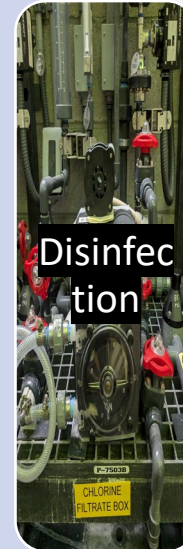
Sedime
ntation



Filtrati
on



pH
adjust
ment /
corrosi
on
control



Disinfec
tion



Fluorid
ation



Storage
/
distribu
tion

Water Treatment Chemicals

Coagulants and oxidants

- Coagulants bind together particles
- Oxidants can remove unwanted substances

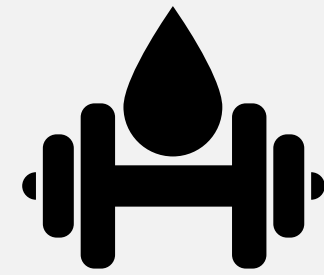


Coagulation, Flocculation, Settling



Filtration

Gravity vs. Pressure Filtration



8.34 pounds/gallon

Gravity

- Weight of water pushes water through filter
- Most common

Pressure

- Applied water pressure pushes water through filter
- Requires energy

Types of Gravity Filters

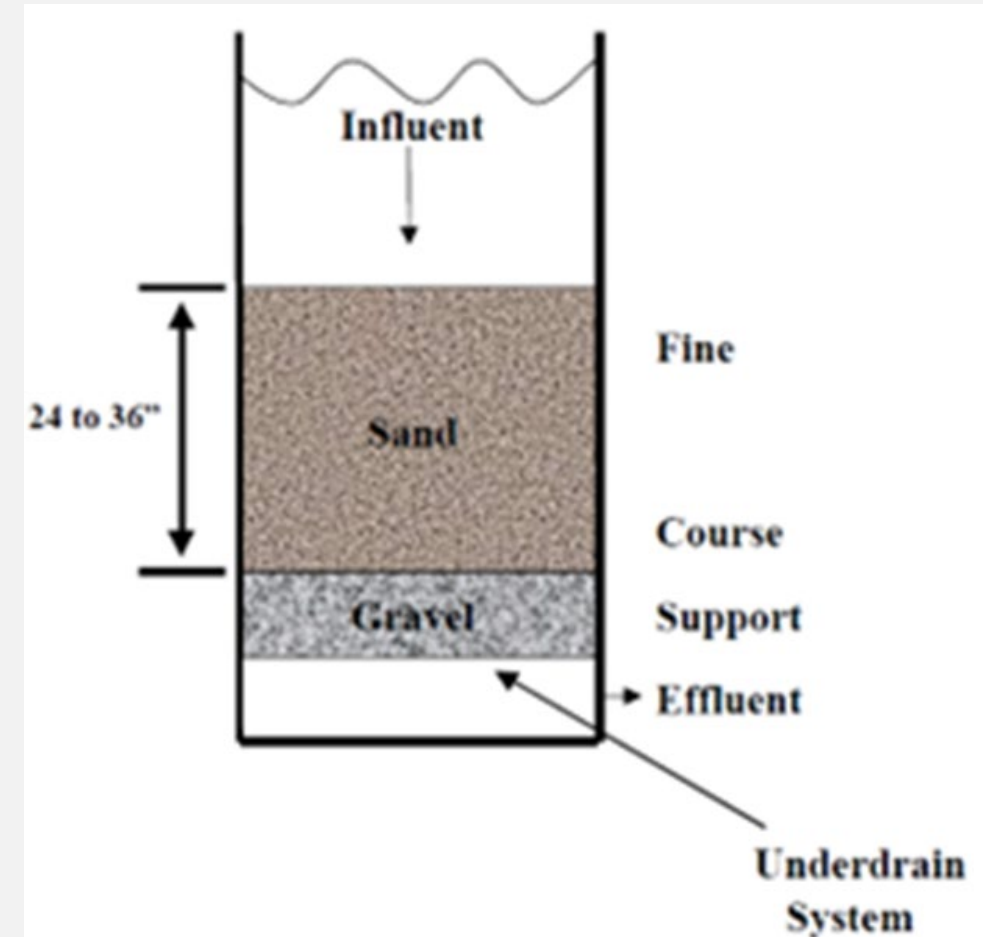
Slow Sand

Rapid Sand
(conventional)

Gravity Filters

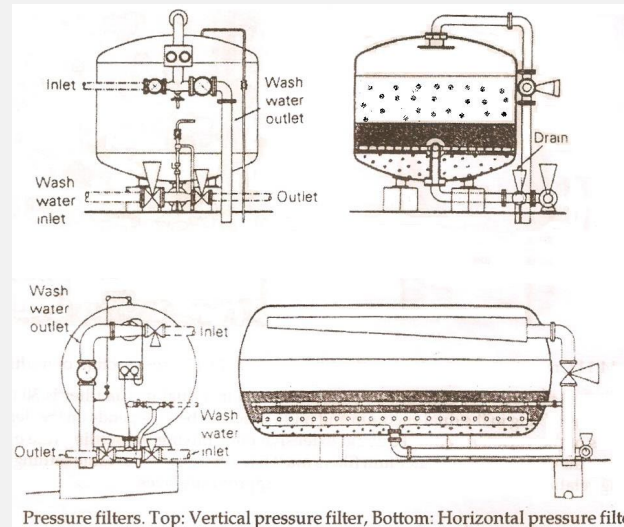
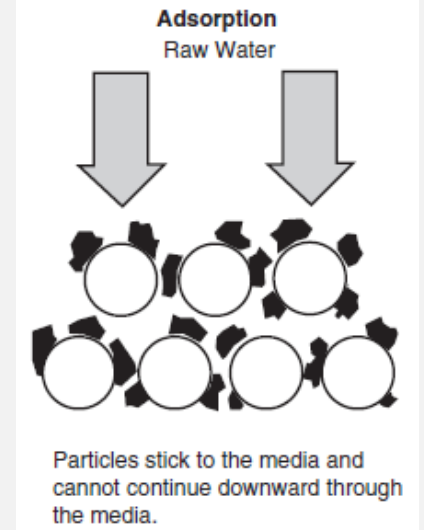
High Rate

Deep Bed,
Monomedium



Types of Pressure Filters

- Sand or Mixed Media (direct filtration)
- Diatomaceous Earth (DE)
- Adsorption
- Cartridge (pretreatment)
- Membrane
 - Microfiltration
 - Ultrafiltration
 - Nanofiltration
 - Reverse Osmosis



Pressure filters. Top: Vertical pressure filter, Bottom: Horizontal pressure filter



Other Treatment Methods

Other types of treatment

Aeration

Precipitation and filtration

Adsorption

Ion exchange

Lime softening

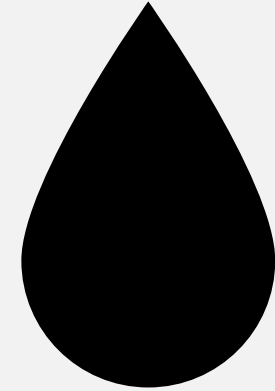
Reverse osmosis

Green sand filtration

Phosphate sequestration

Corrosion control

Fluoridation



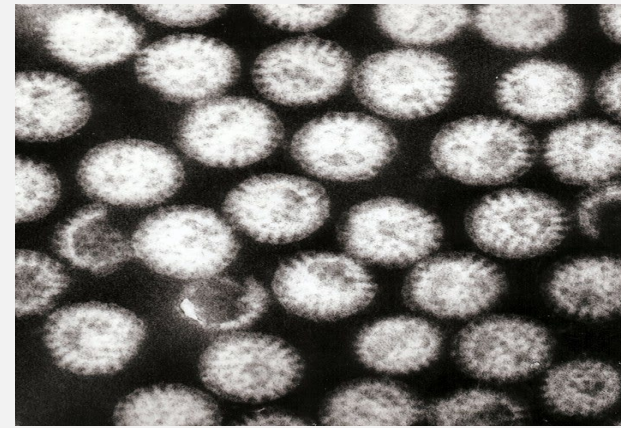


Disinfection

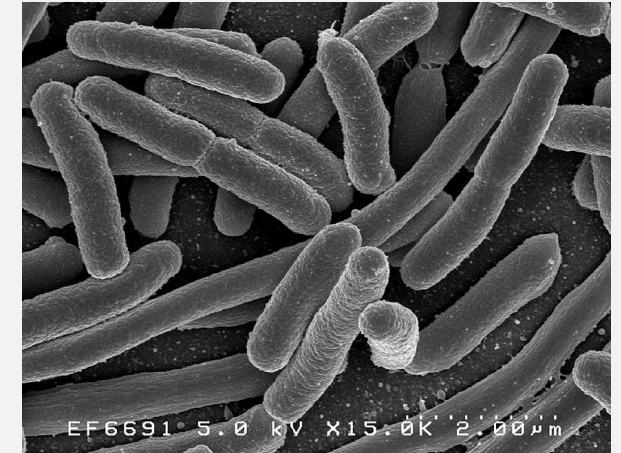
What is Disinfection?

Disinfection is the **inactivation** of **pathogenic** microorganisms

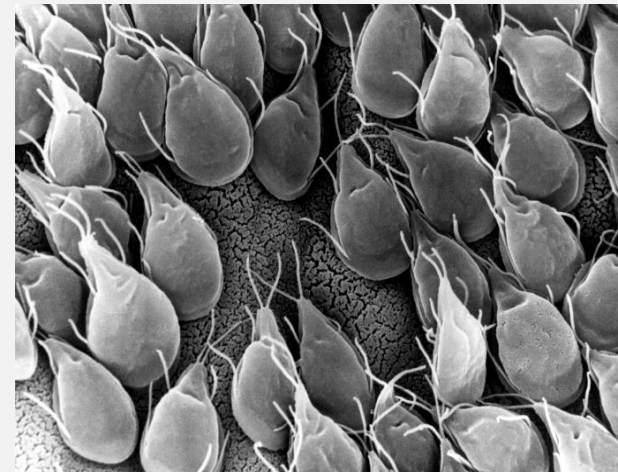
Sterilization is the **destruction** of all living organisms and is NOT disinfection



Viruses



Bacteria



Protozoa

How can **pathogens**
enter our drinking
water systems?



Source
Contamination



Treatment
Contamination



Distribution
Contamination

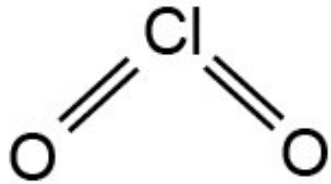


Storage
Contamination

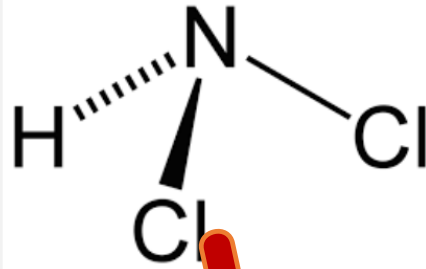
Types of Disinfectants



Chlorine



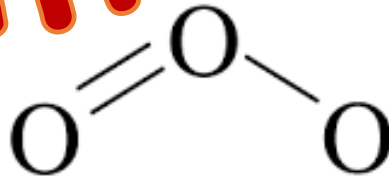
Chlorine Dioxide



Chloramines

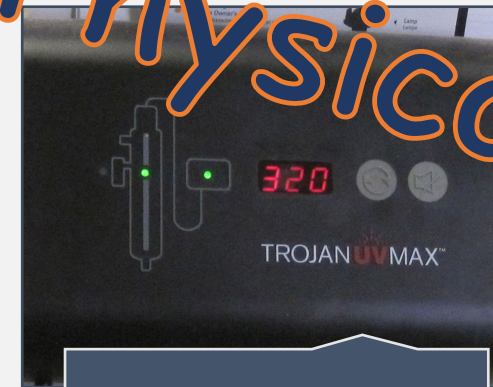


Bromine



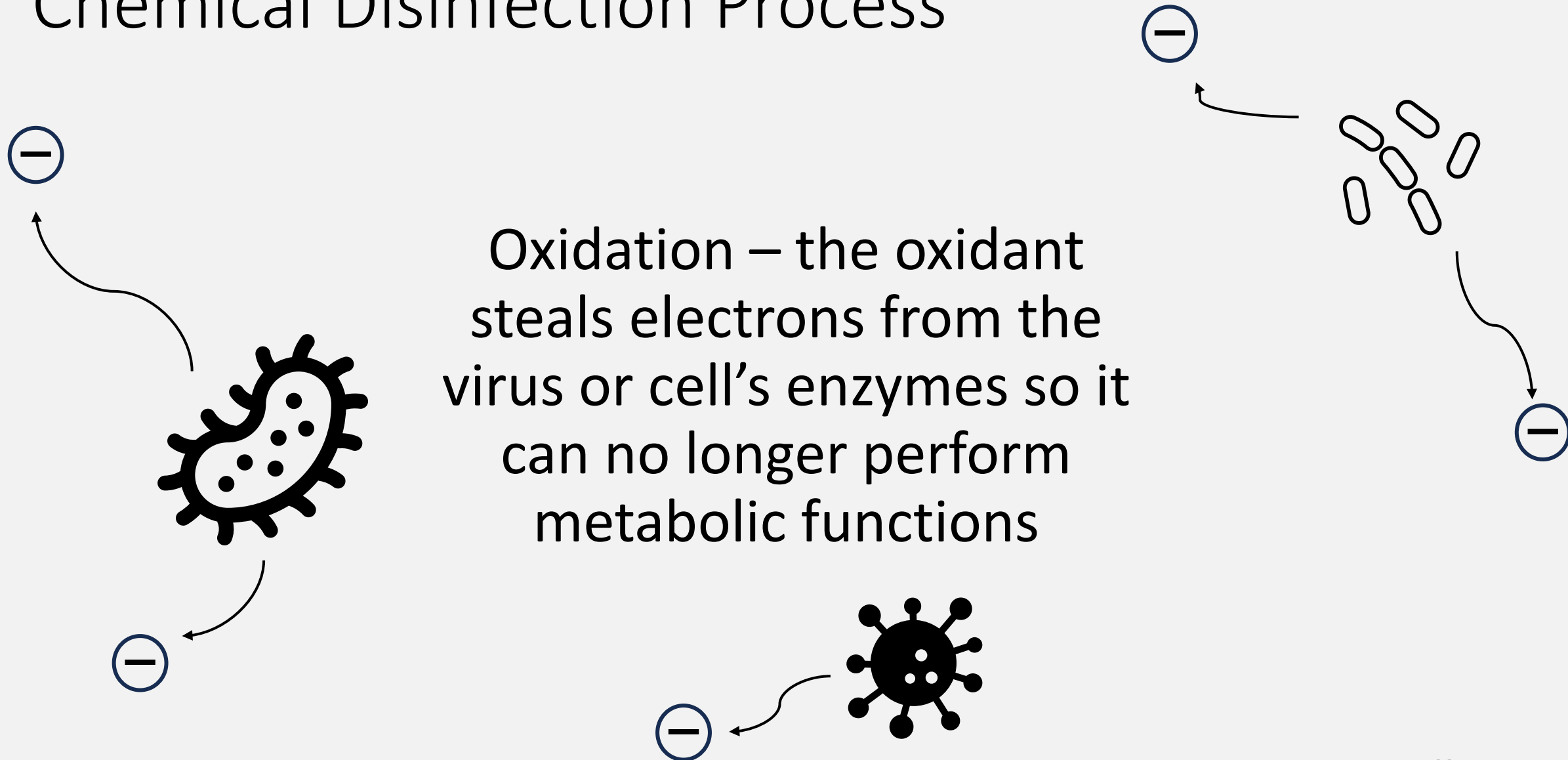
Ozone

Physical



Ultraviolet Light (UV)

Chemical Disinfection Process

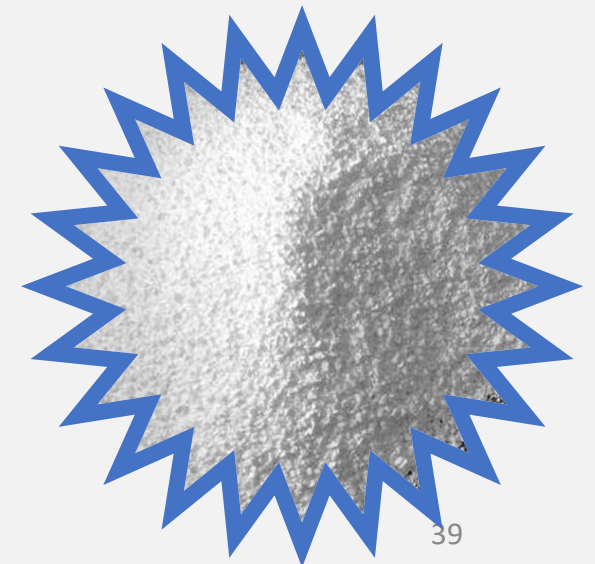
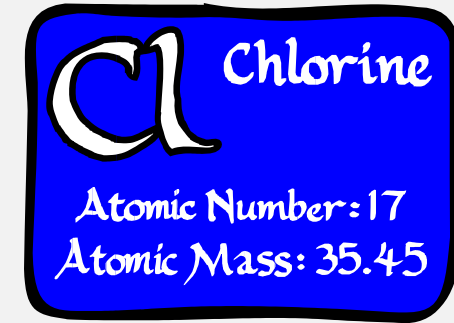


3 Types of Chlorine

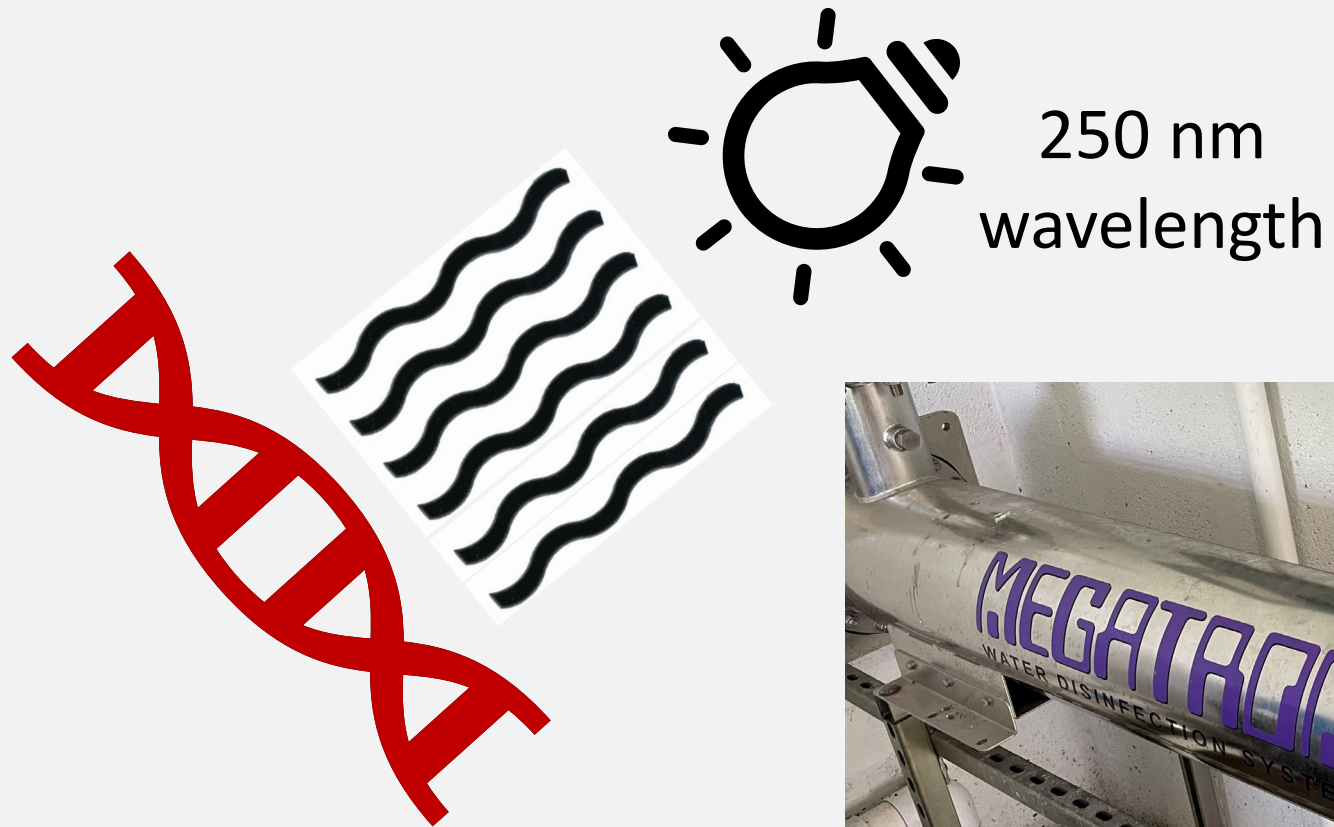
Chlorine Gas (Cl_2) – 100% chlorine

Sodium Hypochlorite – NaOCl (liquid)

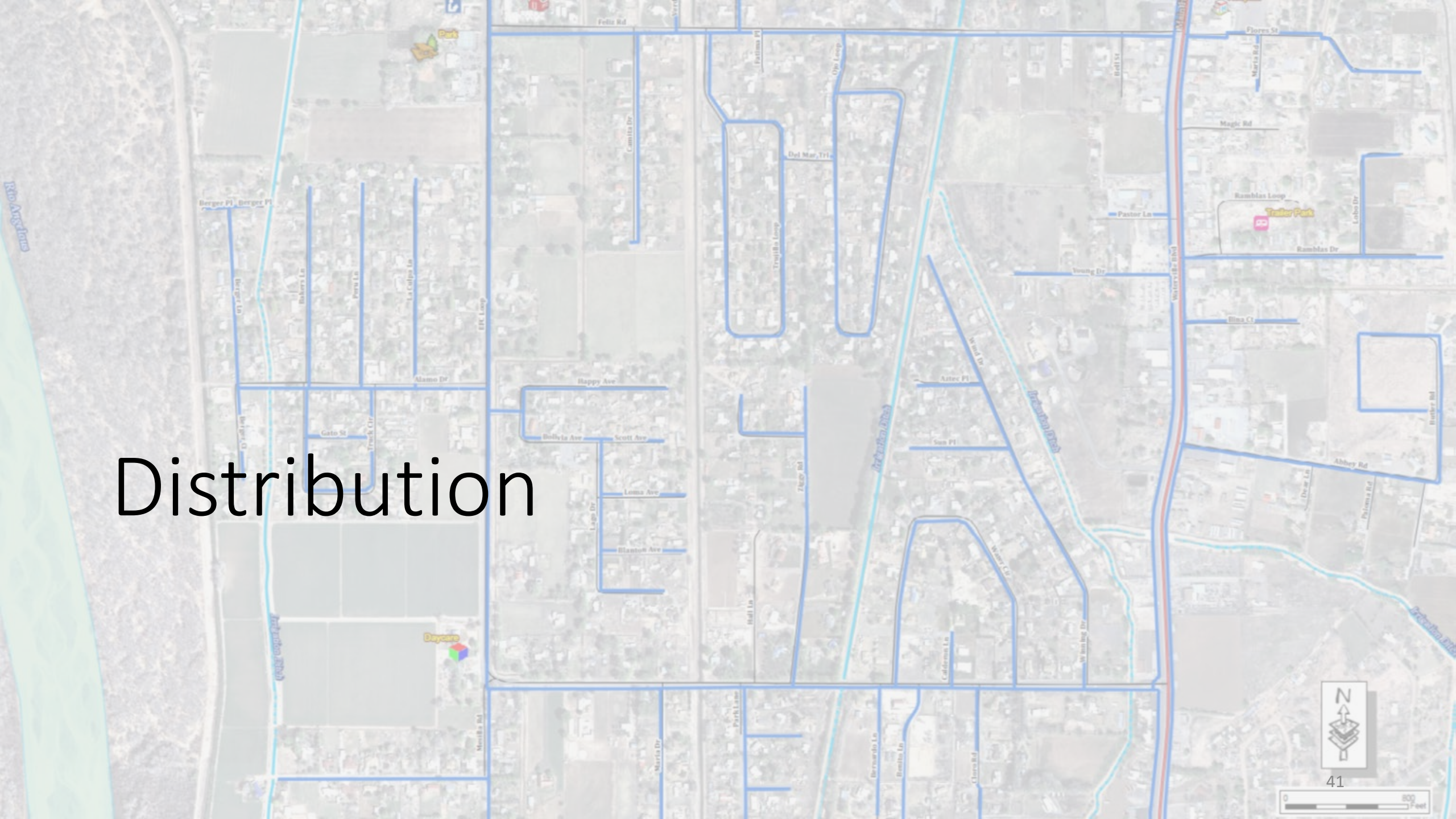
Calcium Hypochlorite – CaOCl (solid, HTH)

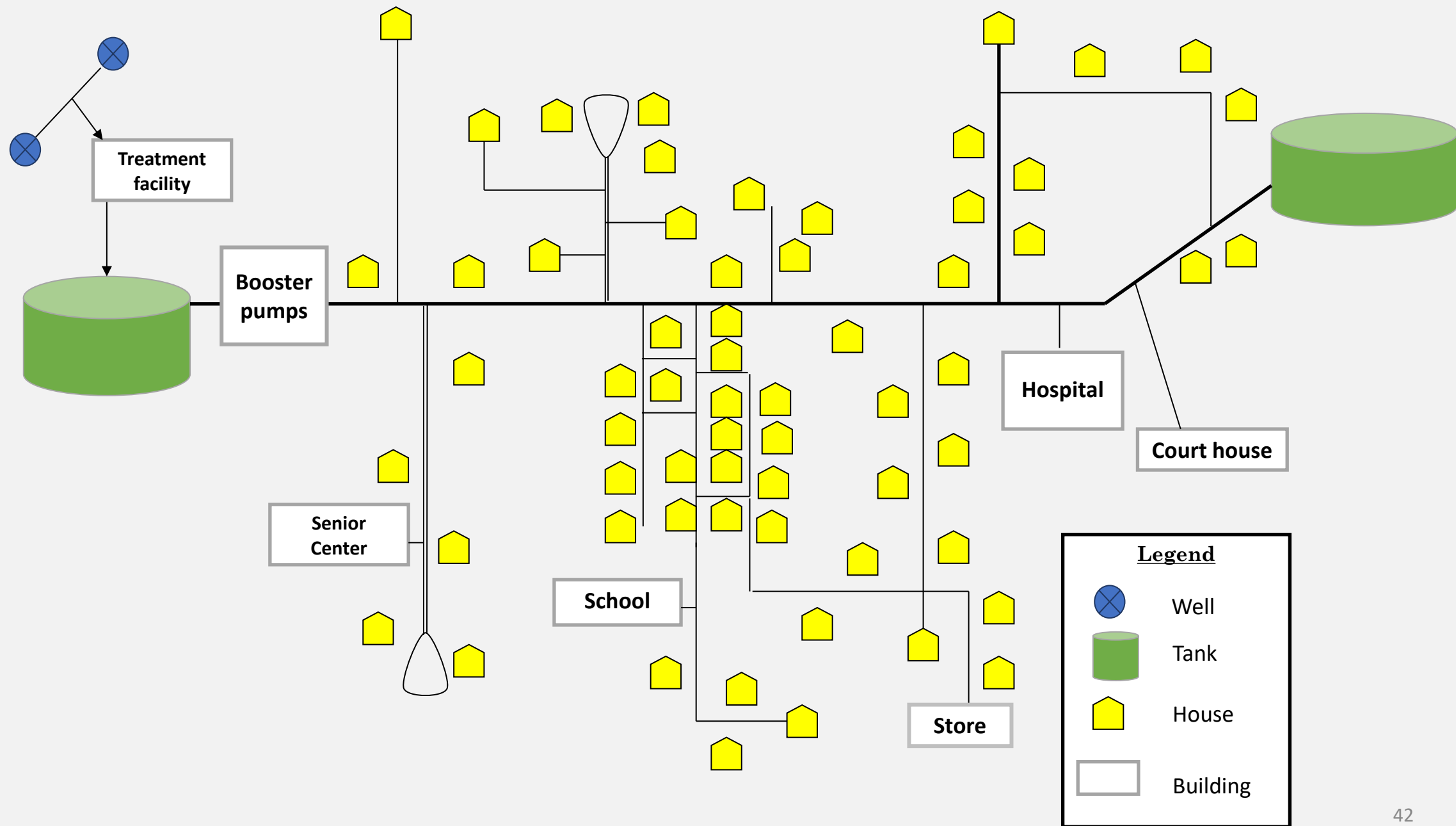


Ultraviolet Light *Physical*



Distribution





Distribution system components

Storage tanks

Booster stations

Water mains, laterals

Hydrants

Isolation valves

Service connections

Storage Tanks





Booster pump station

- Creates pressure in distribution system
- Must be between 20 psi and 100 psi

Water mains and laterals

- Polyvinyl Chloride Pipe (PVC)
- High Density Polyethylene Pipe (HDPE)
- Steel Pipes (ST)
- Ductile Iron Pipe (DIP)
- Concrete
- Asbestos Cement Pipe (AC)
- Cast Iron Pipe (CIP)
- Clay
- Wood



Hydrants

Fire hydrants



Flush hydrants



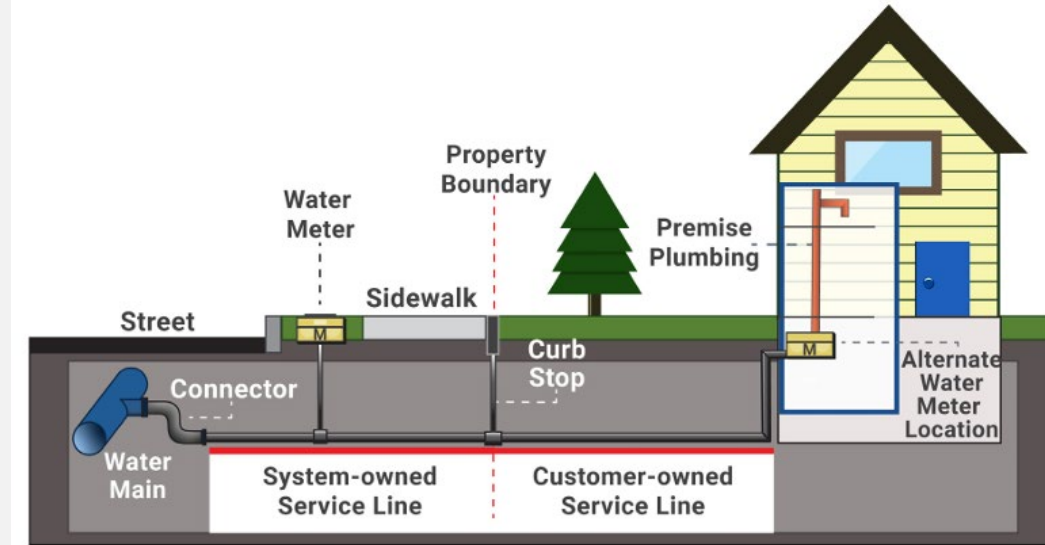
Valves

- Pressure reducing valves (PRV)
- Control valves
- Air Release valves (ARV)
- Isolation valves
- Backflow prevention valves (check valves)



Service connection

- Connects water main/lateral to buildings
- May include corp stop, curb stop, meter
- Ownership dependent on utility



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CONTACT INFORMATION



SOUTHWEST ENVIRONMENTAL FINANCE CENTER

swefc@unm.edu

Department of Civil Engineering MSCo1 1070
1 University of New Mexico
Albuquerque, NM 87131
505-277-0644
swefc@unm.edu
<http://swefc.unm.edu>