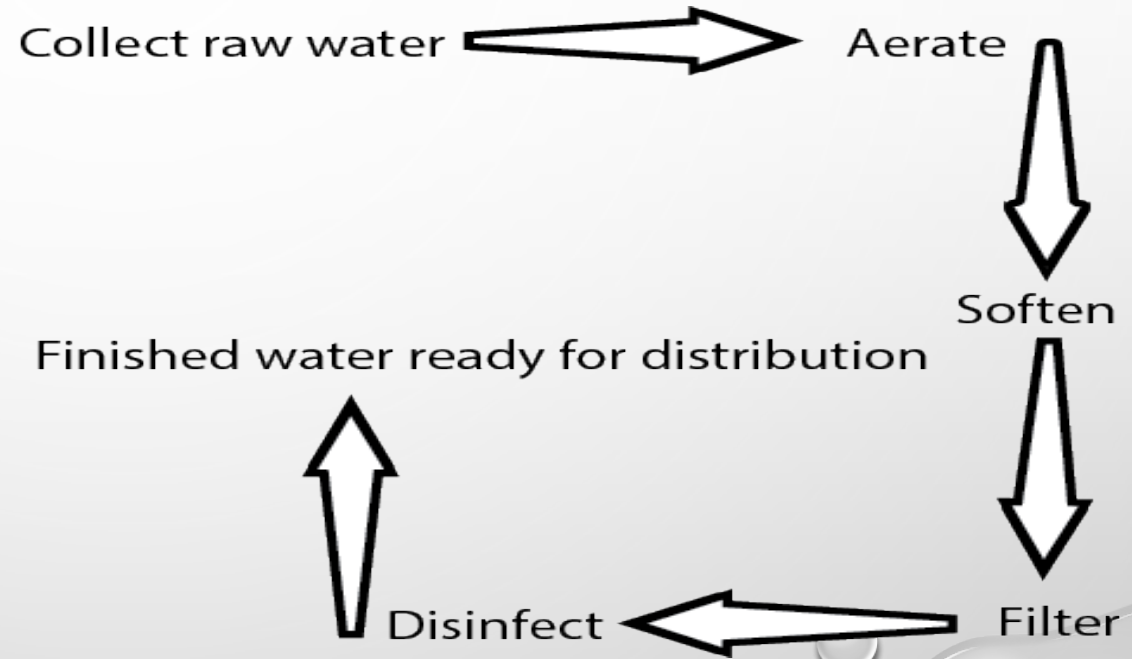


COLUMBIA WATER TREATMENT PLANT



The Treatment Evolution of Water



1ST GLASS RAW WATER, 2ND GLASS AERATOR EFFLUENT, 3RD GLASS PRIMARY EFFLUENT, 4TH GLASS SECONDARY EFFLUENT, 5TH GLASS FILTER INFLUENT, AND 6TH GLASS FINISHED WATER

OVERVIEW OF WATER TREATMENT PROCESS

- ✓ **Collection of raw groundwater**
- ✓ **Aeration**
- ✓ **Lime Softening**
- ✓ **Coagulation/Flocculation**
- ✓ **Sedimentation**
- ✓ **Filtration**
- ✓ **Disinfection**
- ✓ **Fluoridation**
- ✓ **Monitoring**
- ✓ **Finished water transportation**

STEP 1: COLLECTION OF RAW WATER

COLLECTION OF RAW GROUNDWATER – WATER FROM THE MCBAIN ALLUVIAL AQUIFER AND WELL FIELD IS COLLECTED AND PUMPED BACK TO THE TREATMENT PLANT AS RAW WATER

MCBAINE ALLUVIAL AQUIFER AND WELL FIELD



- 18 wells total
- First six wells built in 1972 and the last three added in 2018

INSIDE AND OUTSIDE OF WELL #18



- Each well brings in anywhere from 2 to 2.5 million gallons per day (MGD)

STEP 2: AERATION

AERATION – BY ADDING AIR, DISSOLVED GASES ARE REMOVED AND IRON IS OXIDIZED. THIS SIGNIFICANTLY REDUCES THAT AMOUNT OF LIME NECESSARY FOR THE SOFTENING PROCESS (SOFTENING IS THE REMOVAL OF CALCIUM AND MAGNESIUM IONS)

RAW WATER AND AERATOR INFLUENT/EFFLUENT LINES



- Transport water from the well field and to and from the aerators
- Some water from the raw line is collected and pumped up to the wet lab for testing once a shift

AERATORS



- Air is added and oxidizes iron
- Dissolved gases are removed
- Iron is oxidized but not yet removed, this gives sludge its orange-brown color.

STEP 3: SOFTENING

LIME SOFTENING IS THE REMOVAL OF CALCIUM AND MAGNESIUM IONS

– ADDITION OF LIME SLURRY TO SOFTEN WATER (REMOVAL OF PRIMARILY CALCIUM)

DRY LIME (CALCIUM OXIDE) IS DELIVERED AND STORED IN LIME SILOS

DRY LIME POWDER IS MIXED WITH WATER TO CREATE CALCIUM HYDROXIDE SLURRY IN SLAKER

SLURRY IS HELD IN SLURRY TANKS AND PUMPED THROUGH SLURRY PUMPS OUT TO PRIMARY SEDIMENTATION BASINS

COAGULATION/FLOCCULATION – SUSPENDED SOLIDS IN WATER COMBINE TOGETHER, CREATING SLUDGE

SEDIMENTATION – SLUDGE SETTLES TO THE BOTTOM OF BASINS AND IS REMOVED VIA BLOWOFFS TO LAGOONS TO SOLIDIFY

LIME SLAKER



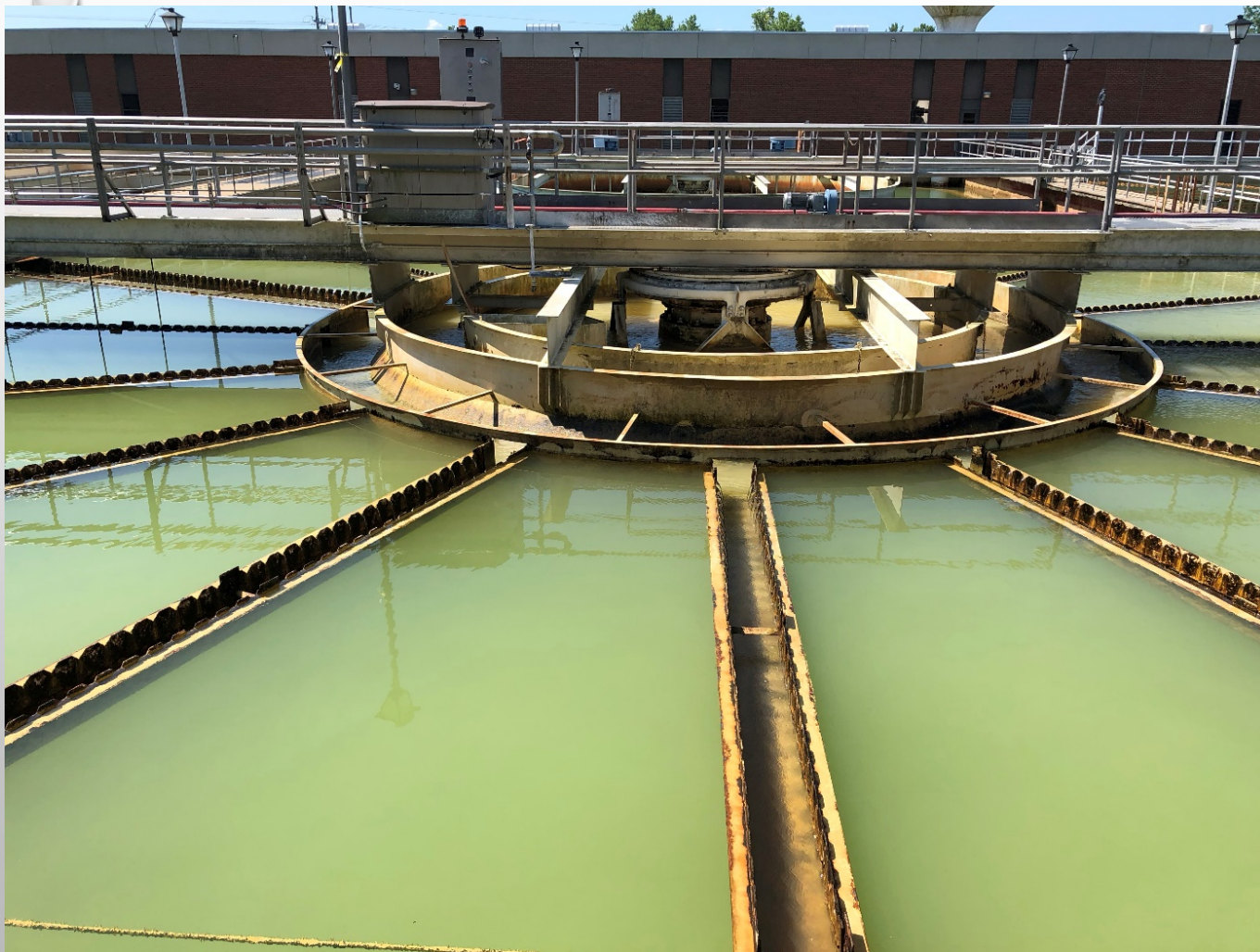
- Lime (calcium oxide) is mixed in a slaker with water to form calcium hydroxide.
- This liquid mixture is called slurry

SLURRY TANK



- Slurry from the Slaker is discharged in the Slurry Tank where it is further mixed
- Grit is removed and discharged into a separate container for proper removal
- When the tank becomes full, the batch is complete and the tank is emptied and pumped to the primary basins

PRIMARY BASINS



- Lime is added to remove hardness (primarily calcium)
- Water is softened from a hardness of around 300-350 ppm to 150-180 mg/L (ppm)
- Suspended solids combine together into bigger particles (flocculation) and settle to the bottom of the basin through gravity (sedimentation)
- The combination of particles at the bottom of the basin forms sludge

SLUDGE PIT: SLUDGE BLOWOFFS AND BASIN DRAINS



- Blowoffs pump sludge from the basin to lagoons to dry and solidify
- The blowoff line is backflushed often to prevent sludge buildup
- The basin can be drained for cleaning or maintenance by opening the drain valve

SLUDGE LAGOONS



- Dried sludge from the primary basins pumped out via blowoffs

PRIMARY TO SECONDARY BASINS



- As unwanted products settle to the bottom of the basin, the water at the top is the water we want to continue on through the process
- The water at the top overflows into the troughs (called weirs) all around the basin and flows to the center ring
- Water in the center ring is then diverted to an exit weir that sends the water to the secondary basin

SECONDARY BASINS



- The disinfection process starts here with the first dosage of chlorine being added prior to entering the secondary basin
- Additional particles can settle to the bottom of this basin
- Water is taken from the top and sent to the filter building for final chlorine and fluoride addition before filtration

STEP 4: FILTRATION

FILTRATION – WATER IS SENT THROUGH FILTERS TO REMOVE REMAINING SUSPENDED SOLIDS

FILTRATION



- Water is sent through filters to catch any remaining suspended particles
- The plant has a total of eight filters
- The filters are regularly backwashed with water from the wash tower located next to the filter building

STEP 5: DISINFECTION AND FLUORIDATION

DISINFECTION - GROUNDWATER SYSTEMS HAVE TO COMPLY WITH GROUNDWATER RULE (4-LOG OR 99.99% REMOVAL OF VIRUSES)

- FIRST DOSAGE OF CHLORINE IN SECONDARY BASINS
- SECOND DOSAGE OF CHLORINE BEFORE FILTRATION AND AMMONIA AFTER FILTRATION. CHLORINE AND AMMONIA COMBINE TO CREATE CHLORAMINE.

FLUORIDATION – ADDITION OF FLUORIDE TO THE WATER

MONITORING – TO STAY IN COMPLIANCE AND TO CATCH PROBLEMS QUICKLY

- WET LAB - HOURLY TESTING OF WATER QUALITY PARAMETERS (PH, HARDNESS, ETC.) AT SEVERAL SAMPLE POINTS (FINAL, PRIMARY EFF., ETC.)
- SCADA READINGS- HOURLY RECORDING OF WATER FLOWS TO AND FROM STATIONS, PRESSURES, AND LEVELS OF RESERVOIRS/TOWERS

DISINFECTION: CHLORINE



- Chlorine is delivered about every other week in one-ton cylinders
- The chlorine inside the cylinder is pressurized and is taken from the cylinder as a gas
- There can be up to eight cylinders on-line at a particular time
- The gas is fed into the feed room where the chlorine gas is injected into water in all secondary basins and before filtration
- The amount of chlorine gas taken and the distribution of it can be adjusted by operators

DISINFECTION: AMMONIA



- Liquid ammonia sulfate (LAS) is added to finished water to react with chlorine to create chloramine
- Chloramine tends to have a longer lasting residual and is a stronger disinfectant than free chlorine

FLUORIDATION



- Hydrofluorosilicic Acid is added to provide fluoride to drinking water which helps protect teeth
- Added to the water before filtration
- Target is 0.7 mg/L (ppm)

STEP 6: DISTRIBUTION OF FINISHED WATER

FINISHED WATER TRANSPORTATION – WATER SENT TO RESIDENTS AFTER TREATMENT

- STORED IN PUMP STATION RESERVOIRS (WEST ASH, SOUTH PUMP, HILLSDALE)
- PUMPED TO WATER TOWERS (WALNUT, SHEPARD, STEPHENS)

MAINS



- The main transport of water after it goes through the process
- The plant has two mains (Central and West)

HIGH-SERVICE PUMPS



- The plant has a total of eight pumps
- 300 horsepower electric motors
- Pumps finished water up to reservoirs at West Ash and South Pump Stations in Columbia