

Executive Summary

Current System Reliability

The following report outlines the results of a study regarding the reliability of the City of Sturgis water system and related infrastructure. Sturgis is a medium-sized community in St. Joseph County with a population of approximately 11,000. The water system is multi-faceted with its sophisticated production, treatment, and distribution components.

The City's water system is very reliable overall. From the City's webpage:

"The constant goal of City of Sturgis water system is to provide our customers with a safe and dependable supply of drinking water. Prior to reaching your home, the City treats water at the well site with Chlorine to prevent bacterial growth in the water supply, Fluoride to help prevent tooth decay, and Polyphosphate Polymer to minimize "red water" and to control corrosion in the water supply system."

Water Distribution System

The City's water distribution system is a network of pipes that dispense water from the water source to customers' residences and businesses. The system was analyzed to determine its ability to meet present and expected future water requirements through year 2036. The analysis was performed using hydraulic modeling software (WaterCAD by *Bentley Systems, Inc.*), a computer program having the capability to model water distribution systems with elevated water storage. A previous model was updated in the process, allowing modifications to be made regarding water mains that have been added or upgraded in the duration.

The model is first calibrated against field results, and subsequently utilized to analyze multiple "what-if" scenarios. This is the true benefit of the software as "worse case" scenarios can be analyzed in the computer realm rather than be visualized in the physical realm (i.e. large fire event).

The results of the hydraulic analysis indicated that the present system is quite capable of supplying all water customers with "adequate" pressure ranging from 40 psi to 80 psi. Fire flow volumes are also ample enough to meet fire protection needs for the community at this time and into the future. Enhancements identified by the model to upsize small diameter water mains and to upgrade those with marginal fire flows are recommended to meet existing and future flow and pressure needs for the water system.

Water Supply

Water for the City's domestic and fire needs is pumped from wells that extend into the groundwater aquifer. The City is supplied water from four wells at three separate locations and has more than ample water resources to accommodate service during emergency shortages.

The Michigan Department of Environmental Quality (MDEQ) requires that a water supply system be able to operate with its largest production well out of service. The largest well is the Oaklawn well with a rated capacity of 1,800 GPM. The City maintains three additional wells with a total combined rated capacity of 4,400 GPM, well above what the system needs to meet its demands for water.

The hydraulic analysis indicates that the existing wells are adequate to meet present maximum-hour, future maximum-day, and future maximum-hour conditions in order to meet the specified demands and periodically refill the elevated tank. Sturgis has sufficient well capacity to meet current and future demand requirements.

The pumps at each of the four wells are rated at between 1400 and 1800 gpm capacity. They pump water to the distribution system and to fill the elevated storage tank.

The Thurston Well #7 has a permanent electric generator that runs off of natural gas for standby power. The generator allows the City to provide a continuous supply of finished water during an electrical service interruption. The City owned electric generator plant serves all four wells and provides auxiliary power to the wastewater treatment facility and hospital through one of the diesel engines there.

Water Storage

The Recommended Standards for Water Works (Ten States Standards) indicates that communities should provide a volume of treated water storage equal to the average-day demands of the community. If possible, the storage should be elevated storage.

Sturgis presently has a 1.5 million gallon (MG) elevated storage tank in the distribution system. This elevated storage volume provides approximately 1.5 day's storage based on the **City's present average-day demand of ± 1.1 MGD**. This report has also analyzed the adequacy of the storage regarding pressures and fire flows.

Water Treatment

The City of Sturgis provides limited water treatment to the community from its groundwater system. At present raw water from its four wells is treated using chlorine for disinfection, fluoride for dental health, and polyphosphates for iron sequestration. Chlorine gas is used at the Lakeview, Oaklawn, and one of the Thurston wells. The other Thurston well uses liquid hypochlorite for chemical disinfection.

Primary Recommendations

The City has as an effective water supply and distribution system that has provided reliable service to its customers since the 1890's. Due to the ground elevations, the northern area has lower pressures than other areas of the system. The higher ground in the northern area leads to lower static pressures in that region. For example the northern region has ground elevations at elev. ± 955 , whereas the southern region has ground elevations at \pm elev. 865. This $\pm 90'$ elevation difference can equate to as much as a ± 40 psi differential, which is difficult for a single pressure zone system to overcome as far as operating parameters.

However this elevation difference has not been problematic to the City as the majority of the City is relatively flat, and has pressures in the 60 to 70 psi range. If development were to occur further to the north, the City would need to address potential pressures getting down to 40 psi or lower. Also high pressures in the southern region can be addressed in the future through pressure reducing valves, if needed.

The City may expand to the north of town or southward towards Indiana. In either case there is ample storage and well supply. The City should plan for a future wellfield, in case of a major development.

There are many 4" water mains which can provide typical average daily demand, but are not capable of providing a minimum of 500 gpm through hydrants. The City has been actively replacing these lines via the City's street reconstruction program and plans to continue eliminating dead-end mains in a phased manner.