

WASTE WATER TREATMENT PLANT OUTLINE

Remember that waste treatment at this type of plant is *almost completely* a function of physical and biological processes. We do not use chemical filters or a lot of chemical additives.

Goal of treatment: to remove organic material. No chemicals in the waste can be removed during the process.

Why organic material is bad to put in river: public health and environmental health.

Environmental health: Bacteria and other microorganisms in the river will consume the organic material (“decomposition”)—this causes their populations to grow. As they consume organic material they also use oxygen (“respiration”—cells require oxygen): using up oxygen that is dissolved in the water. This disrupts the ecosystem of the river because native microorganisms, insects, fish, plants, etc will have insufficient quantities of oxygen available, and so they die. So, a “high BOD” (**biological oxygen demand**) means that there is a lot of organic material and that oxygen is going to be removed at a high rate. This is bad for environmental quality.

Public health: Furthermore, toxic microorganisms can get into the water supply without waste treatment... they will also grow and thrive if added to water with organic material.

Influent: *everything* flushed or dumped down any drain in municipal Cortland, Homer, McGraw, Cortlandville ends up at the wastewater plant. Influent enters through a 4 foot underground pipe.

BRIEF OVERVIEW OF OUR TOUR

1. **bar screen** removes items greater than 1 inch in diameter from influent. (*physical treatment process*)

2. **Influent wet well:** here they monitor the rate of flow and pumps will adjust the rate of flow through the plant to keep up. Pumps are sending influent to top of the building that houses the grit removal chamber and primary clarifier.

Up to roof of building:

3. **Grit removal chamber.** This chamber has a spinning paddle in the center that creates a vortex (like a tornado). Heavier inorganic material like sand and glass is pulled to the middle and center and is removed. (*physical treatment process*)

4. **Primary Clarifier** (round tank). Settle-able organic material falls to bottom through the effect of gravity and is removed (squeegeed from the bottom into pipes—see page C69). This material is called **sludge**. Floating objects are scraped off the top with the rotating arm. Liquid still has dissolved organic material in it, even though a lot of material has settled out. (*physical treatment process*)

Here we have a split in the waste stream: sludge (a complex slurry of organic material) will go one way for treatment and the liquid influent (with dissolved organic material) will follow a different path for treatment.

following liquid only (we get back to sludge later!:

5: The liquid goes to **Aeration Basins**. This was a surprising step because the water that minutes ago looked mildly dirty now appears really dirty: a dark brown color. The reason: a diverse community of microorganisms (bacteria, protozoa, rotifers, etc.) has been added--- they consume the dissolved organic material. While they are growing and reproducing they are removing the dissolved organic material that came in with the influent and *converting* it into their own bodies and the bodies of their offspring. Oxygen is bubbled-in to increase microbial efficiency, so the whole tank looks like bubbling chocolate milk. (*biological* treatment process)

6. Chocolatey-looking liquid goes to next building's roof where the **Secondary Clarifier** is located. Now all it contains is just water and a lot of microorganisms—the organic waste is gone even though the liquid looks brown. In the secondary clarifier, live microorganisms settle to the bottom and are recycled back to the aeration basin. Dead microorganisms are scraped off the top. (*physical* treatment process)

OK, now the water is clear! 95-98% of organic material has been removed!!!!

7. Down next to the river, the effluent has oxygen bubbled into it in tanks just before release into the river. In the summer months *only*, we employ a *brief* **chemical** process: **chlorination and then dechlorination**. This is to ensure no dangerous microorganisms that came in with the influent have managed to slip through the process. They might proliferate in warm summer waters.

getting back to sludge:

8. Organic sludge is pumped out of the bottom of the primary clarifier and sent to the **anaerobic digester** (104 degrees and no oxygen). Here, bacteria first convert complex organics to smaller organic acids then a second kind of bacteria converts acids into simple inert (inactive) organic material... this material will not decompose or react with anything. This process also kills toxic microorganisms that might be in the sludge. Byproduct: methane, which is used to heat the plant and the anaerobic digester. (*biological* treatment process)

9: Sludge is **dewatered** by being pressed on a **belt roller** machine so that the water comes out of it, and the left over material—called a “sludge cake”—is buried in the landfill. (*physical* treatment process)

The liquid portion of waste passes through the entire system in about 12 hours, the sludge treatment takes 12 days or more.