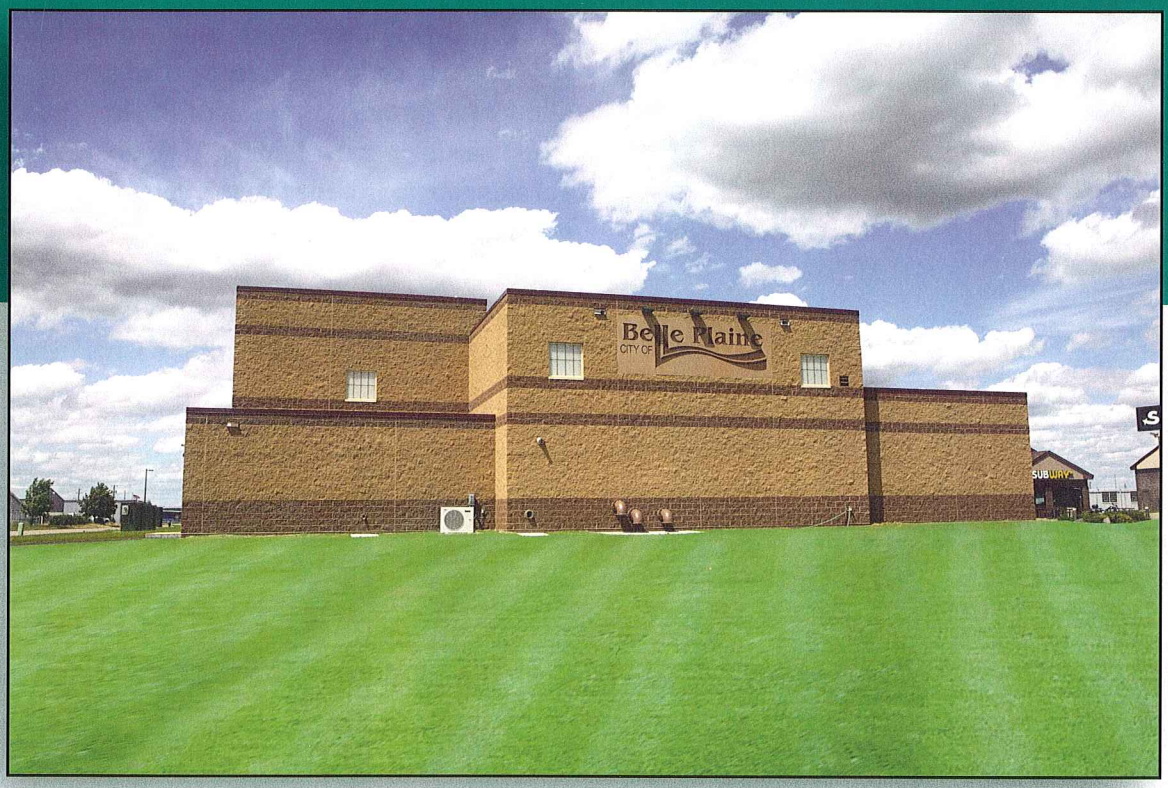
Municipal Water Treatment Facility

Belle Plaine, Minnesota



BOLTON & MENK
Engineers & Surveyors

Belle Plaine
CITY OF

BACKGROUND

The City of Belle Plaine engaged the services of Bolton & Menk, Inc. to study and design a new water treatment facility to meet existing needs, accommodate future growth, and meet drinking water quality standards to provide a safe drinking water supply to the residents of Belle Plaine.

The treatment facility has been designed to remove iron and manganese from the raw water as well as chlorinate and fluoridate the water to enhance public health. Future advanced treatment can be accomplished by adding reverse osmosis membrane filters to the facility.

The purpose of this handout is to provide information about the Belle Plaine Water Treatment Facility. A flow diagram of the facility can be found on the back page.

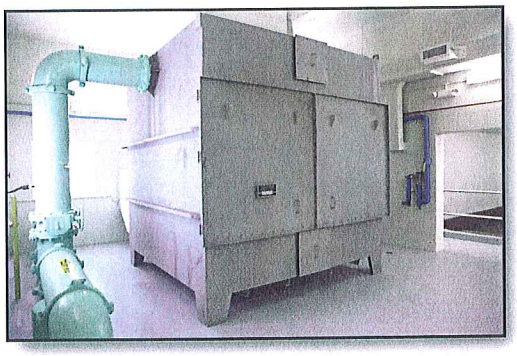
Description & Process

The Belle Plaine Water Treatment Facility has a design capacity of 2,300 gallons per minute. The first step in the water treatment process is aeration. The purpose of aeration is to begin the oxidation of iron and manganese to an insoluble form so they can be filtered from the water (form rust particles). The water is pumped from the municipal wells to the top of the aerator. The aerator is comprised of numerous pipes through which the water flows over. A fan blows air through the aerator to further aid in the oxidation process.

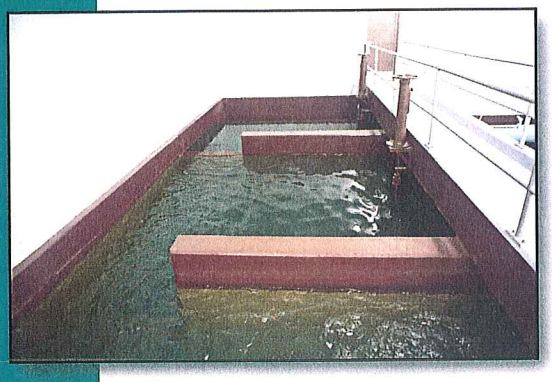
From the aerator, the water flows by gravity into an 89,700-gallon detention tank, which holds the water for approximately 40 minutes. The detention tank allows for further oxidation of the iron and manganese (Rust particles grow larger). The chemical potassium permanganate is added to the detention tank to assist in the oxidation of manganese.

After the detention tank, the water flows by gravity into four 16' x 14' filter basins. Each filter

Filter Basins

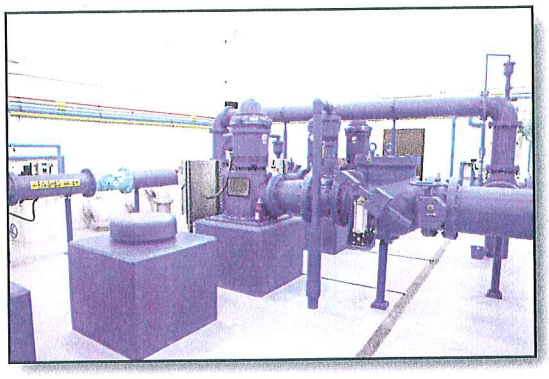


Aerator



Detention Tank

basin has an underdrain system, reverse graded gravel and dual filter media. The underdrain system is constructed of a series of blocks, approximately 11" wide by 12" high by 48" long, made of plastic. The blocks are arranged end-to-end and mechanically joined to form continuous underdrain laterals for the full length of the filter. The reverse-graded gravel is a series of layers of progressively smaller gravel placed on top of the underdrain blocks designed to retain filter media. The filter media itself is composed of 15 inches of anthracite and 15 inches of manganese green sand. The anthracite and green sand filter out the iron and manganese, which were oxidized to form small rust particles in the previous stages.



High Service Pumps

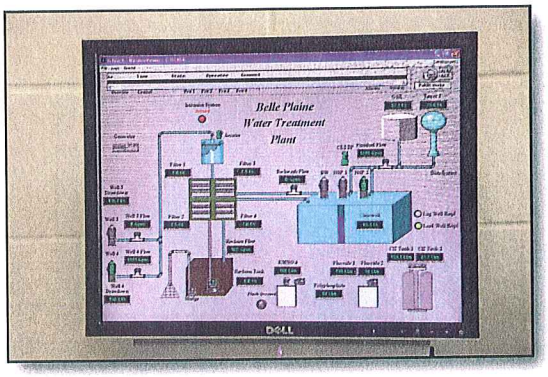
The material that is trapped by the filter beds is removed from the filters by a process called backwashing. Backwashing is accomplished by means of reversing the flow of water through the filter. This process is further enhanced by blowing compressed air up through the underdrain blocks, causing the media to scour itself. This maximizes the cleaning of the filter bed media prior to returning it to service. The backwash water flows to the reclaim tank. The backwash reclaim tank is located underground, just north of the treatment plant, and has a total capacity of 102,000 gallons. The backwash water is held in the tank to allow particles to settle out. The clear water is returned to the beginning of the process and the settled solids are pumped to the sanitary sewer system for treatment at the wastewater treatment facility.

Fluoridation Equipment

The filtered water then flows into a 263,000-gallon clearwell holding tank. Two 125 H.P. high service pumps pump the water out of the clearwell into the distribution system and water tower. After the pumps, the water is enhanced to provide a disinfecting residual (chlorine) and fluoridated for public dental health. Polyphosphate is also added to decrease the corrosiveness to piping. The facility has been constructed with additional space to add reverse osmosis membrane filters to further treat the drinking water in the future.

Laboratory

The operation of the wells, treatment plant and high service pumps are automatically controlled by an Allen Bradley Programmable Logic Controller (PLC) and a Supervisory Control And Data Acquisition (SCADA) computer. The PLC coupled with the SCADA system enables the operators to run the treatment plant directly from the control room. All alarm conditions are printed out in the control room and any critical alarms are sent out to the duty operator by an automatic telephone dialer.



SCADA Computer

DESIGN SUMMARY

DESIGN LIFE

20 years

NEW PLANT CAPACITY

2300 gallons per minute or approximately 3,000,000 gallons per day

CONSTRUCTION COST

$4.85 million

2007
Belle Plaine
Water Treatment Facility

City Officials
Tom Meger: Mayor
Jim Lange: Councilor
Tim Lies: Councilor
Peter Anderly: Councilor
Tim O'Laughlin: Councilor
Dawn Underferth: Councilor
Gary Trost: Past Councilor
David Murphy: City Administrator
Al Fahey: Public Works Superintendent

Engineer
Bolton & Menk, Inc.
Consulting Engineers
Mankato, Minnesota

General Contractor
ABE Construction Company
Golden Valley, MN

Process Flow Diagram