Overview of Equipment and Last Installation/Upgrade

Influent Screening added in 1994

Wastewater passes through ¼ inch screen to remove rags, plastic bags, toys, etc. Screenings are disposed of in a sanitary landfill.

Influent is measured by Parshall flume. Daily influent flow range is approximately 4.5-5.5 mgd.

Grit Removal System- West Grit Chamber added in 1959, East Grit Chamber added in 1976

Grit (heavy, sandy, settleable material) is settled from wastewater. Grit is disposed of in a sanitary landfill.

Settling Tanks (Primary Clarifiers) Four inside tanks added in 1932, Four outside tanks added in 1976

Primary sedimentation removes the lighter settlable solids, which are pumped to the anaerobic digesters for treatment. Materials that float (fats, oils, and grease) are mechanically skimmed from the surface.

Fine Screens added in 2004

Two-millimeter perforated plate screens (holes about the size of the lead in a wooden pencil) remove small debris and fiber. Fine screenings are disposed of in a sanitary landfill.

Aeration and Membrane Process [membrane bioreactor (MBR)]

Aeration Basin originally installed in 1976, last modified in 2004, Membranes added in 2004.

The MBR is a pairing of biological treatment with a membrane separation process. In the aeration basins, aerobic and facultative microorganisms consume the dissolved pollutants remaining in the wastewater after primary sedimentation. The aeration basins are divided into compartments where treatment biology is subject to conditions favorable for bacterial uptake of nitrogen and phosphorus. Ferric chloride can be added to precipitate phosphorus that may not be removed biologically. The mixture of water and microorganisms then flows to the membrane tanks. There, water is withdrawn from the treatment biology by pulling it through membranes having a pore size smaller than bacteria. Automatic air scour, back pulse, and chemical cleanings keep membranes from fouling. Pumps recirculate the concentrated microorganisms [return activated sludge (RAS)] from the downstream end of the membrane vessels back to the aeration basins.

UV Disinfection added in 1995

The treated water from the membrane process is then introduced into the disinfection system where UV light kills pathogens making the water safe for discharge to the Boardman River.

Waste Activated Sludge (WAS)

The population of microorganisms in the MBR constantly grows in proportion to the amount of pollutants it removes from the wastewater. The excess biology, WAS, is removed from the system. WAS is dosed with polymer coagulant and concentrated in a gravity belt concentrator. Concentrated Waste Activated Sludge (CWAS).

Digester Tanks (Anaerobic Digestion)

Digesters #1 and #2 added in 1932, Digesters #3 and #4 added in 1959, Digester #5 added in 2004.

Solids removed from the treatment processes (fats, oils, greases, primary sludge, and CWAS) are stabilized creating a sludge that is suitable for land application. This process generates a gas mixture that is mostly methane, which the plant burns as a fuel.

Digested sludge is dosed with a polymer coagulant and concentrated in sieve drum concentrators. Concentrated Digested Sludge (CDS).

Sludge Storage (biosolids storage) Building and pumps added in 1985

Concentrated digested sludge (biosolids) is stored in tanks having a total capacity of 3.05 million gallons. Biosolids are hauled and subsurface injected in to farm fields. Almost 4.5 million gallons are injected annually, containing roughly 940 tons of biosolids (dry basis).

Odor Control

In an effort to control odors, foul air is contained under fiberglass covers and conveyed through fiberglass ducts to the aeration basin or an activated carbon system for treatment. The fiberglass covers were installed in 1994, the fiber glass ducts were upgraded in 2013, and the activated carbon system was added in 2001.

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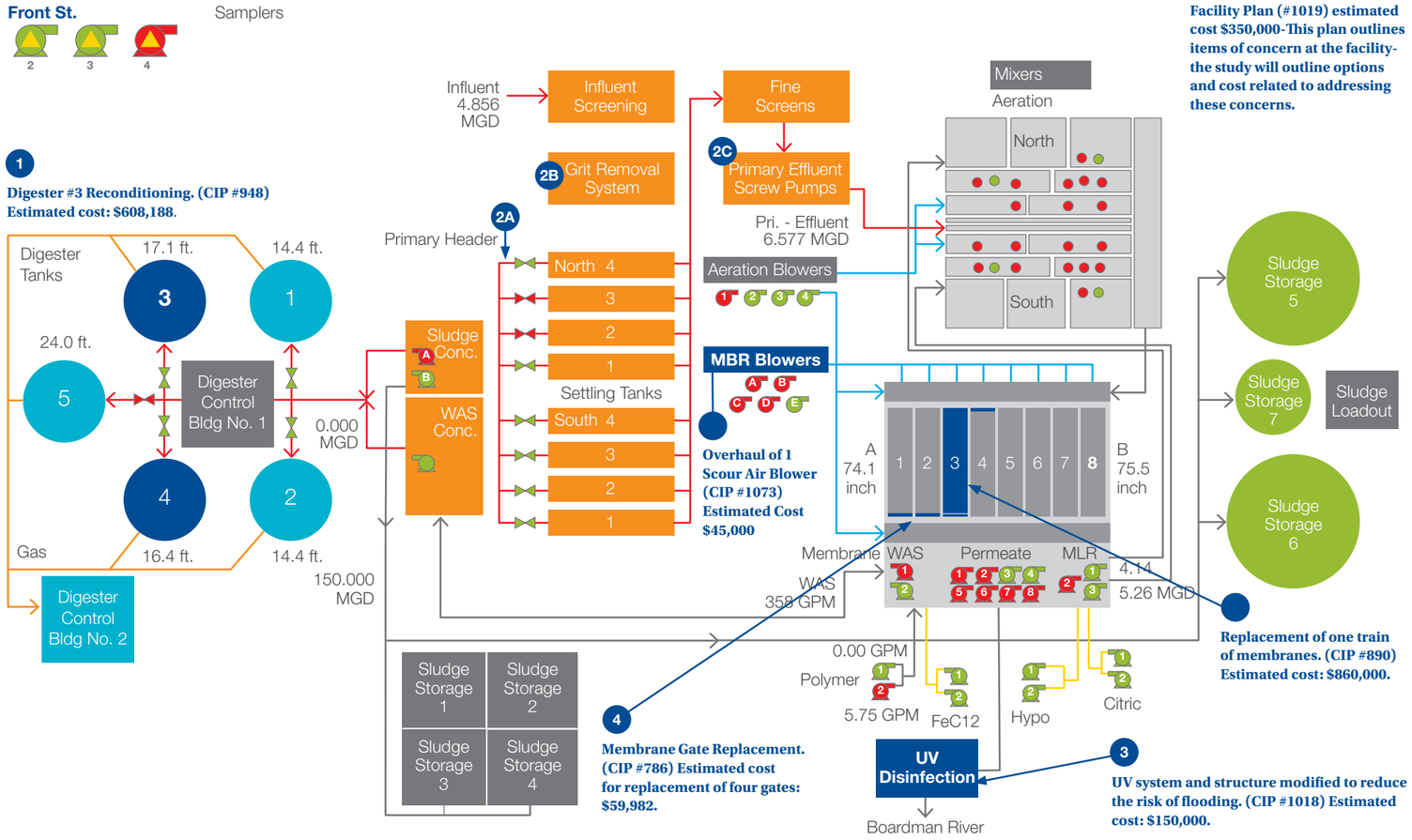
Traverse City Regional Wastewater Treatment Plant

Overview of Equipment and Last Installation/Upgrade

2018-2019 Capital Improvements



2

Engineering Study Pertaining to Facility Plan (#1019) estimated cost $350,000-This plan outlines items of concern at the facility- the study will outline options and cost related to addressing these concerns.

This plan outlines items of concern at the facility. The study will outline options and cost related to addressing these concerns.

1 **(CIP #948 and #966)** Digester #3 and #4 were put into service in 1959 - They are in need of a condition assessment to identify areas needing reconditioning. Digester #3 (currently out of service as a result of cracks in cap, cover and manhole excess points) had a condition assessment performed in 2017. The related reconditioning of Digester #3 is in the CIP for 2018-2019. The condition assessment for Digester #4 is included in the Engineering Study pertaining to the Facility Plan (CIP #1019).

Digester #3 -cracked cap.

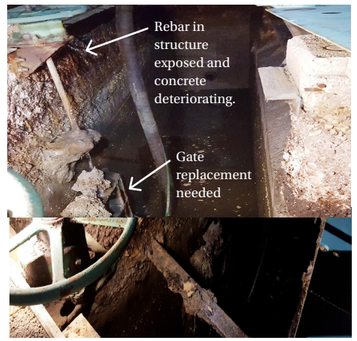
2A **The engineering study, CIP #1019** (That pertains to the facility plan), will serve as a plan of action on how best to address the needs of the aging portions of the facility. There are portions of the facility that were originally constructed in the 1930s, 1950s, 1970s, and 1980s. These portions of the facility are showing signs of failure or have failed. The pictures below illustrate a couple of these areas.

Primary header installed in 1976.

Primary header.

Primary header.

2B East Grit Chamber-Effluent Channel discharging to the primary header-installed in 1976 (West Grit Chamber was installed in 1959).



Grit chamber

4 **Membrane Gate Replacement (CIP #786)** The Membrane gates were installed in 2004. At that time, it was standard practice to install Aluminum gates for Membrane trains. The Aluminum gates have not held up, and have failed or are nearing failure. We have replaced 8 of the 16 membrane gates that needed replacing with stainless steel gates and have 8 gates left to replace. The replacement of 4 Membrane Gates is in the CIP for 2017-2018 and 2018-2019.

Old aluminum gate.

New stainless steel gates.

2C **Screw Pump Replacement (CIP #893)** The 3 Screw Pumps were installed in 1976. Screw Pump #1 has been replaced and the trough and wet well have been reconditioned. The replacement of Screw Pump #2 and #3 is scheduled for 2019-2020. The facility plan will include the upgrade of these to screw pumps for the purpose of evaluating the condition of the concrete troughs and wet wells, and examining alternative technologies.

Before upgrade. Out of service because screw body was cracked.

New screw body and trough reconditioned.

3 **UV System and Related Structures Modification Project (CIP#1018)** Installed in 1995, the UV System and related structures have to be modified to increase hydraulic capacity, and eliminate the possible flooding of the UV modules.