THE BOSSIER CITY WATER TREATMENT PLANT

(Background and Current Water Treatment Process Layout - 2021)

PLANT HISTORY

The Bossier City Water Treatment Plant was built in 1958. The original plant had a treatment capacity of 6 million gallons per day (MGD) and the water was pumped directly from the Red River before being treated. Plant expansions and treatment modifications were made over the years to keep up with increased drinking water demands required for Bossier City and the surrounding areas. Production capacity was increased in 1972 to 16 MGD and again in 1996 to 25 MGD. In the 1996 upgrade, new treatment techniques and technologies such as the addition of ozone and computer control systems were implemented in order to contend with the unique treatment challenges that resulted with newly adopted State and Federal Drinking Water Regulations.

The most recent production increase was completed in 2013 bringing the total production capability to 50 MGD. This addition included the implementation of low pressure membrane microfiltration system along with additional ozone injection technologies and granular activated carbon treatment processes in order to further improve the finished water quality. Water Treatment Plant personnel work 24/7, 365 days each year to maintain, protect, monitor, control and manage all related processes and systems, while meeting and/or exceeding compliance with stringent very water regulatory requirements.

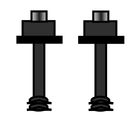
In addition, to save money through department-wide optimization, the City of Bossier decided to restructure management within the Public Utilities Department. On July 1, 2017, Bossier City and Manchac Consulting Group, Inc. (Manchac) formed a Public Private Partnership whereas the management and oversight of Bossier City's Utilities Department would be Manchac's responsibility. This mutual agreement includes for Manchac to provide planning, design, construction management, financial assistance, operational assistance, maintenance oversight, and all management of day-to-day activities associated with Bossier City's Public Utilities Department. This department includes the following five divisions: Wastewater Treatment, Drinking Water Treatment, Water Distribution Maintenance, Lift Station Maintenance and Sewer Pre-Treatment.

The Bossier City Water Treatment Plant has the versatility of having three independent treatment schemes that can be utilized together or separately. The processes that are placed in service are dependent on various environmental and other conditions ranging from source water quality changes that may impact treatment requirements to consumer water demand fluctuations that dictate the untreated and treated water flow requirements that are needed to keep up with these continually changing variables.

Below is a description of the different processes that make up entire water treatment system. Since two of the water plant's treatment schemes are similar and conventional by definition, they are summarized together in sequence. The third treatment scheme is the newest of the three and consequently it is much more advanced. Therefore, although the water from all three treatment plants combines together near the end of the treatment process, the layout of Plant 3 is also described in sequence, but done so separately. The process description for Plant 3 is summarized directly after the treatment process descriptions for Plant's 1 and 2.

Pre-Treatment

Raw Water Pumps

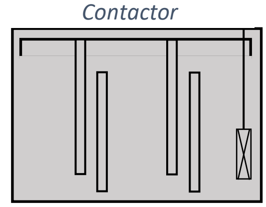


Large pumps bring “raw" or untreated water, from either the City's reservoir or directly from the Red River into the treatment plant through screens that exclude fish, weeds, branches and large pieces of debris.

CONVENTIONAL WATER TREATMENT PROCESS (Plants 1 & 2)

Ozone Disinfection

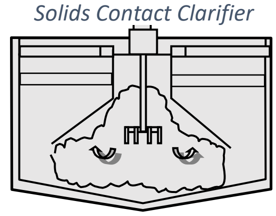
Raw Water Ozone Contactor



Ozone is a very powerful oxidant and disinfectant that must be generated onsite due to its unstable properties. The ozone generation system located in the Ozone Building supplies ozone to both the raw water and pre-filter ozone contactors at Plants 1 and 2 and to the pre-filter ozone contactors at Plant 3. Liquid oxygen is pumped into an ozone generator to make ozone. The raw water for Plants 1 and 2 is ozonated as it flows through two ozone contact chambers. Ozone is fed at this point to remove organic substances from the source water, to control taste and odor causing compounds in the raw water that is being pumped into the plant, to oxidize iron and manganese and to reduce color. Ozone is very effective in destroying most of the harmful bacteria in the water. Ozone treatment in the raw water also provides primary disinfection credit for the Water Plant. Next, the effluent from these contactors flows by gravity to the solids contact clarifiers located at Plants 1 and 2 and it is also fed to the pre-filter ozone contactors located at Plant 3.

Coagulation, Flocculation, and Solids Contact Clarifiers

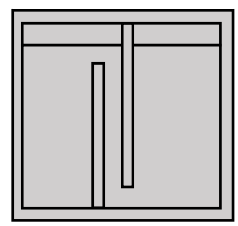
Solids Contact Clarifier



The flow then combines into a single pipe at the end of the ozone contactors. A coagulant chemical is fed into the water directly prior to these units. These solids contact units combine the coagulation, flocculation, and sedimentation processes into each unit. These units are also referred to as upflow clarifiers or sludge-blanket clarifiers. Within these units, the water flows in an upward direction through a sludge blanket of flocculated suspended solids. This coagulant chemical works to clear the water of the small particles that cause it to be turbid or cloudy, as turbidity renders the water hard to disinfect. The water is then rapidly agitated to disperse the coagulant chemical throughout these units. The smaller discrete particles begin to agglomerate into larger floc particles. In the flocculation process, the water is mixed gently so that these larger floc particles become heavy enough to settle out by gravity more rapidly away from the water that is being treated through these clarifiers. Approximately 85 to 90 percent of the suspended particles responsible for turbidity are removed at this point, including large amounts, but not all, of the bacteria present.

Pre-Filter Ozone Disinfection

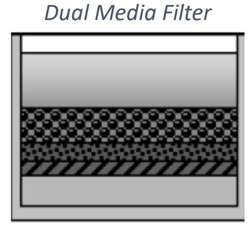
Pre-Filter Ozone Contactor



Ozone is once again fed into the ozone contactor located between the Plant 1 and Plant 2 filter complex by means of bubble diffusion. Ozone is fed at this juncture for further iron and manganese removal, to induce micro-flocculation of soluble organics and for additional color, taste and odor removal. Pre-Filter ozone disinfection helps enable the filters to remove the remaining organic matter, which is very important as the water nears final disinfection. Pre-Filter ozone disinfection also provides for partial Plant disinfection log inactivation credit by removing Giardia and Viruses that could possibly still be present in the water treatment process at this point.

Dual Media Filtration

Dual Media Filter

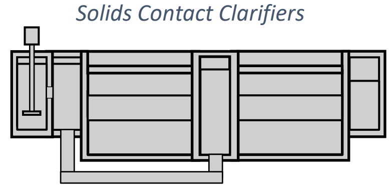


The water is then filtered through a multilayer medium composed of sand, anthracite coal, and garnet sand in order to remove up to 99.5 percent of the solid materials remaining in it, whether flocs, microbes, minerals or parasites. A small amount of a coagulant chemical filter aid is added at the point to improve filter performance. Filtration is the last stage in the treatment process that removes solids from the water. Filtered water is collected in a common underdrain system and conveyed through filtered water conduits under the pipe gallery floor and then into the finished water blending structure located directly prior to the clear wells.

ADVANCED WATER TREATMENT PROCESS (Plant 3)

Coagulation, Flocculation, and Solids Contact Sludge Blanket Clarifiers

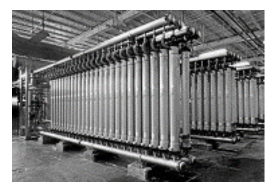
Solids Contact Clarifiers



The Bossier City Water Treatment Plant uses a relatively new process at Plant 3 that consists of concrete treatment basins called Super-Pulsator (Super P) Clarifiers designed to remove particles from the water. There are two independent treatment basins located within this unit. Each Super P basin can treat up to 12.5 million gallons of water a day. A coagulant chemical is fed directly prior to these clarifiers to clear water of the small particles that cause it to be turbid or cloudy. These smaller discrete particles known as floc, which include many categories of bacteria, begin to agglomerate into larger groups of floc, thus increasing their size to a point where they can settle more rapidly away from the water that is being treated through these clarifiers. The basins use a vacuum chamber for pulsing action as water flows upward, becoming clearer as larger particles settle. Pulsing prevents particles from settling completely, and over time these particles form a sludge blanket that helps filter the water as it flows upward through the units.

Membrane Filtration

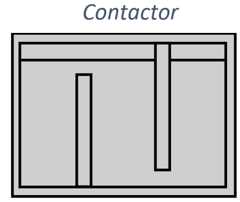
MF/UF Membrane Modules



The water then flows from the clarifiers into our membrane filtration system. Micro/Ultra-Filtration is used to remove particulate matter out of the water. In this process, the water is pumped through hollow micro fibers. The fiber walls are porous, letting water through while keeping particles behind. They act as a sieve; whereby larger material is left and cleansed. This process requires millions of micro fibers packed into more than 1,200 individual modules to be available to filter the water at maximum flow. These modules are located on twelve racks spread throughout the Membrane Building. All of these micro fibers are needed to accommodate flows of up to twenty-five million gallons per day.

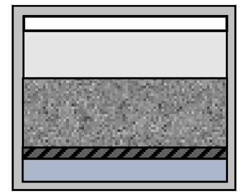
Post-Membrane Ozone Disinfection

Post-Membrane Ozone Contactor



Ozone is introduced into an ozone contactor by means of side-stream injection. It is fed into the water just prior to the Granular Activated Carbon (GAC) filters. Ozone is a strong oxidant that is very effective for the degradation of a wide range of organic chemicals. Post-Membrane ozone disinfection helps enable the filters to remove any remaining organic matter (important for final disinfection). Post-Membrane ozone disinfection also provides for partial Plant disinfection log inactivation credit by removing Giardia and Viruses that could possibly still be present in the water treatment process at this point.

Granular Activated Carbon Filtration



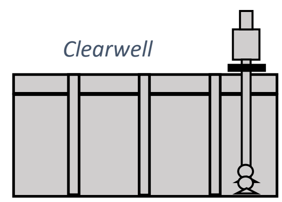
The water is then filtered through Granular Activated Carbon (GAC) filters. These GAC filters remove certain chemicals, particularly organic chemicals, from the water. They also aid in removing chemicals that project objectionable odors or tastes from the water. This step is the last one in the process that removes solids from the water. After filtration, this water combines with the treated water from Plants 1 and 2 inside the finished water blending structure.

THE FINAL STAGES IN THE PROCESS (Plants 1, 2 & 3)

Disinfection and Fluoridation

As mentioned previously, the water from all three treatment plants combines together within the finished water blending structure located just prior to the clearwells. At this point, chlorine and ammonia are injected to form chloramine. The ammonia combines with the chlorine to make its disinfection ability last longer. Chloramine is a very efficient disinfectant and is also used to meet current regulations. This disinfectant kills off disease-bearing organisms such as bacteria and viruses that are present in the water. Fluoride is then added within this structure for dental health prior to this treated water being pumped out to our customers. Fluoride helps prevent dental decay.

Clearwells



Lastly, the water gravity flows into three underground reservoirs located at the Water Treatment Plant. These finished water basins ensure contact time is allotted for adequate disinfection. They also store the water before it enters the Bossier City's distribution system. At this point in the process, large pumps pull from these clearwells and send clean, safe water to consumers throughout the community.

ADDITIONAL INFORMATION ABOUT OUR SYSTEM

Our constant goal is to provide our customers with a safe and dependable supply of drinking water, to always work toward improving the water treatment process and to protect our natural water resources while achieving these efforts. If you would like more information about our water, you can obtain additional data on the quality Bossier City's drinking water by typing http://www.bossiercity.org/files/bossierwater.pdf into any Web browser for direct access to Bossier City's latest Water Quality Report.

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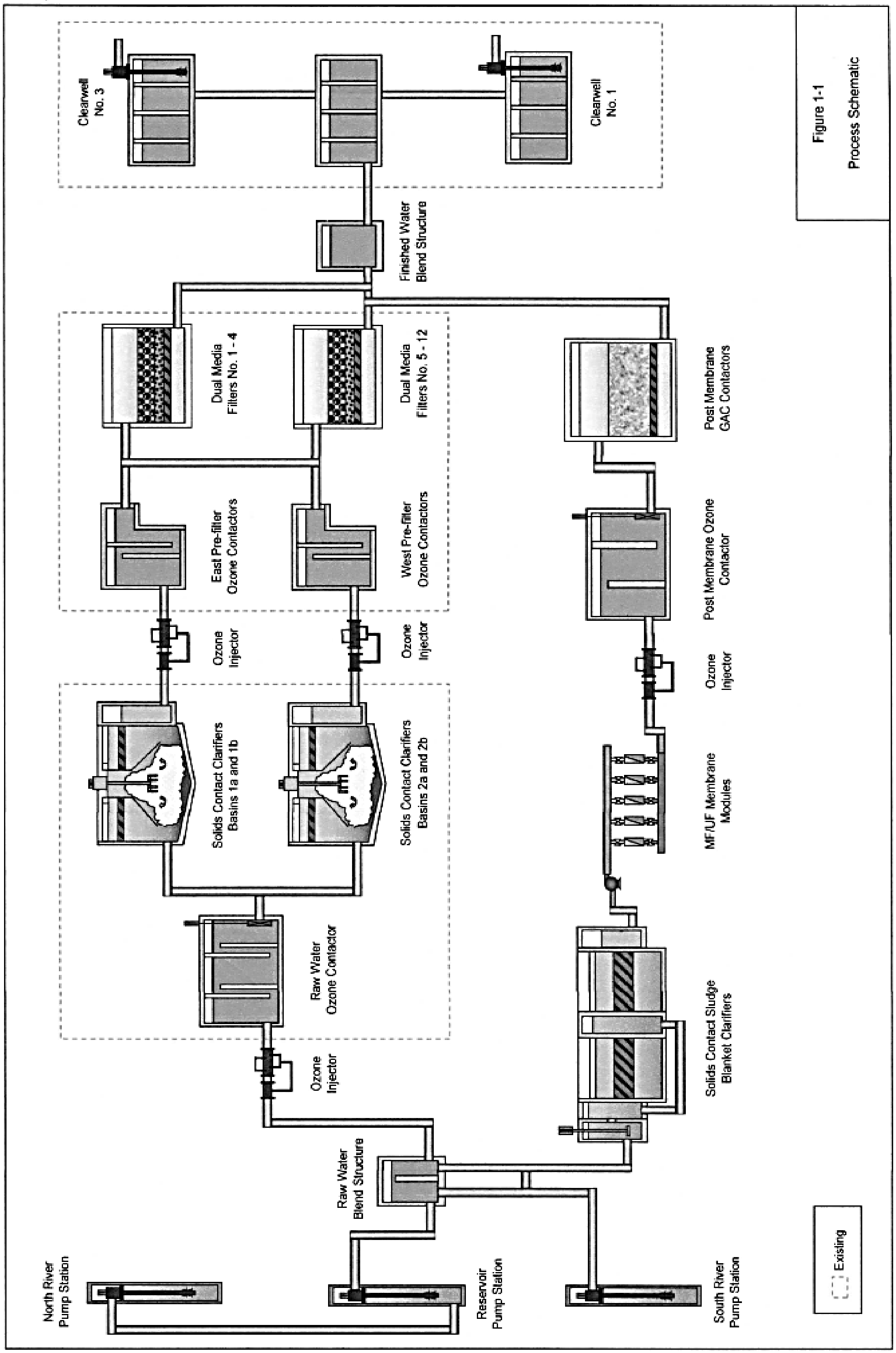

Figure 1-1
Process Schematic