City of Topeka
Utilities Department

A Tour of Topeka's Water Treatment Facility

The Topeka Water Treatment Facility uses various chemical and mechanical processes to transform raw water from the Kansas River into clean and safe drinking water. The first of these treatment processes is the elevation of raw river water into the treatment basins using water intake structures. The Topeka Water Treatment Facility has two (2) intake structures that contain six pumps each. All water intake pumps have rated daily capacities of five to ten million gallons each. A durable and heavyweight, small mesh traveling screen is positioned immediately ahead of the intake pumps to prevent entry of debris that may either damage mechanical equipment or impair chemical treatment processes.

Water intake structures located on the shores of the Kansas River. Picture shows elevated turbidity levels caused by recent rains.

At the Topeka Water Treatment Facility, there are many shapes and sizes of basins and each is designed to provide controlled contact and settling time for each specific chemical or mechanical process. Depending on their location in the treatment scheme, individual basin capacities range from thousands of gallons to nearly three million gallons. The basins in each of the three (3) treatment plants at the Topeka Water Treatment Facility are connected in series, with each adjoining basin slightly lower in elevation than the previous. This allows the water to continuously flow by gravity from the beginning of the treatment process to the end. The average detention time for an entire process cycle through each of the three (3) treatment plants is nearly 24 hours to flow from the intake to the treated water clearwell for pumpage into the distribution system for use.

Picture shows the West Plant (1954). The newest plant, the East-South Plant (1999), was constructed in parallel and identical design as the East-North Plant (1981).

The first chemical used in the water treatment process is a positively charged synthetic polymer. It is flash-mixed into the raw river water before it

flows into the first sedimentation basin. The polymer effectively attracts and enmeshes negatively charged turbidity particles in raw river water and causes them to settle. A large blow-down located at the center of the polymer sedimentation basin is activated at timed intervals to dispel settled and collected solids. This process reduces the amount of suspended material or turbidity significantly before flowing to the next treatment stage.

The partially processed water then flows by gravity to the disinfection contact basin. Chlorine is added at the disinfection contact basin to destroy any bacteria or viruses that may be present. Ammonia is subsequently added at a specified entry point after chlorine addition to form the secondary distribution disinfectant, chloramine. A series of baffles in the disinfection contact basin provide effective contact and reaction time to ensure that the destruction of pathogens is complete. The controlled application of chlorine and ammonia in the absence of sunlight reduces the level of disinfection by-products below regulatory Safe Drinking Water Act (SDWA) requirements. These small, covered and baffled treatment units are also designed to retrofit alternative treatment processes as regulations and concerns progress for various contaminants and alternative disinfectants, such as chlorine dioxide and ozone, are required.

The disinfected water then flows into the coagulation, flocculation and softening basins where lime and alum are added. Lime reacts with various dissolved minerals to form primarily two insoluble precipitates: calcium carbonate and magnesium hydroxide. Additionally, the softening process

An empty East Plant sedimentation basin shows large sweeps and blow-down structures used to collect and dispel settled solids.

Clarification basins have similar collection weirs, sweeps and blow-downs.

View of disinfection contact basin roof.

Interior partitions and baffles provide controlled chemical application.

enmeshes, coagulates and settles smaller remaining particles and dissolved organic substances. Alum is added to further aid and enhance coagulation. In the two (2) East Treatment Plants, previously reacted solids are recirculated in specialized solids contact basins to provide improved softening precipitation and efficiency of chemical application.

The water is then diverted to large primary clarification basins that allow additional detention time for gravity to settle out remaining precipitates and suspended materials. Large sweeps slowly rotate along the entire bottom of these basins to collect and move settled precipitates and turbidity to a central collection pit. Large blow-downs located at the center of the primary clarification basins are activated at timed intervals to dispel settled and collected solids to a residuals processing facility for further treatment and to concentrate the waste solids.

To efficiently repurpose the waste lime-solids residuals, the Topeka Water Utility makes the material available to contractors for the purpose of hauling and subsequent application on agricultural farm land. Contractors (hauler/spreaders) must provide proof of adequate liability insurance and enter into a contract with the City before they commence work. Contractors must also submit a certification that waste was applied according to the terms of the contract before payment is issued by the City.

After the partially treated water exits the primary clarification basin, carbon dioxide is bubbled in to stabilize and lower the pH of the softened water. Phosphate is also added to aid in stabilizing the water and to provide corrosion control. The water then flows into a second large clarification basin. This allows additional detention time for remaining

Center ring of an East Plant solids contact basin shows a mixture of lime and dissolved minerals coming out of solution.

Precipitated water hardness minerals are removed with blow-downs.

View of the previous basin shown when empty to illustrate solids contact structure and bottom solids collector arms.

suspensions and precipitates to settle. Center sweeps and blow-downs collect and remove additional settled solids which are then pumped for further processing and concentration of the waste solids at the residuals processing facility. After the water exits the secondary clarification basin, fluoride is added to supplement levels that occur naturally and to mitigate dental caries in children and adult customers.

Cleansing of the water through specialized filtration units completes the treatment process at the Topeka Water Treatment Facility. The small amounts of suspended fine particles that remain after secondary clarification are nearly all removed by processing the water through automated filtration units. The Topeka Water Treatment Facility has nearly 10,000 square feet of mixed layer filtration units containing approximately four feet of filtrating materials. Scheduled backwashing of each filter bed after it has accumulated large quantities of suspended, fine particles is accomplished by forcing clean water back up through the units until they are prepared for another operational cycle. To ensure the filtration process is optimized, turbidity meters continuously monitor finished water quality from each filter unit. The processed filtered water is stored in clearwell reservoirs located beneath the filters.

The Topeka Water Treatment Facility has nearly nine million gallons of underground reservoir storage and seven high service pumps with rated capacities ranging from five to fifteen million gallons a day each. These pumps transfer water from the underground clearwells into four large transmission lines that convey water from the treatment plant to a water distribution system that contains nearly 800 miles of water mains and nine storage towers.

The collection of water in weirs in the clarification basin after additional detention time has allowed more suspended particles to settle.

The picture shows West Plant filtration beds.

Filtration beds are regularly cleaned by backwashing with water stored in a 200,000 gallon on-site reservoir.

The City of Topeka Water Utility processes and pumps an average of 8.4 billion gallons of water every year or nearly 22 (MGD) million gallons of water every day to approximately 180,000 residents in Topeka, Shawnee County and 6 surrounding rural water districts. Water demand is seasonal, with the highest and lowest typical and respective average monthly pumpage occurring in summer and winter. The highest ever daily water demand for the City of Topeka Water Utility was set in 1987 at 55 MGD.

The original buildings at the Topeka Water Treatment Facility were constructed in 1923 with major expansions to update and increase capacity occurring in 1953 and 1979. For nearly 100 years, the Topeka Water Treatment Facility has been producing and distributing safe drinking water for the citizens of the city every day.

Large pumps are used to transfer water from underground reservoirs and into four arterial mains that are 2-4 feet in diameter.

The suction shafts on these pumps are as long as twenty-seven feet.