

CLAYTON GETS APPROVAL TO OPERATE NEW WATER TREATMENT FACILITY

Town of Clayton Background

The Town of Clayton is a State of Delaware municipality situated primarily within Kent County. One parcel located within New Castle County is planned for annexation into the Town within a year. The water system services approximately 2,200 persons in 1,000 households.



Source of Water

In Delaware, groundwater is the only source used by public water systems located south of the Chesapeake and Delaware Canal. Much of this water is taken from the unconfined Columbia aquifer, also referred to as the water table aquifer. However, in northern Kent County, the Columbia aquifer becomes shallow and provides insufficient capacity for municipal needs. Hence, Clayton's public water supply is drawn from the deeper, confined Rancocas Aquifer. The water is generally of good quality, having a pH of about 7.5, moderate hardness, acceptable iron concentration, virtually no nitrates and a fluoride level of about 0.8 milligrams per liter (mg/L). Naturally-occurring arsenic is present at concentrations ranging from 5 to 13 micrograms per liter ($\mu\text{g/L}$), or parts per billion (ppb).

The Town of Clayton operates three (3) wells. Well No. 1 is screened from 235 to 272 feet below grade and produces approximately 300 gallons per minute (GPM). Well No. 2 is screened from 237 to 320 feet below grade and produces approximately 185-200 GPM. Well No. 3 is screened from 230 to 270 feet below grade and produces approximately 105 GPM.

Disinfection by injecting sodium hypochlorite solution at each well head was the only form of treatment provided prior to the project discussed herein.

Change to SWDA

In 2002, the United States Environmental Protection Agency (EPA) drinking water standard for arsenic was lowered from a 50 parts per billion maximum contaminant level (MCL) to 10 parts per billion. Public water systems were required to comply with this new standard by January 23, 2006. Clayton's average arsenic concentrations are 13 ppb in Well No.1, 10 ppb in Well No. 2, and 5 ppb in Well No. 3. Although significantly lower than the previous standard, the water from Wells 1 and 2 exceeds the new MCL, making treatment necessary.

Meeting the Challenge

The Town of Clayton hired CABA Associates, Inc., to evaluate the conditions and design a system to reduce the arsenic level to meet regulatory requirements.

Responding to the Town's request, CABA evaluated eight commercially-available arsenic removal technologies including oxidation/filtration, ion exchange, activated alumina, granular ferric hydroxide, reverse osmosis, coagulation-assisted microfiltration, enhanced-coagulation filtration and enhanced lime softening. Based on suitability for the groundwater characteristics, arsenic removal efficiency, capital and operating costs and operational complexity, granular ferric hydroxide (GFH) was recommended as the preferred mode for the Town of Clayton.

As its name suggests, this process uses a granular ferric hydroxide compound that removes arsenic from water by the process of adsorption. Water is pumped from the ground, through one or more pressure vessels containing the GFH media, disinfected and into the distribution system. No sand filters, sludge handling, clear wells or re-pumping of treated water are required. The media is back-washed occasionally to remove particulate build-up that impedes the flow. When it has reached the end of its useful life, the media must be replaced. Spent media has been found to meet the disposal requirements of most non-toxic solid waste landfills.

As a part of the evaluation, a capacity analysis was conducted on Wells 1, 2, and 3. It was concluded that these wells have sufficient capacity to meet Clayton's supply needs up to a population of about 3,100, at least 15 years in the future.

Due to the distance between Wells No. 1 and 2, a single water treatment facility for both wells was deemed impractical. However, the economies of scale made one larger treatment plant far more cost-effective to build and operate than two smaller ones. Considering the economics of treatment and the uncertain long-term reliability of Well No. 1, the following approach was recommended:

- § Construct an arsenic removal facility at the Well No. 2 site
- § Construct a new well (Well No. 4) near the Well No. 2 site.
- § Remove arsenic from Well No. 2 and new Well No. 4 water.
- § Continue to use Well No. 3 without arsenic removal.
- § Relegate Well No.1 to stand-by, emergency-only status.

Plant Design

The recommended treatment plant was designed for a capacity of 650 gallons per minute, with the operational flexibility to treat water from Well No. 2 only, Well No. 4 only, or both wells simultaneously. The major items of equipment included three 90-inch diameter by 6-foot sidewall height pressure tanks containing GFH media, a disinfection system similar to the ones currently in use, associated piping, valves, automatic controls and an emergency generator. All treatment equipment was located inside a concrete masonry unit (CMU) building for freeze protection and security. The generator and fuel storage tank was located outside the building in a weather-resistant enclosure.





The design included provisions for blending of raw well water with treated water by use of a blending valve with flow control to allow The Town of Clayton flexibility during operation to achieve the desired results. Blending will also increase the longevity of the GFH media, which will reduce annual operation and maintenance (O&M) costs.

Well No. 3 improvements designed included:

- § Emergency generator
- § New well pump controls with remote alarm capabilities
- § Security fencing
- § Repair corroded discharge piping.

Construction, Testing and Start-up

Construction of the new water treatment plant for the Town of Clayton, Delaware began on June 24, 2007 with substantial construction completed in February 2008, by contractor Dan Banks Company, Inc. With the authorization of the Delaware Department of Public Health Office of Drinking Water, a testing and start-up sequence was established where small amounts of water were allowed to enter the distribution system. This was unavoidable in order to take samples and successfully test the plant system in all of its operational modes. Until the plant could be demonstrated to operate successfully, flow bypassed the plant and discharged directly to the distribution system. The flow path remained in the bypass mode until authorization was received from the Office of Drinking Water to begin operating the plant.

During equipment checkout the preliminary laboratory test taken by the contractor, Dan Banks Company, Inc., yielded a result of 5 ppb for arsenic when ground water was pumped through the filters. With this information, the plant was then scheduled for testing. The laboratory test results taken during plant testing by The Department of Public Health, Office of Drinking Water revealed the arsenic level to be at 3 ppb. On February 20, 2008, The Delaware Department of Health, Office of Drinking Water issued a *Certificate to Operate* to the Town of Clayton for its new treatment facility. Further testing by the Office of Drinking Water in late May 2008 resulted in a treated water arsenic concentration of 2.4 ppb proving the effectiveness of the GFH water treatment system.