Well water treatment

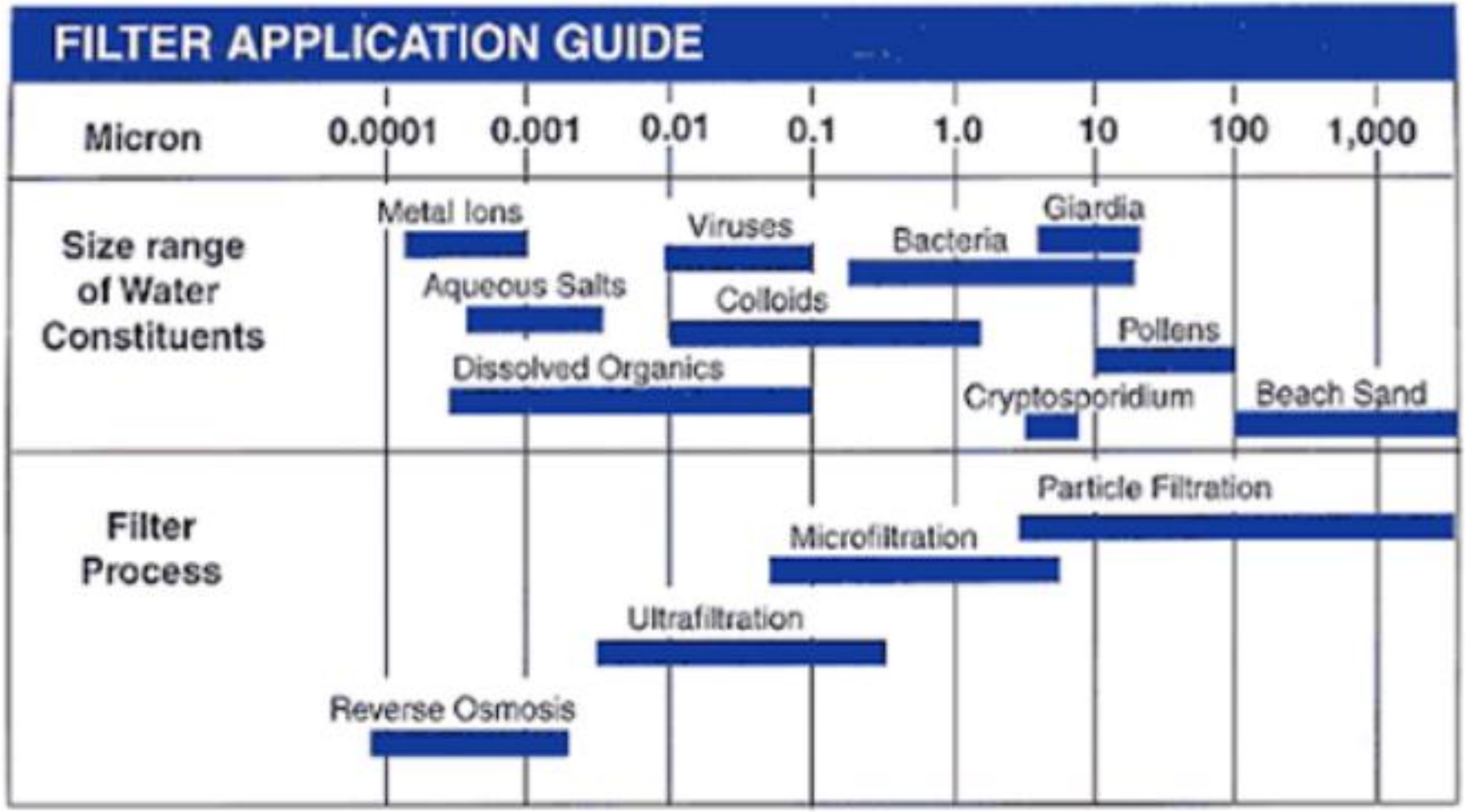
Common Well Water Problems And Contaminants

- **Scale** and **hard water**: contains calcium and magnesium
- **Staining**: If you notice red or orange staining, you likely have iron in your water. Blue-green staining can mean your water is slightly acidic or has a low pH, which can be damaging to your water pipes
- **Tastes and Odors**: Unpleasant tastes and odors can make drinking your water difficult and can affect the smell and taste Hydrogen sulfide (sulfur smell), decayed vegetation, and other naturally-occurring substances can make well water taste and smell bad.
- **Cloudy Water**: Cloudy Water can be caused by dissolved solids, tannin, sand, or other substances that affect your water's clarity.

Questions To Guide You In Well Water Treatment.

1. Is the water cloudy, tan, or rust colored?

If yes ,the water needs filtration.



2. Does the water chemistry report show there is an excess of minerals or elements in the water that need to be removed?

If the report indicated excessive hardness, pH, iron, or other metals, you would need to add chemical treatment, water softeners, or pH adjustment. Treatment is needed if your water has a bad taste or smell or is excessively corrosive.

If yes, water need softener.

If your answer is no, then proceed to question 3.

3. Does the chemistry report indicate that the water is high in dissolved solids, harmful metals such as arsenic, or trace organics?

- If yes, then you will probably need to

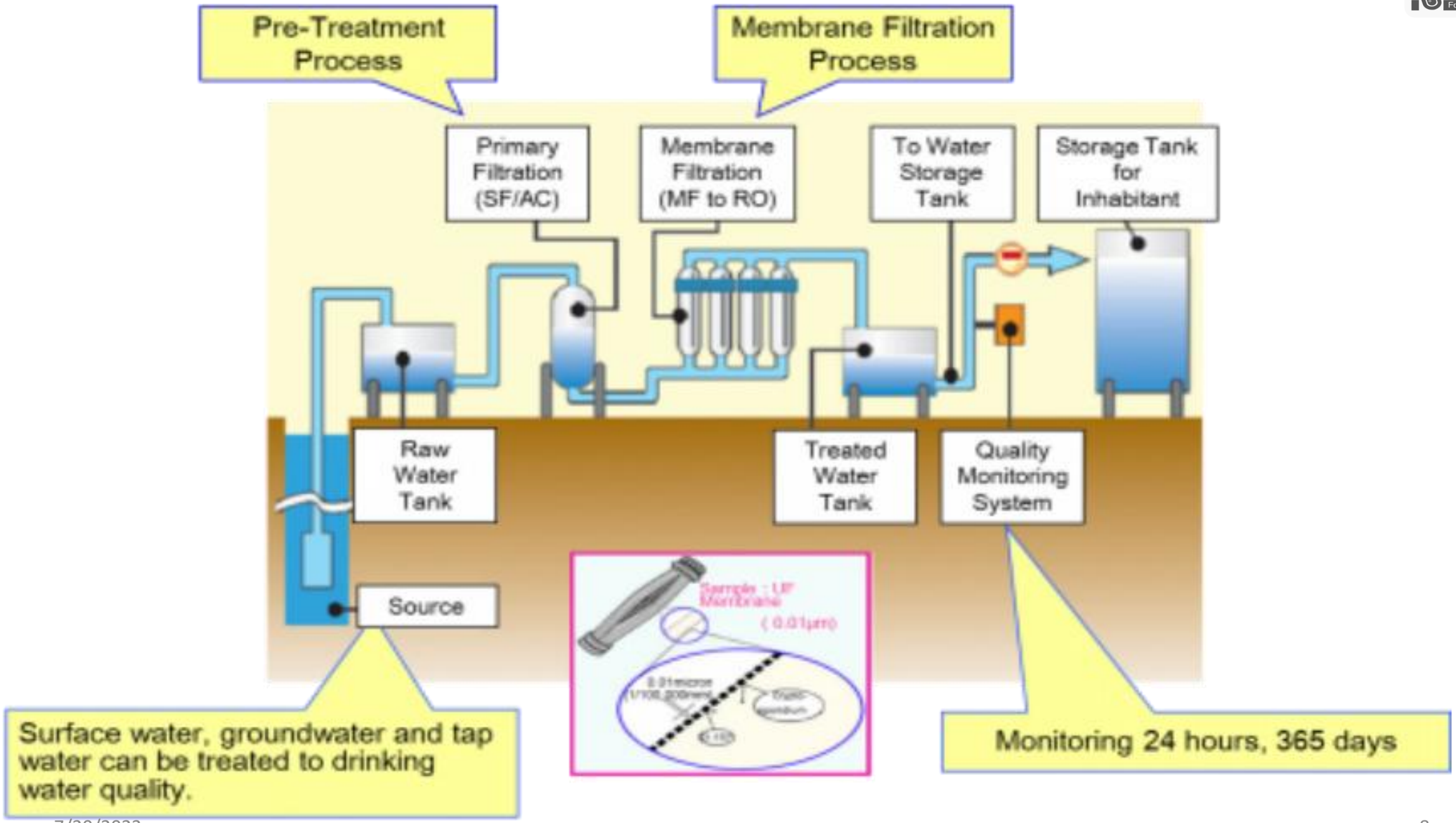
4. Does the water need disinfection?

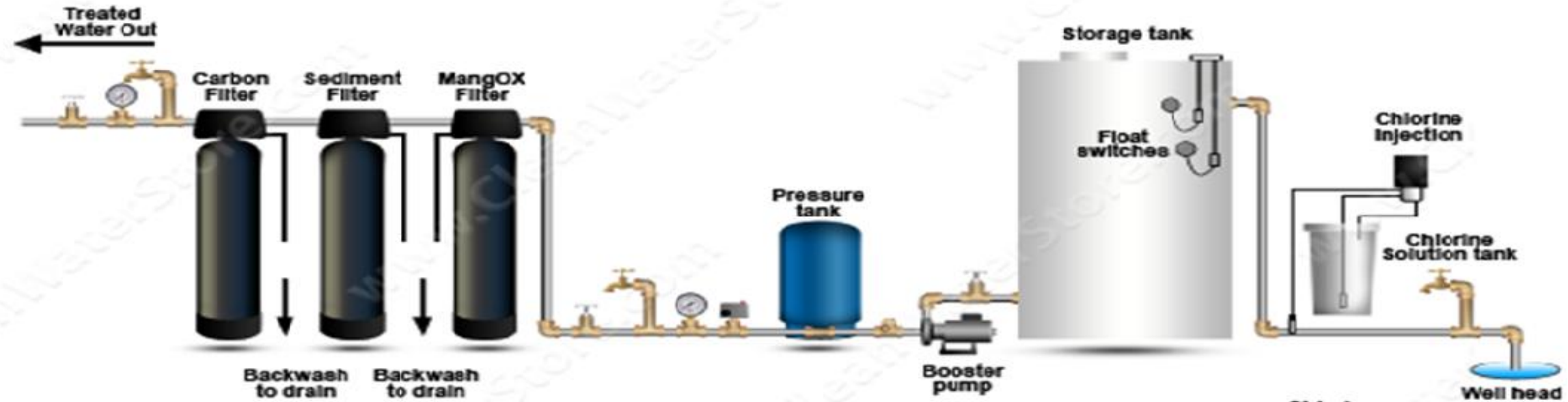
- After all required water treatment methods have been answered yes, we do or no we don't need one of the above steps, then the final treatment to be considered is disinfection.
- Because water treatment can sometimes be a slow or low flow process, there will probably be a container to hold the treated water for later use. Anytime stored water is allowed to stand, it has the

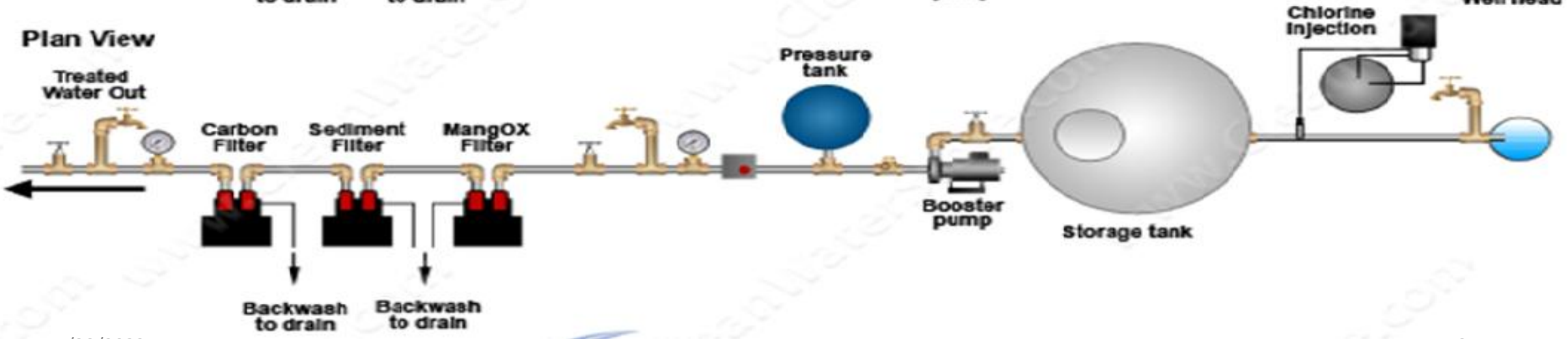
WATER TREATMENT SEQUENCE:	SYMPTOMS:	IF YES, THEN:
STEP 1 **REMOVE PARTICULATES** *(cloudy water)*	*Cloudy, colors*	Particle Filtration Microfiltration
STEP 2 **CHEMICAL TREATMENTS** *Hardness, pH Iron, Magnese, Sulfides*	*Bad taste or smell, appliance damage*	Water Softener. Replace Hard ions (Ca + Mg) for soft ions (Na or K) Chemical Filters, Alkaline, Permanganate
STEP 3 **LOWER DISSOLVED SOLIDS (TDS)** *Salts, Metals, Organics*	*Bad taste*	Reverse Osmosis (salts, arsenic, metals, organics) Iron Filters (arsenic, fluoride) Resins (anion/cation) (salts, metals, arsenic, fluoride) Activated Carbon (ultrafiltration) (trace organics & some inorganics ONLY)
STEP 4 **DISINFECTION**	*Illness: stomach*	Chemical Chlorination UV Radiation Heat Distillation

Types of Crossflow Membrane-Filtration

	Microfiltration	Ultrafiltration	Nanofiltration	Reverse Osmosis
Range	macro molec.	Molecular	sub molecular	Ionic
Particle size [Microns]	1.0 - 0.1	0.1 - 0.01	0.01 - 0.001	< 0.001
Removes	Susp. solids Large colloids Bacteria	Proteins Colloids Organics	Pyrogens Divalent ions Virus	Small organics Metals Salts
Molecular Weight	>100,000	$10{,}000 - 100{,}000$	200 - 20,000	< 300
Operating Pressure	60 kPa	60-600 kPa	1350-1750 kPa	1350-5550 kPa
Pretreatment needs	Low	Medium	High	High
Capital Cost	Low	Medium	High	High


Pre-Treatment Process
Membrane Filtration Process
Primary Filtration (SF/AC)
Membrane Filtration (MF to RO)
To Water Storage Tank
Storage Tank for Inhabitant
Raw Water Tank
Treated Water Tank
Quality Monitoring System
Source
Surface water, groundwater and tap water can be treated to drinking water quality.
Monitoring 24 hours, 365 days


Treated Water Out
Carbon Filter
Sediment Filter
MangOX Filter
Backwash to drain
Backwash to drain
Pressure tank
Booster pump
Storage tank
Float switches
Chlorine injection
Chlorine solution tank
Well head


Plan View
Treated Water Out
Carbon Filter
Sediment Filter
MangOX Filter
Backwash to drain
Backwash to drain
Pressure tank
Booster pump
Storage tank
Chlorine injection

Filters & Units

Microfiltration And Ultrafiltration Systems

- **What does microfiltration remove?**

MF membranes are available in pore sizes ranging from 0.1 to 10 µm.

MF porosity is the highest in the membrane filtration family, with the result that MF membranes allow water, ions, dissolved organic material, small colloids, and viruses to pass through, while retaining larger contaminants such as:

- Algae
- Bacteria
- Pathogenic protozoa
- Sediment, including sand, clay, and complex metals/particles

- **What does ultrafiltration remove?**

UF membranes are available in pore sizes ranging from 0.1 to 0.001 µm. Owing to the smaller pore size of its membranes, UF removes a more comprehensive range of contaminants than MF does, while leaving behind ions and organic compounds of low molecular weight. UF is suited for removal of very fine particles, including:

- Endotoxins
- Plastics
- Proteins
- Silica
- Silt
- Smog
- Viruses

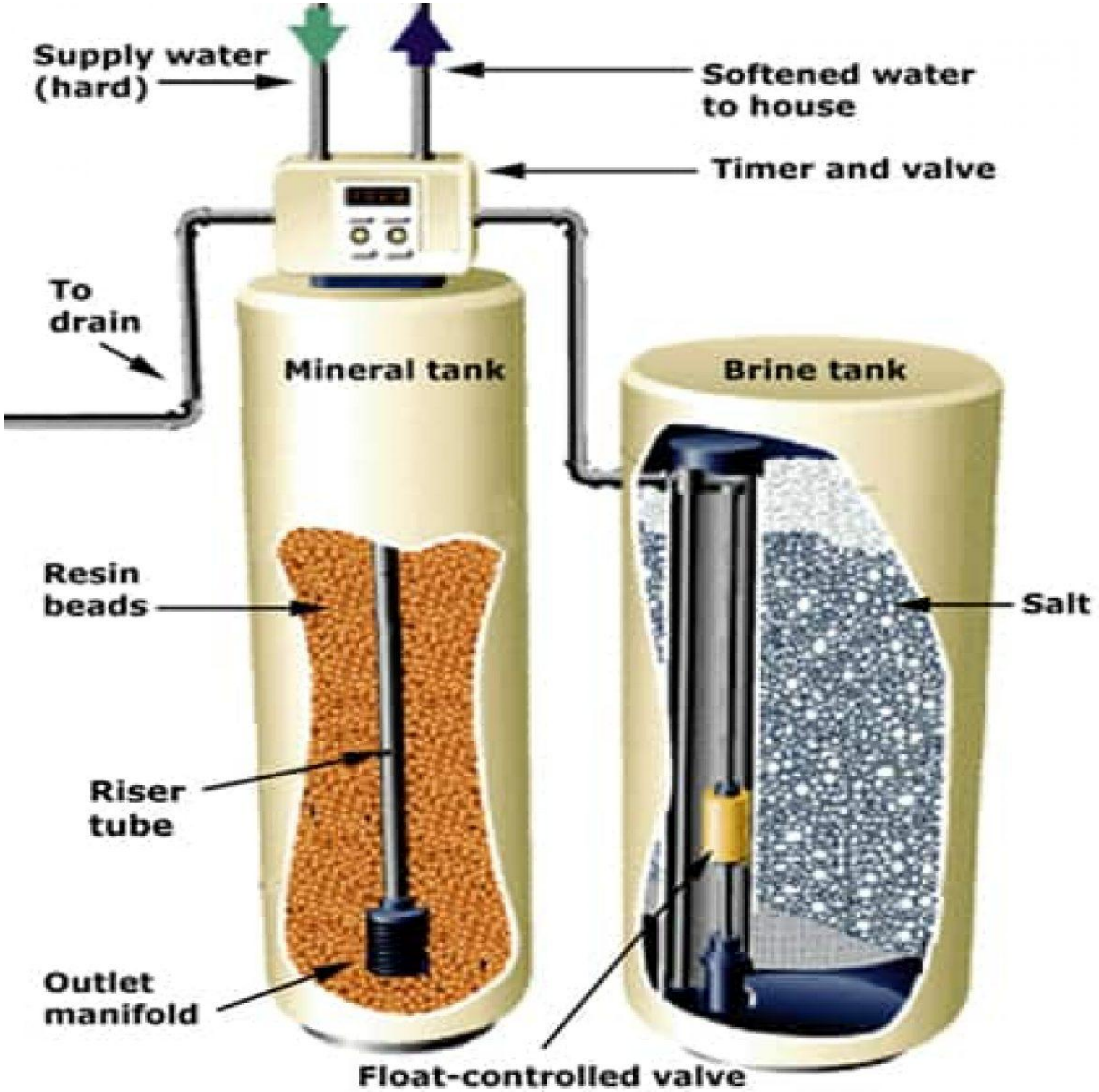
- **How does MF/UF work?**

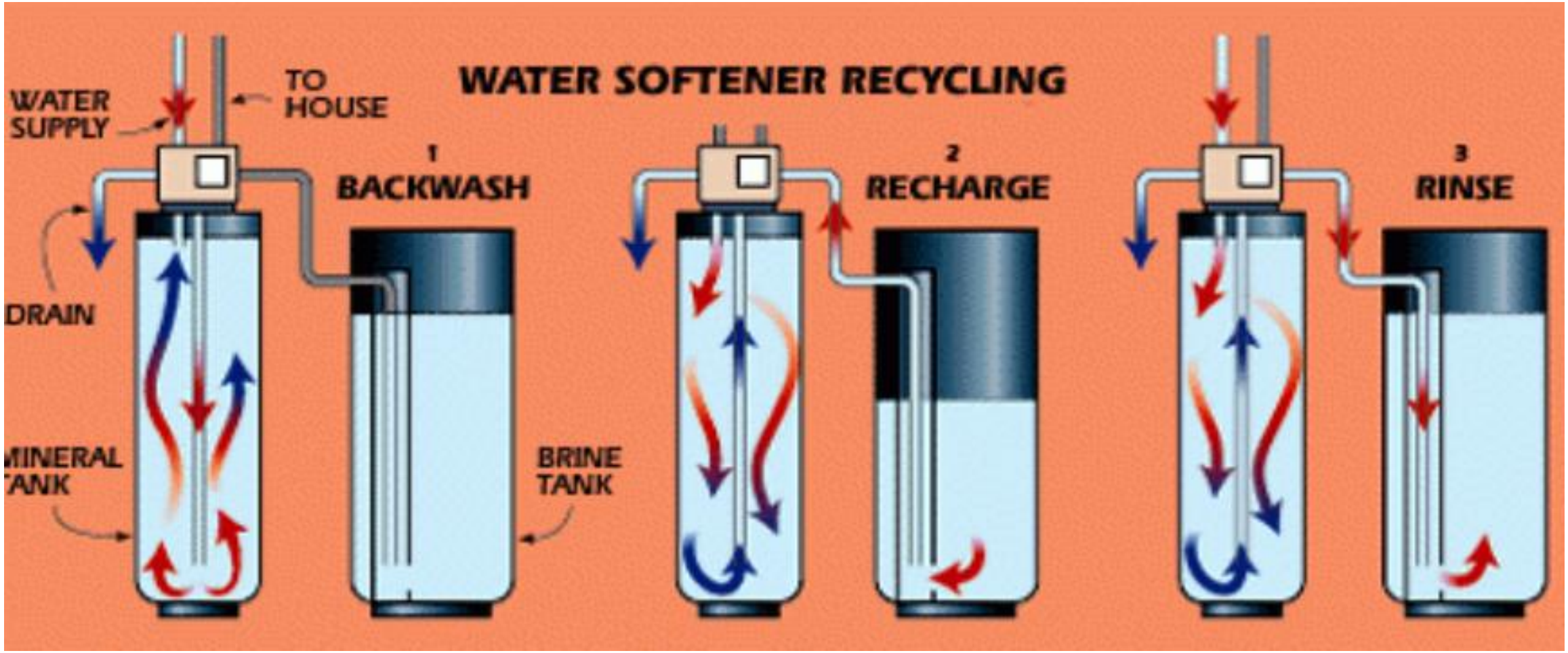
MF and UF physically separate solids from liquid streams based on the principle of size-exclusion. As a feed stream is passed through the MF/UF membrane, any solids that are too large to pass through the membrane's pores are retained, while any liquid or small particles are permitted to flow through. In either MF or UF, the portion of the feed stream that has passed through the filter membrane is referred to as the filtrate or permeate, while the remainder is known as the retentate. Depending upon the industrial application at hand, filtrate and/or retentate may each be directed to other systems, as appropriate, for waste treatment, or purification through RO.

Softener unit

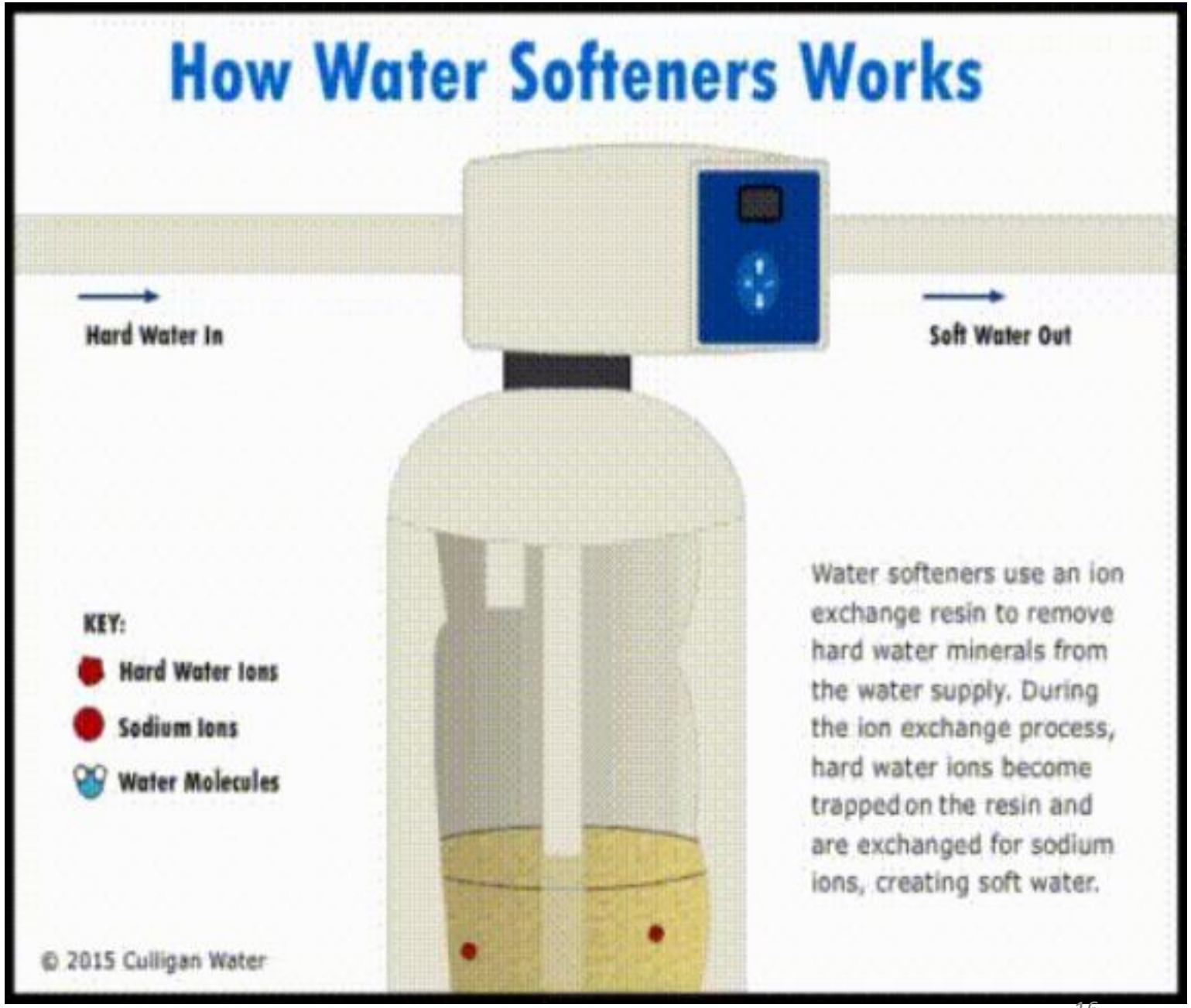
- A water softener is a filtration system that removes hardness-causing calcium and magnesium minerals from your water through a process called ion exchange.

- a water softener removes calcium and magnesium from water through a process called ion exchange. when the hard water enters into the mineral tank, it flows through a bed of spherical resin beads. These plastic beads, usually made from polystyrene, are charged with a sodium ion. The resin beads are anions, meaning they have a negative charge. The calcium and magnesium minerals have a positive charge, making them cations. Since opposite charges attract, the negative charge of the minerals is attracted to the positive charge of the resin beads. As the hard water passes through the resin, the beads grab ahold of the mineral ions and remove them from the water. When the bead seizes the mineral ion, the sodium ion is released. The column of resin strips all the hardness out of the water as it passes through the mineral tank, and softened water flows out.


Supply water (hard)
Softened water to house
Timer and valve
To drain
Mineral tank
Brine tank
Resin beads
Salt
Riser tube
Outlet manifold
Float-controlled valve


WATER SOFTENER RECYCLING
WATER SUPPLY
TO HOUSE
DRAIN
MINERAL TANK
BRINE TANK
1
BACKWASH
2
RECHARGE
3
RINSE

Softener unit



Pre-treatment for RO:

- **Flocculation**
- **Lime Softening**
- **Decarbonization (Ion Exchange)**
- **Softening**
- **Filtration**
- **Ultrafiltration**

How does Reverse Osmosis work?

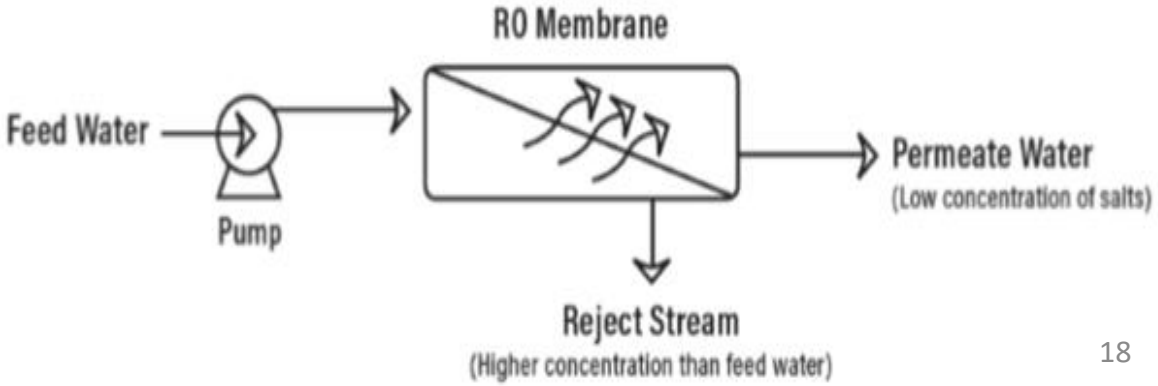
The amount of pressure required depends on the salt concentration of the feed water.

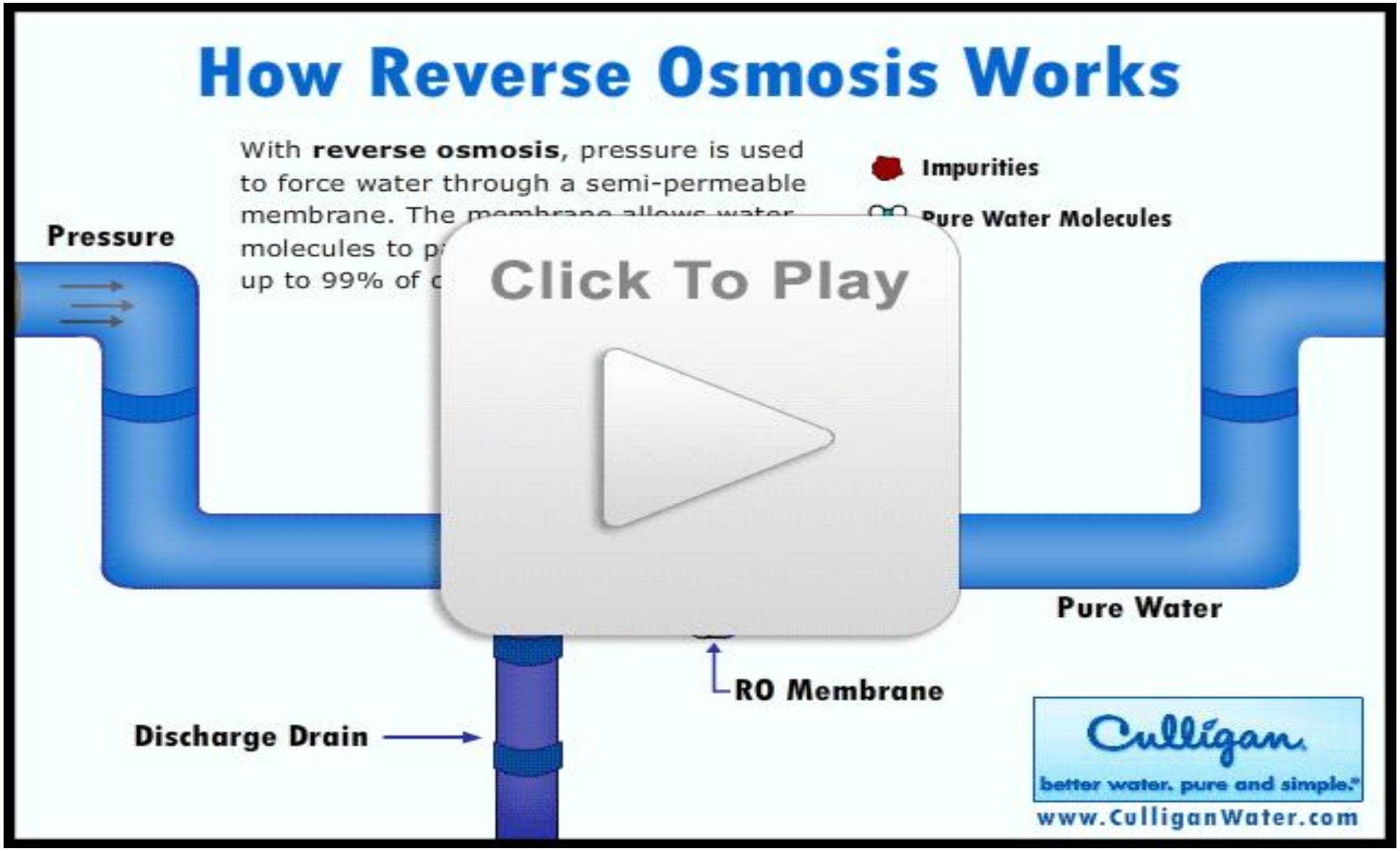
feed water : good water and bad water.

The ‘bad’ water is the water that contains all the contaminants that were unable to pass through the RO membrane and is known as the concentrate, reject, or brine. **Permeate** is the water that was pushed

through the RO membrane and

contains very little contaminants.



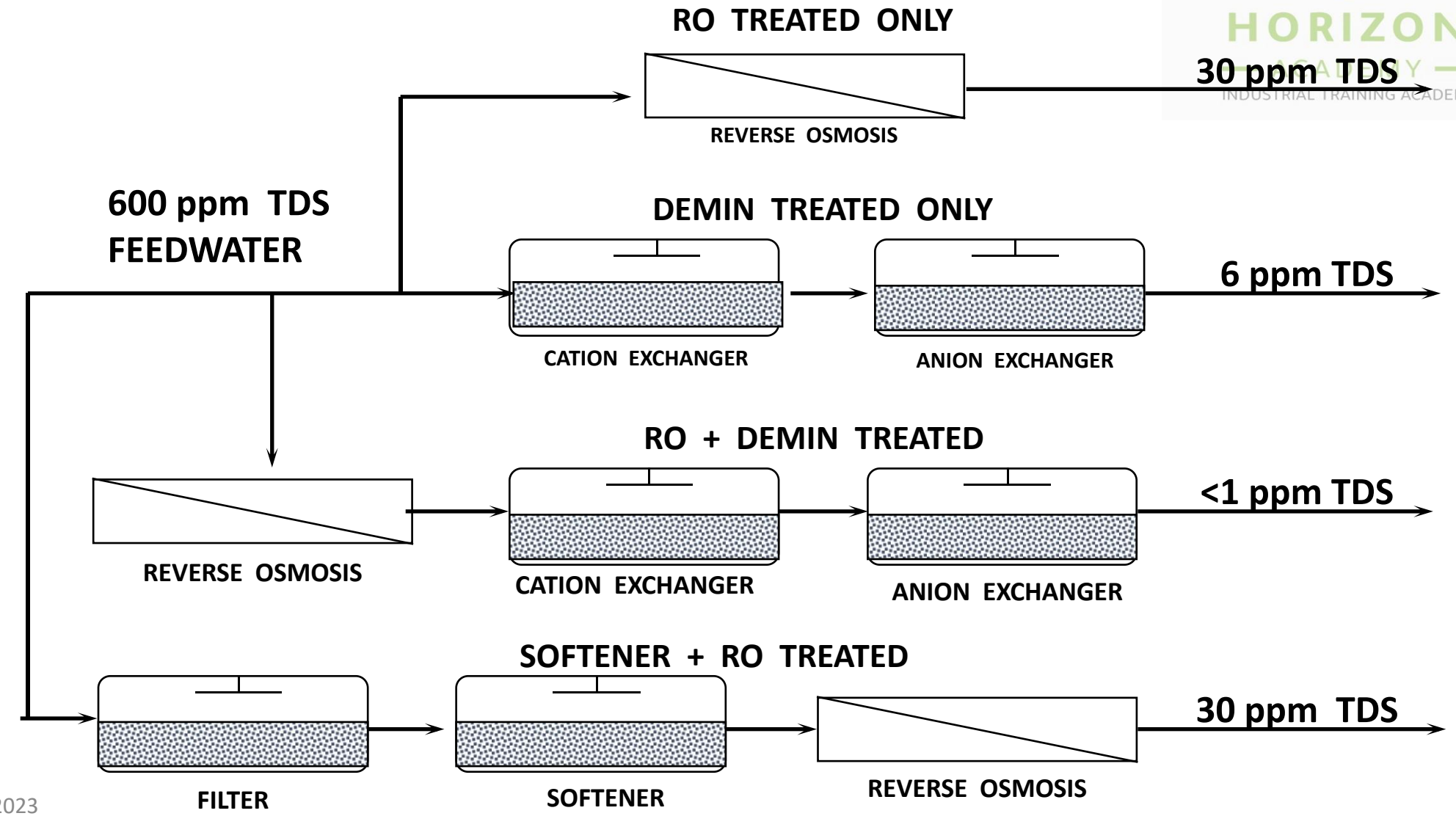

How Reverse Osmosis Works
With reverse osmosis, pressure is used to force water through a semi-permeable membrane. The membrane allows water
molecules to p
up to 99% of c
Impurities
Pure Water Molecules
Pressure
Click To Play
Pure Water
RO Membrane
Discharge Drain
Culligan
better water. pure and simple.®
www.CulliganWater.com

What will Reverse Osmosis remove from water?

- Reverse Osmosis can remove 95-99% of the dissolved salts (ions), particles, colloids, organics, bacteria, and pyrogens from the feed water. An RO membrane rejects contaminants based on their size and charge.

- Because an RO system does not remove gases, the permeate water can have a slightly lower than normal pH level depending on CO2 levels in the feed water as the CO2 is converted to carbonic acid.

Water Quality Comparisons

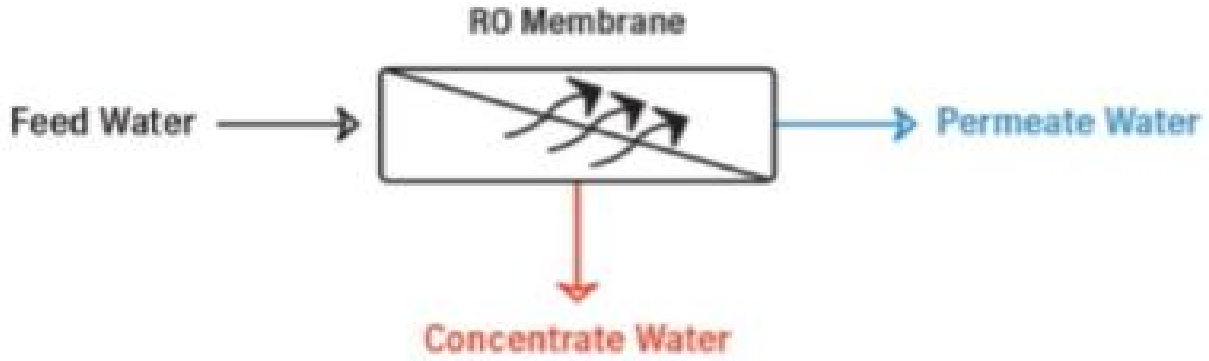


The Difference Between A 1 And 2 Stage RO System

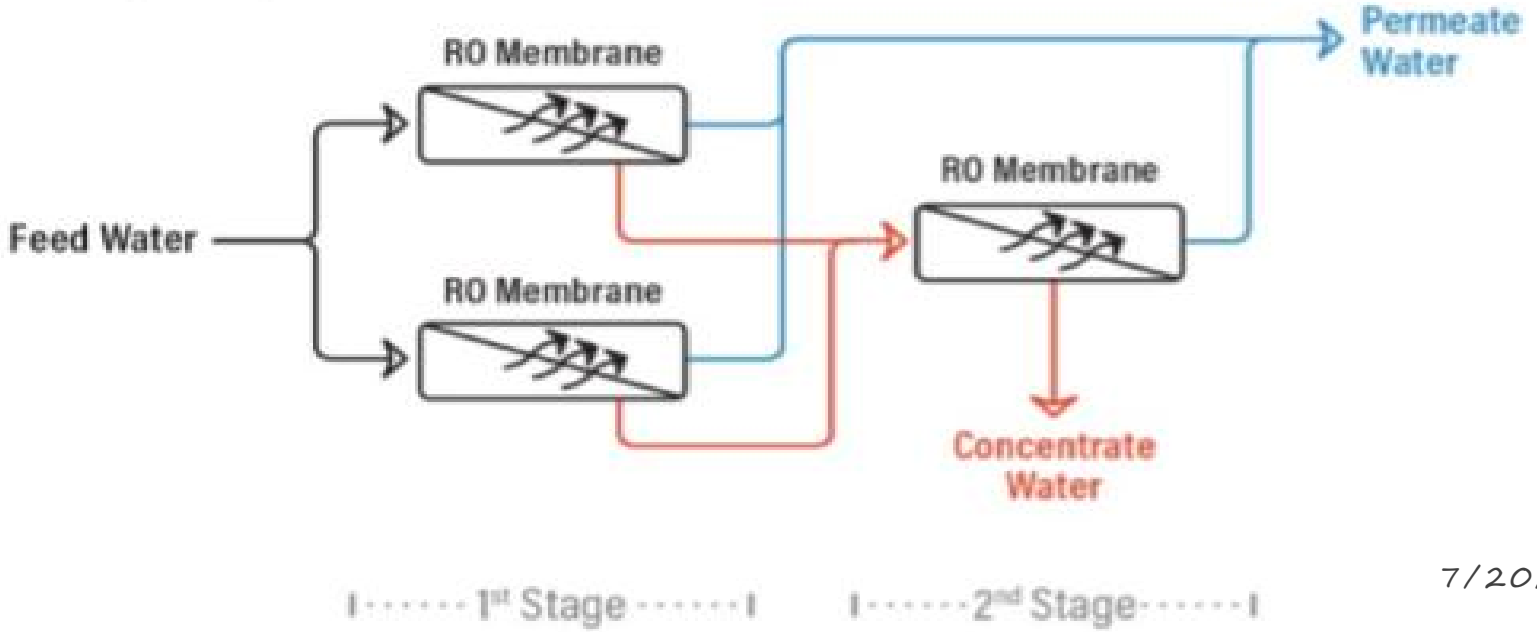
- Difference between a 1 and 2 stage RO System In a one stage RO system, the feed water enters the RO system as one stream and exits the RO as either concentrate or permeate water.

- In a two-stage system the concentrate (or reject) from the first stage then becomes the feed water to the second stage. The permeate water is collected from the first stage is combined with permeate water from the second stage. Additional stages increase the recovery from the system.

1 Stage RO System



2 Stage RO System

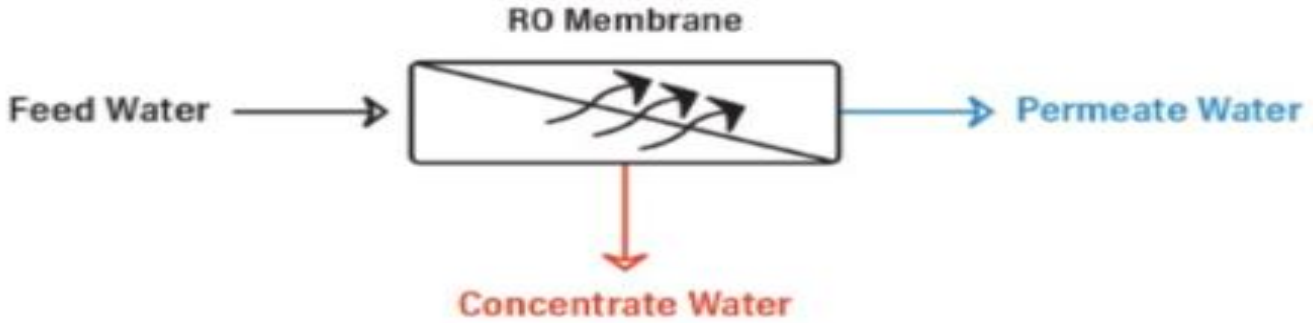


The difference between a single pass and a double pass RO system

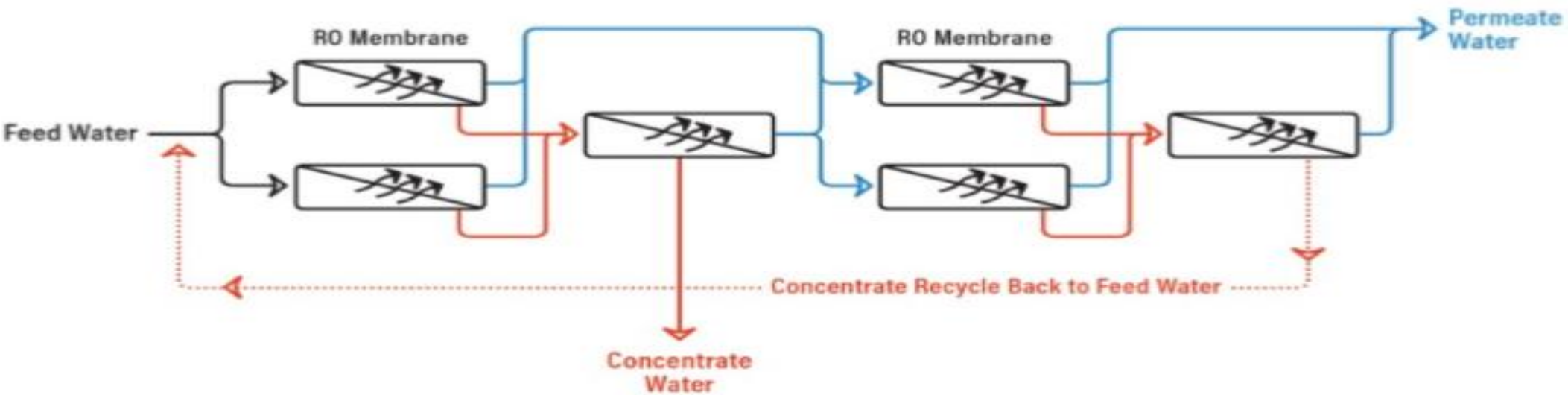
- The difference between a single pass RO system and a double pass RO system is that with a double pass RO, the permeate from the first pass (first RO) becomes the feed water to the second pass (or second RO) which ends up producing a much higher quality permeate because it has essentially gone through two RO systems.

- The double pass system also allows the opportunity to remove carbon dioxide gas from the permeate by injecting caustic between the first and second pass. C02 is undesirable when you have mixed bed ion exchange resin beds after the RO. By adding caustic after the first pass, you increase the pH of the first pass permeate water and convert C02 to bicarbonate (HCO-) and carbonate (CO-2) for better rejection by the RO membranes in the second pass.

Single Pass RO



Double Pass RO



أنواع الآبار المائية

تنقسم الآبار إلي آبار سطحيه , أو آبار عميقه , وآبار متعدده الطبقات

الآبار السطحيه

اعلي أول طبقه غير (Water table well)وهي التي يستمد منها الماء من طبقه حامله للمياه (منفذه (صماء) ,ويكون منسوب سطح المياه في حاله عدم تشغيل البئر مساويا لمنسوب سطح المياه الجوفي , ومساويا للضغط الجوي

الآبار العميقه

وهي التي تستمد منها المياه من طبقه حامله للمياه علي أعماق بعيده ومحصوره بين طبقتين عير منفذتين (صمائتين) ,وعاده ما تكون غنيه بالمياه .وتتميز الآبار العميقه بعدم التلوث مياهها من الناحيه البكتريولوجيه (الأمر الذي يحدث في الآبار السطحيه), وكذلك باندفاع الماء ذاتيا في بعضها دون الحاجه لاستخدم الطلمبات (الآبار الارتوازيه).

الآبار الارتوازيه

هي الآبار التي تتغذي من طبقه مساميه ,تكون المياه الجوفيه فيها تحت ضغط اعلي من الضغط الجوي ,فيرتفع سطح الماء في البئر إلي مستوي اعلي من الطبقات المحيطه بالبئر ,وهذه النوع من البار ينقسم إلي نوعين هما:

Following Artesian well أبار ارتوازيه متدفقة

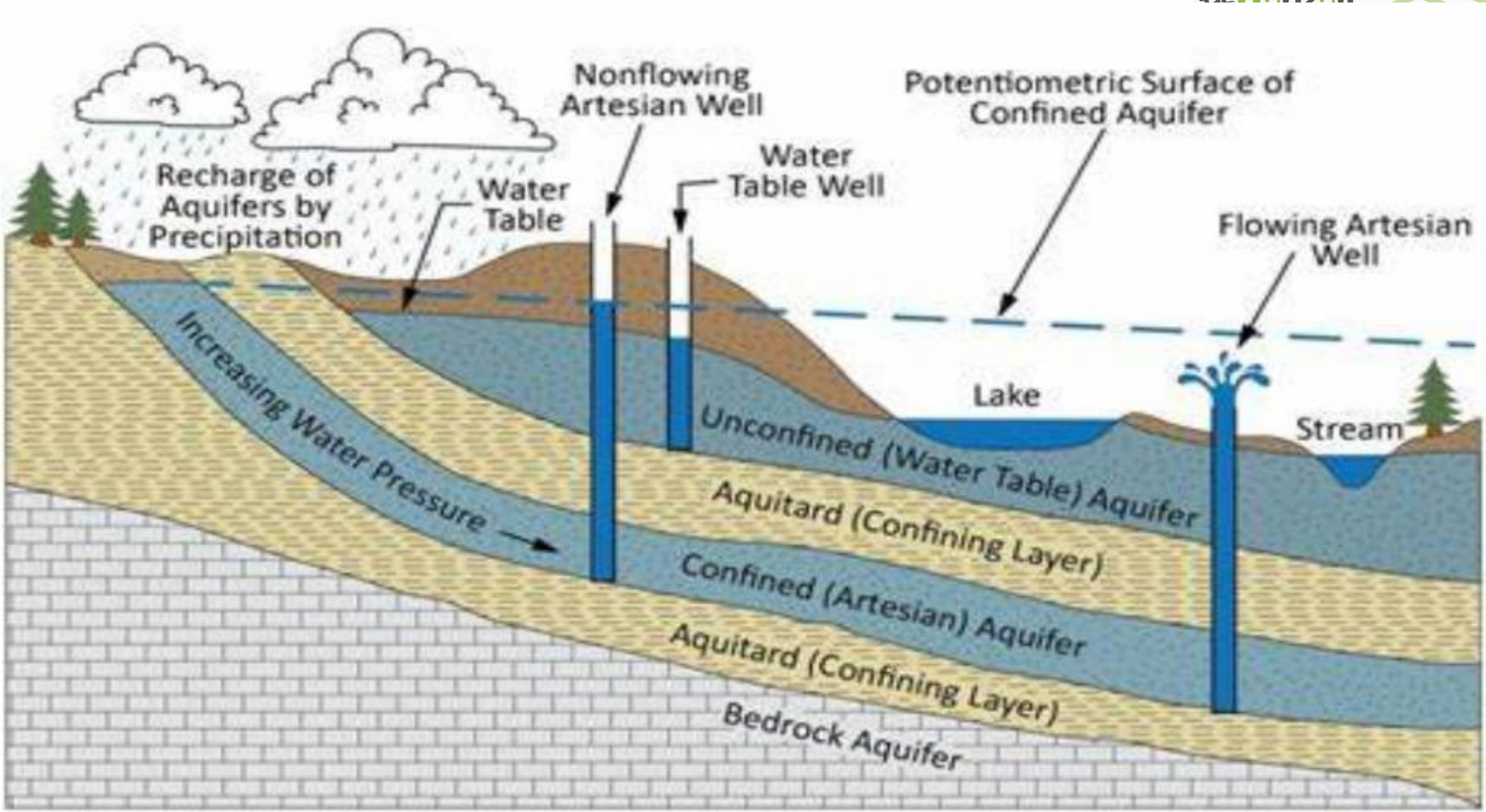
وهي الآبار التي تكون المياه فيها معرضه لضغط كاف يسبب ارتفاع الماء إلي فوهه البئر عند مستوي سطح الأرض أو اعلي الأمر الذي يغني عن استعمال طلمبات لسحب المياه من البئر

Non-following Artesian well آبار ارتوازيه غير متدفقه

وهي الآبار التي لا تتعرض المياه الجوفيه فيها لضغط كاف يسبب ارتفاع الماء إلي سطح الأرض ,بل يسبب ارتفاع الماء إلي منسوب اقل من سطح الأرض , الأمر الذي يستلزم معه استخدم الطلمبات لأستخراج المياه من البئر.

الآبار متعدده الطبقات

وهي الآبار التي تخترق عده طبقات حامله للمياه,مما يودي إلي زياده تصرف البئر ,وتحسين خواص المياه بسبب اختلاف نوعيه المياه في الطبقات الحامله المختلفه


Nonflowing Artesian Well
Potentiometric Surface of Confined Aquifer
Water Table Well
Recharge of Aquifers by Precipitation
Water Table
Flowing Artesian Well
Lake
Stream
Increasing Water Pressure
Unconfined (Water Table) Aquifer
Aquitard (Confining Layer)
Confined (Artesian) Aquifer
Aquitard (Confining Layer)
Bedrock Aquifer

Thank you