Working Group Meeting #2
August 11, 2015

Tour of Lakewood's Waste Water Treatment Plant (WWTP) and an Overflow Site

Refresher Question: Why was this working group formed?

Goal of this meeting: To learn how a sewage treatment plant works, and to gain an understanding of where the overflows discharge when it rains.

Some might say the most important facility in Lakewood is our treatment plant. This plant treats an average of 7.85 million gallons of sewage water a day, and consistently meets all state water discharge permits. Bill Crute, the Division Manager, has been working at this plant for 45 years. He, along with a crew of about 22 people, makes sure the plant is running efficiently on an hourly basis.

In the USA there are 800,000 miles of sewage collection systems (networks of pipes) according to the EPA. This does not include private home laterals that connect to these systems, which would add an additional 500,000 miles of pipes.

In Lakewood, we have more than 875,000 feet (166 miles) of pipe, which includes 393,500 feet of sanitary sewer, 348,000 feet of storm sewer, and 133,500 feet of combined sewer. Lakewood has a sewered area of approximately 3,100 acres, 500 of those acres are serviced by combined sewers (Facility Plan for the City of Lakewood, 1978).

Large storms overwhelm sewers and dramatically increase the volume reaching the plant, often leading to overflows.

Part 1: Touring the Plant

Plant is located at 1699 Cleveland Metro Park Drive. See attached sewage treatment plant map to help guide you as you read the descriptions.

Preliminary Treatment

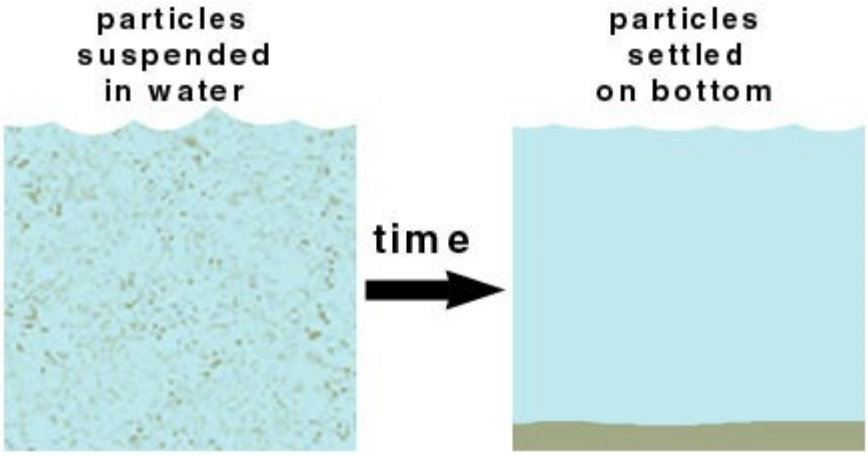
Goal of the headworks is to remove anything larger than ½ inch, things like: trash, rocks, rags and cans. Influent screens filter out large debris. This prevents pipes and pumps in the plant from getting clogged. The trash that is removed is landfilled.

Grit removal chamber

Water flows slowly, and heavier grit falls to bottom, lighter organics float. Rake runs across bottom of tank, sweeping grit away.

Primary Treatment/ Primary Clarifier

Goal: start to separate water from solids.



http://www.chemistry.wustl.edu/~edudev/LabTutorials/Water/PublicWaterSupply/images/sedimentation.jpg

Primary treatment relies on physical separation methods—sedimentation is done via gravity. Other solids are screened out. Average detention time in these tanks is 2 hours.

Waste water comes up through center of the circular settling tank, water sits in this tank for a few hours, becoming very still. 60-70% of solids falls to bottom and is removed. Oil and grease form film on top and are skimmed off. Cleaner water flows over weirs as solids settle out.

There is a rotating arm that brings solids from the bottom of the clarifier into a hopper in the center, and the hopper is connected to a pipe that brings it to the sludge (biosolids) treatment process, located on site.

Secondary Treatment

This process removes solids and nutrients like nitrogen and phosphorous (N&P). N&P are important to remove for the health of Rocky River and Lake Erie as they promote algae growth, and can lead to low oxygen zones in the water.

Nutrients are also a valuable resource, particularly for agriculture, and these nutrients can be recovered through sludge processing.

Aeration tank is the first part of secondary treatment—it relies on biological science, not physical separation.

Blowers distribute oxygen via pipes into aeration basin. Oxygen is used by bacteria; they feed on the solids and reduce their volume as well as reduce nutrient concentrations.

Secondary clarification is similar to primary clarification, in the sense that the solids settle out and are sent to biosolids treatment. These solids are called “activated sludge”. Some of the activated sludge is sent back to aeration tank to keep bacteria counts high enough to continuously eat up the solids.

UV Disinfection

This removes bacteria that would cause illness. When bacteria are exposed to UV light, they are rendered incapable of reproducing and therefore they are short-lived.

Water is now free of solids, grit, and microorganisms and is considered clean enough for use in: cooling systems, irrigation, or firefighting.

Sludge Processing

Sludge is put into an anaerobic digester and different species of bacteria reduce pathogens and volatiles, as well as produce methane as a byproduct. This methane (natural gas) can be a great energy source and Lakewood uses this energy to run their boilers as well as heat their buildings in the winter. They are hoping to one day also use the methane produced by the digesters for electricity.

The sludge is squeezed between two belts so that all the water is squeezed out; the removed water is sent back to the headworks. Approximately 5000 wet tons of biosolids are produced annually.

Part 2: Where are the overflows?

Lakewood has sewer systems that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe, as well as a unique system involving “over-under” sewers intermingled with combined sewers. Most of the time, our sewer system transports all of the wastewater to a sewage treatment plant, where it is treated and then discharged to Lake Erie.

During periods of heavy rainfall or snowmelt, however, the wastewater volume can exceed the capacity of the sewer system or treatment plant. For this reason as well as to guard against basement flooding, our sewer system was designed to overflow and discharge excess wastewater directly to nearby waterways—Rocky River and Lake Erie.

In a typical year Lakewood discharges over 15 million gallons of sewage mixed with stormwater to Lake Erie and Rocky River. This is equivalent to 4.4 million water bottles of waste released every day.

This June was an incredibly wet month and 51 million gallons overflowed just in that month.

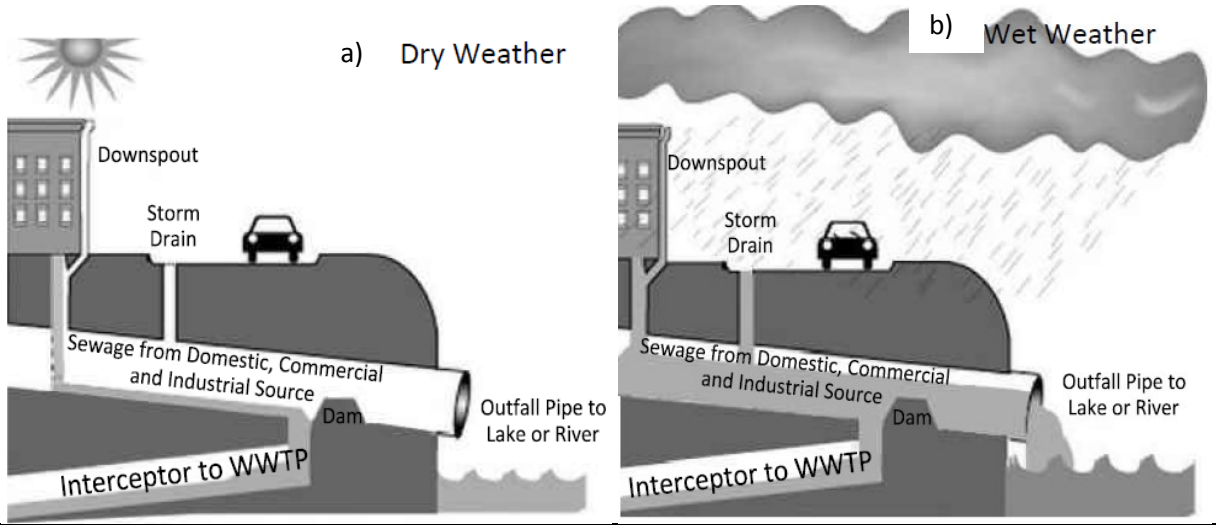


Figure 1. a) During dry weather, sewage and commercial wastes do not cause overflows. The waste flows into an interceptor pipe to the waste water treatment plant. b) During wet weather, sewage, commercial wastes and stormwater mix and overwhelm the system. Due to the surge in volume, not all waste gets to the interceptor and therefore it is released to the nearest water body.

Attached you will find two additional maps; 1) shows the 55 outflow pipes leading to the lake or the river from Lakewood, and 2) shows the CSO sewersheds of Lakewood.

Lakewood is making progress on reducing overflows and is in the process of removing two permitted CSOs that discharge into Rocky River.

One is overflow RRES 1140, which we can see from the bridge, the other is right near the sewage treatment plant, RRWS 1205, which acts as a release if too much water is going into the treatment plant influent pipe.

The pipe you can see from the bridge is going to remain, but it will only release stormwater, rather than combined sewage and stormwater.

By November of 2016, you will see a new pipe spanning across the river and leading into the sewage treatment plant (Figure 2), this is so that the combined sewage and stormwater from the West End neighborhood, does not discharge to the river, but instead goes through the pipe for treatment. This is expected to cost about $5 million, and half of this is covered by state grant and loan money.

Figure 2. Rendering of new pipe spanning Rocky River leading to the WWTP.

Overall the cost to collect all of the waste water and manage the sewer system is estimated to cost $6,748,370 in 2015. The cost to run the waste water treatment plant is estimated at $4,480,745 for 2015. These numbers were taken from the 2015 Estimate of Expenses Report:

http://www.onelakewood.com/pdf/Finance%20Reports/2015_Lakewood_Comprehensive_Budget.pdf, page 152 and 156, respectively.

Other types of grey infrastructure; which may be referenced in the future

What is grey infrastructure?

A general term referring to man-made, constructed assets, like tunnels and storm drains.

Examples are below:

Storage Tunnels: brings large volume of water into storage tunnel during rain event and then that water gets pumped to WWTP when they have capacity to treat it

http://www.waterworld.com/content/dam/etc/medialib/new-lib/waterworld/print-articles/volume-28/issue%208/parsons-tunnel-interior-1208ww.jpg

Sewer Separation: separates the storm and sanitary sewers so that all overflows going into river and lake are just stormwater, not storm mixed with sewage

http://www.severinotrucking.com/images/gallery/12/lg_Lincoln%20Ave%202010%20-%201%20%2869%29.JPG

high rate treatment: increasing the capacity that the treatment plant can handle by using technology and chemicals that settle the solids and disinfect the water in minimal time

http://vertassets.blob.core.windows.net/image/67a33121/67a33121-b234-4d63-9c86-b1ddda114e88/actiflomem.jpg