Saint Peter

Municipal Wastewater Treatment Facility

City of Saint Peter

Where History & Progress Meet

Welcome to the Saint Peter Municipal Wastewater Treatment Facility. This project is the result of 10 years of planning, design and construction. By utilizing advanced technology, with careful attention to detail, this facility will provide effective treatment of wastewater for the Saint Peter area for decades to come. Its completion and operation demonstrate the commitment of Saint Peter and its citizens to the preservation of Minnesota's resources, protecting the environment for future generations.

BACKGROUND

The City of Saint Peter's original wastewater treatment facility was built in 1961. The 202 acres of stabilization ponds are located in the Minnesota River floodplain, and have flooded several times. Expansion of the existing facility was considered unfeasible, both economically and environmentally, due to its location.

The planning process for the new wastewater treatment facility began in February 1994. During the planning process, the primary focus was on producing a long-term, cost-effective solution to treating the city's wastewater. In the end, the city selected an advanced technology process, which was first developed in Europe. Bids were let in September 2000, and the contract was awarded to Robert L. Carr Co. The new wastewater treatment facility began discharging treated effluent to the Minnesota River in February 2004. The plant is designed to accommodate community growth through the year 2020 and has room for future expansion.

The total funding for the wastewater facility and additional infrastructure improvements was $31,774,092. Thirty-three percent was funded by grants ($10,500,000) and the other 67 percent was funded by loans and the City of Saint Peter.

PRELIMINARY TREATMENT

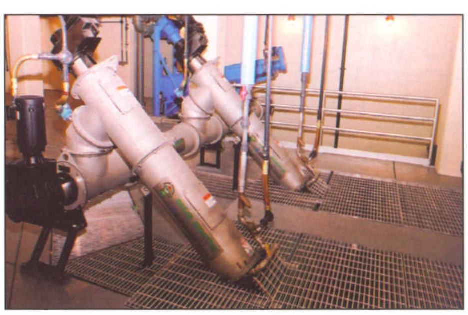
During preliminary treatment, material such as large solids, rags and abrasive grit are removed from the wastewater stream, utilizing screening and grit removal processes.

The system first grinds any material present in the incoming waste stream. This helps to separate organic material from inorganic material. The material is screened through a drum screener, which removes inorganic material larger than one quarter inch while allowing the smaller material and organic material to continue through the treatment process. The screened material is removed from the waste stream using an auger system which also washes and dewaters it prior to discharge into a waste dumpster. Screened inorganic waste material is then disposed of at a sanitary landfill.

Grit, consisting of sand and soil particles, is removed using a vortex grit removal system. The spiral flow pattern induced by the mechanical vortex chamber lifts lighter organic material while settling heavy grit to the bottom of the chamber. Grit is removed from the chamber using a grit pump, and is then washed and dewatered using a hydrocyclone. The dewatered grit is then discharged to a waste dumpster and taken to a landfill.

PRIMARY TREATMENT

The main objective of the primary treatment stage is to separate solids from the influent wastewater stream. Wastewater is pretreated with ferric chloride and polymer, using rapid mix and flocculation basins. The wastewater is then routed to the parallel plate clarifiers. Parallel plate clarifiers utilize plates installed at a 60° angle to increase the settling surface area. This decreases the necessary footprint of the clarifiers as much as 90% over conventional clarifier processes. Biosolids settled in the clarifiers are removed and are routed via positive displacement pumps to the biosolids treatment system. This system also provides for excellent removal of phosphorous from the waste stream.

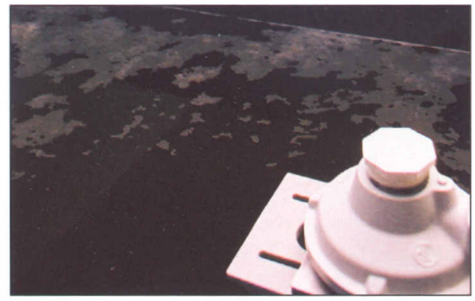


Grinder screens separate organic and inorganic materials.

Pretreatment in a rapid mix basin helps particles settle more readily.

Plate clarifiers set at an angle save space, as much as 90%.

Wastewater is pumped to the filters.



Biological Aerated Filters convert the organic material to biomass.

SECONDARY TREATMENT

In the secondary treatment process, wastewater is pumped from the clarifier effluent to a feed channel above six Biological Aerated Filters (BAF). In this feed channel, flow is routed to each filter for treatment. These filters employ media made of polystyrene beads to provide a surface for attachment of a biofilm. This biofilm is the biological system, which converts the organic material to biomass, thus achieving treatment of the wastewater. Each filter has an aeration grid, filled with 10 feet of polystyrene bead media.

Growth of biomass and the retention of suspended solids in the filter media make periodic backwashing necessary. The backwash phases are fully automatic and are triggered either when an adjustable time limit set by the operator has expired or when the pressure differential (head loss) across the filter exceeds a predetermined set point. Treated water from the filter flows to a common reservoir. During backwash periods, water is supplied from this reservoir to the top of the backwashing filters. Water flows downward through the filter, thereby expanding the media. Air is pumped into the filter through an air grid location below the media. Air is utilized to scour the media beads during the backwash sequence. Water used in the backwash is pumped back to the primary treatment process, where filtered solids are separated from the flow and routed to the biosolids treatment process.

DISINFECTION

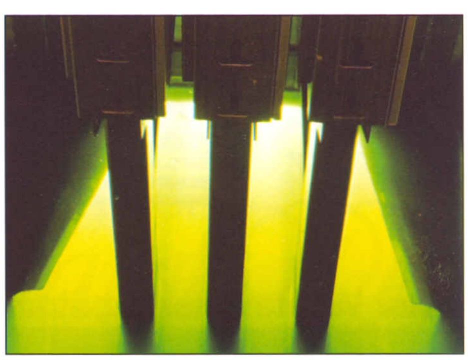
The disinfection process occurs just prior to discharge into the Minnesota River. Wastewater is disinfected at the treatment plant to reduce the pathogens, which pose health concerns to humans and the environment.

The Saint Peter facility uses ultraviolet light (UV) disinfection. Ultraviolet light bulbs are submerged in the effluent wastewater flow, where the pathogen organisms are exposed to the UV light. This light kills these organisms, meeting environmental standards for pathogen reduction.

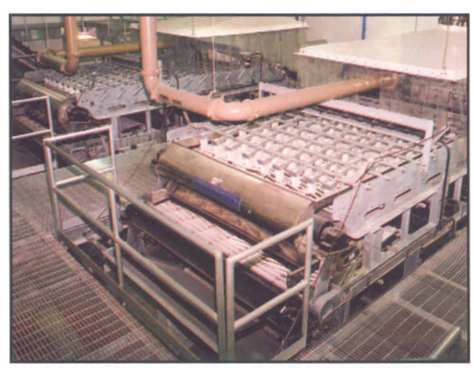
BIOSOLIDS TREATMENT AND DISPOSAL

Biosolids are a combination of materials present in the wastewater stream as it enters the facility and the biological growth generated by the secondary treatment process. Biosolids contain nutrients, which can be beneficially recycled as soil additives. Biosolids also contain pathogens, which need to be controlled for public health reasons. In order to treat pathogens and prepare the biosolids for future use, biosolids are pasteurized using a combination of lime and heat.

Biosolids are first pumped in liquid form, at two percent solid, from the clarifiers to a sludge storage tank, which allows for scheduling of biosolids treatment on a batch type basis for efficiency. Biosolids are then pumped to the belt filter presses. These presses squeeze the water from the liquid biosolids, producing a biosolids "cake" that is 25 to 30 percent solid material. This biosolids cake drops from the belt filter press onto a conveyor, which transports it to a lime-heat system. There, lime is added and heat is applied to raise the temperature to 150° Fahrenheit. This temperature is maintained for a minimum of 30 minutes. The cake is then dropped onto another conveyor, which transports it to a finished biosolids storage bunker. This bunker holds up to 180 days worth of biosolids production. The bulk cake product is a 40-45 percent dry solid and is now ready to be transported to agricultural land, where it is applied as a nitrogen and lime rich soil additive.



Ultraviolet light disinfects the wastewater.



Presses remove water from biosolids during the biosolids treatment process.

Odor Control Unit.

CONTROLS AND SUPPORT FACILITIES

Control of the wastewater treatment facility is provided by a computer-based system, which provides control and monitoring of all equipment. The monitoring system includes graphic displays, alarm conditions and logs, as well as historical data trending and displays.

All equipment and processes are monitored.

The data collected is used to provide weekly operation and maintenance reports.

The support facilities for the wastewater treatment plant include a standby power generator, laboratory services to perform the testing required to assure proper operation of the plant, and a utility equipment storage and maintenance area.

FACILITY SPECIFICATIONS

Average Wet Weather flow = 4 mgd

Peak Hourly Flow = 11.1 mgd

Biochemical Oxygen Demand = 3170 lb/day

Total Suspended Solids = 6476 lb/day

Total Kjeldahl Nitrogen = 450 lb/day

Total Phosphorous = 92 lb/day

Design year population = 13,778