Waste Water Treatment Process

INCLINED SCREW PUMPS

The raw influent flows into a wet well where it is carried up nearly thirty feet by one of two inclined screw pumps. The 78-inch diameter screw pumps are set at a 38-degree angle so their rotation carries the influent up a trough. Each screw pump has the capacity to pump 11.8 Million Gallons Per Day (MGD). In addition, space was allocated for a third screw pump to be installed if needed. Average daily flow through the Stevens Point Wastewater Plant is 3 MGD.

FINE SCREENING and WASH PRESS

Fine Screens

Washed Screenings

After the Screw Pumps, flow is diverted through two mechanical fine screens having an 11.8 MGD screening capacity. The main purpose for the fine screens is to capture and remove solids greater in size than 3 mm. Solids that are removed from the waste stream by the fine screens are washed and dewatered by a screening wash press and then discharged into a dumpster to be land filled.

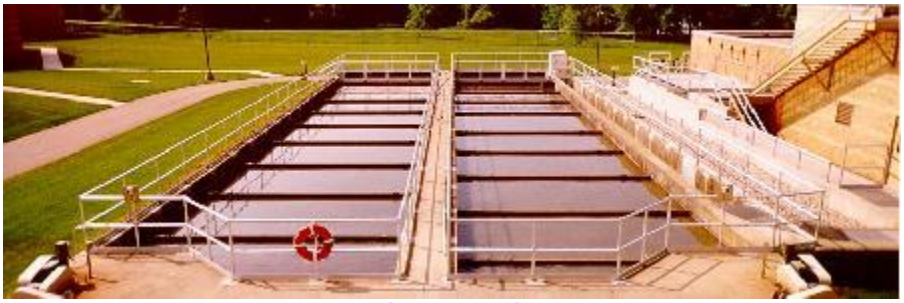
GRIT REMOVAL and GRIT WASHING

Grit Washer

Washed Grit

A vortex type grit removal system is located downstream from the Fine screens. Materials collected include sand, gravel, and other mineral matter. Grit is pumped via a centrifugal pump into a grit washer. After the grit is washed it is discharged into a dumpster. The grit removed is sent to the local landfill.

PRIMARY CLARIFICATION



Primary Tanks

After screening and grit removal, the wastewater flows to two Primary clarifiers. The primary clarifiers remove settleable solids from the water. The settled solids are then pumped via two air driven diaphragm pumps to the digesters.

AERATION BASINS

Aeration Basins

The existing aeration basins are adequate for effluent limitations until the year 2013. The four basins have a combined volume of 1,229,500 gallons. Three blowers provide air to the aeration basins. The air is forced through ceramic fine bubble diffusers to supply oxygen to the activated sludge microorganisms. For operating flexibility, gates are installed which allow for several different options for the flow through the basins. Normal operation consists of three aeration basins operating in parallel following the anaerobic (A/O) basin. These basins are the area responsible for the biological breakdown of the organic matter present in sewage as well as the biological removal of Phosphorus. The process that takes place in these basins is called the Activated Sludge process.

Activated Sludge Process

The treatment of wastewater by suspended growth biological treatment is known as the activated sludge process. In the activated sludge process, microorganisms are mixed thoroughly with organic material in the wastewater so that the microorganisms grow by using the organics as food. As the microorganisms grow and are mixed by the agitation of the air, the individual organisms clump together (flocculate) to form an active mass of microbes called "activated sludge". The wastewater flows continuously into the aeration tanks where air is injected to mix the activated sludge with the wastewater forming "mixed liquor" and to supply the oxygen needed for the microbes to break down the organics. The mixed liquor in the aeration tank flows to the final clarifiers where the activated sludge is settled out. Most of the settled sludge is returned to the aeration tank to maintain a high population of microbes to permit rapid breakdown of the organic material.

Biological Phosphorus Description

Biological phosphorus removal is a process where phosphorus is removed from the wastewater through an excess uptake of phosphorus into the activated sludge microbial population and the subsequent wasting of the sludge from the process. The main difference between typical activated sludge processes and biological nutrient removal (BNR) processes is the sequencing of anaerobic and aerobic conditions, which selects for the phosphorus-storing microorganisms. If sufficient volatile fatty acids are present, and the microorganisms are subject to anaerobic conditions, the microorganisms will release phosphorus to provide energy in order to store organics (BOD). When the microorganisms are reintroduced into an aerobic environment, the microorganisms will uptake phosphorus in excess amounts (greater than required for cell synthesis) as they breakdown the BOD for food.

The wastewater plant uses enhanced biological phosphorus removal (EBPR) by the wastewater microorganisms to remove phosphorus from the wastewater 100% of the time. The Stevens Point WWTP utilizes the anaerobic/oxic (A/O) process for EBPR. The A/O process is a simple process that utilizes an anaerobic zone followed by an aerobic (oxic) zone. If it is determined that the biological phosphorus removal system alone will not meet our effluent Phosphorus limit of 1.4 mg/L, then chemical addition will be used to help remove phosphorus to achieve the WPDES permit limit. At Stevens Point, Ferric Chloride would be used. Ferric Chloride would only be used if absolutely necessary.

FINAL CLARIFICATION

Final Clarifiers

Two 75-foot round clarifiers and one 55-foot round clarifier provide a quiescent zone for gravity separation of the activated sludge from the clear water. The settled solids are pumped from the bottom of the clarifiers back to the anaerobic basin and aeration basins.

DISINFECTION

After the Final Clarifiers the clean water flows through a UV light disinfection system. The UV disinfection process disinfects the wastewater by inactivating microorganisms with UV energy emitted from lamps at a wavelength of 254 nanometers. The UV light disrupts the cells genetic material, preventing replication of the microorganisms. Final effluent is in contact with the UV rays for 10.32 seconds at 2.95 million gallons per day. The final effluent flows through one of four channels. Each channel contains one bank of UV bulbs. Each bank consists of 21 modules of eight bulbs, for a total of 168 bulbs per bank.

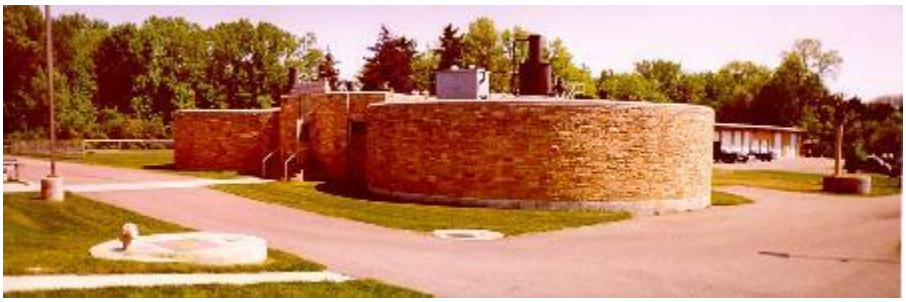
RAS PUMPING STATION

Return activated sludge (RAS) is pumped via four centrifugal pumps back to the aeration basins. Three pumps are used with one as a stand by pump. The pumps have variable speed drives and have the capacity to pump from 400-1,200 gallons per minute.

DISSOLVED AIR FLOATATION (DAF) THICKENING

A certain amount of Activated Sludge is removed (wasted) from the system daily to keep the microorganism population at the proper levels. Two Rotary Lobe pumps pump Waste Activated Sludge (WAS) to a Dissolved Air Floatation (DAF) tank. The DAF is a thickening process in which air bubbles are forced through the WAS. The bubbles attach themselves to suspended solid particles creating a thickened surface layer. This layer is then skimmed off and sent to the sludge well where it is pumped, via a rotary lobe pump, to the primary digesters.

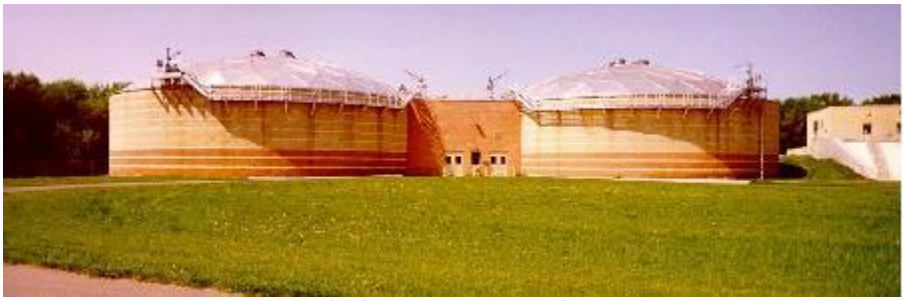
ANAEROBIC DIGESTION



Digesters

Waste Activated sludge and Primary sludge are sent to three digesters. Primary digestion occurs for 15 days in two 45-foot diameter primary digesters. Digestion is then completed in the single 50-foot diameter secondary digester. A 1,500,000 BTU heater/heat exchanger is used to keep the digesters at their optimal temperature of 95-98 degrees Fahrenheit. The digesters are heated with the methane gas that they produce.

SLUDGE STORAGE TANKS



Sludge Storage Tanks

The solids that are removed from the digesters daily are passed through a Rotary Drum Thickener and then sent to one of two 100-foot diameter sludge storage tanks. Within these tanks lies the ability to mechanically mix and to decant any supernatant liquid. Each tank holds 1,600,000 gallons of digested biosolids. Together the tanks volume represents greater than180 days worth of sludge storage at plant design loadings. These tanks are covered to keep out precipitation. Biosolids are removed from the tanks and land applied on local farm fields.

Land Application of Biosolids on Farm Fields

QUALITY CONTROL LABORATORY

Plant personnel in this award-winning laboratory perform several lab procedures daily. Analytical tests performed include BOD, TSS, pH, Total Phosphorus, Ortho Phosphorus, and Fecal Coliform.

SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) COMPUTER

The SCADA system collects, stores, and processes information from the wastewater plant. In this way, present information can be compared to historic system information and informed decisions can be made quickly.

FINAL EFFLUENT

Final Effluent

Final Effluent at Wisconsin River