Durham Water Resource Recovery Facility, located in Tigard near Cook Park and Tigard High School, is a nationally acclaimed, state-of-the-art facility, serving Washington County residents in the cities of Beaverton, Durham, King City, Sherwood, Tigard, Tualatin, and small portions of southwest Portland and Lake Oswego.

Today, the facility cleans an average of 22 million gallons of used water each day to among the highest safety and quality standards in the nation. Through innovative, advanced technology and processes, the Durham facility treats and removes valuable resources from water collected from homes and businesses. This water flows through a strategic process of liquids and solids recovery. The water is then returned to Washington County's only river – the Tualatin – so clean, it actually improves water quality.

Cleaned water is also used for local irrigation, and natural byproducts of the treatment process are converted to electricity, heat and used as soil amendments. Captured methane gas, a byproduct of anaerobic digestion, supplies electrical power for the facility. In 2009, Durham installed the first commercial nutrient recovery facility in the nation in partnership with Ostara Nutrient Recovery Technologies in Canada. The facility captures 80% of the phosphorus from the wastewater recycle stream and converts it into a premium, slow-release fertilizer used in agriculture and nurseries.

The Durham facility began operations in 1976 to reverse decades of severe water pollution in the Tualatin River and its tributaries, and to meet the demands of a growing population. This facility centralized a scattered system of inefficient wastewater treatment plants, creating one of the most efficient and advanced facilities in the world.

Durham Facts
- Provides a higher level of treatment than 98% of facilities in the nation
- Meets over 1,000 permit conditions, including monthly, weekly and daily limits established to protect the Tualatin River
- Operates 24-hours a day, 365 days a year
- Serves a growing population of approximately 250,000
- Cleans an average of 22 million gallons of wastewater per day
- Recycles more than 50 million gallons a year of reclaimed water for local irrigation
- Recycles more than 12 dry tons of biosolids daily for use as a soil amendment
- Produces approximately 400 tons of Crystal Green®, a commercial, high-value fertilizer
- Meets 60% of facility electrical needs through the self-generation of energy
- 2007 – U.S. EPA National Clean Water Act Recognition Award for the best operated and maintained large, advanced treatment facility in the nation
- National Association of Clean Water Agencies (NACWA) Gold Award for 100% permit compliance achieved over multiple years
**Liquids Recovery**

At the Durham Water Resource Recovery Facility, used water flows through the plant through a series of processes: preliminary, primary, secondary, tertiary, disinfection and effluent discharge.

1. **Preliminary Process**
   Flow from homes and industry eventually comes to the Durham Influent Pump Station. The flow is measured and then pumped to the Headworks Building. Headworks prepares the incoming flow for downstream treatment by screening out larger debris and garbage and allowing heavy materials to drop out prior to Primary Treatment.

2. **Primary Treatment**
   Flow from Headworks is sent to up to four separate primary clarifiers. Primary clarifiers are large tanks that allow the flow to slow down. This lets particles settle to the bottom of the tank while fats, oils, and grease float to the surface. A skimming arm skims the water surface to remove buildup while sludge pumps remove sludge from the bottom of the clarifiers. The solids removed from these tanks are sent to solids handling for further treatment.

3. **Secondary Treatment**
   There are many types of secondary treatment. The Durham facility employs activated sludge with an enhanced biological nutrient removal configuration. This means an environment is created in aeration basins that allows the natural bacteria in wastewater to grow and thrive. The bacteria incorporates contaminants and phosphorus in the liquid flow stream.

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**Solids Recovery**

The first half of the job at a water resource recovery facility is to remove foreign constituents from the liquid flow stream. Those foreign constituents, or solids, are resources that can be reclaimed. The solids treatment process consists of thickening, digestion, dewatering, and phosphorus recovery.

4. **Thickening**
   The main purpose of thickening is to concentrate the solids by removing a large volume of water. We are able to do this by gravity thickening the primary sludge. The UFAT® process was created at Durham to capture the volatile fatty acids in the primary sludge and returns those acids to the aeration basin to aid in nutrient removal.

The secondary sludge goes through a process invented by CWS called...
water. The bacteria can also convert the nitrogen in the water into nitrogen gas. As the flow leaves the aeration basin, secondary clarifiers slow the water down similar to primary clarifiers. As the bacteria sink to the bottom, sludge pumps return the bacteria to the front to meet the incoming flow and remove further contaminants. A portion of the bacteria are removed (wasted), along with contaminants and nutrients in the bacteria, and sent to solids handling to maintain a stable aeration basin population.

4 Tertiary Treatment – Chemical Clarification
At Durham, tertiary treatment is accomplished by chemical clarification. Alum is added to the secondary effluent to allow smaller particles to clump together and form a “floc” of particles. These larger clumps are easier to settle in the chemical clarifiers, where they are removed and sent to solids handling.

5 Tertiary Treatment - Filtration
The filters contain a mixture of sand and anthracite media to capture fine particles that were unable to settle out in the primary and secondary treatment processes. This is the same process that occurs at drinking water plants for purifying the water and is a final step to reduce phosphorus concentrations to extremely low levels.

6 Disinfection
Disinfection inactivates harmful microorganisms and Durham accomplishes this with chlorine. The flow is dosed with sodium hypochlorite, a more concentrated form of bleach, and held in serpentine tanks called chlorine contact basins to allow sufficient contact time to disinfect the flow. As the flow leaves the chlorine contact basins, it passes through filters.

7 Effluent Discharge
As the flow prepares to leave the plant, sodium bisulfite is added to neutralize any remaining chlorine in the water. The resulting water is such high quality, it actually improves the health of the river and is close to drinking water quality. In the summer, a portion of the water is not returned to the river, but is instead used onsite or pumped offsite as Class A recycled water for irrigation. The recycled water is not dechlorinated so that the chlorine can prevent a recurrence of contamination.

WASSTRIP®. It goes through a process of gravity thickening in an environment without oxygen, which causes the bacteria to release stored phosphorus. Then, the secondary sludge is further thickened using a centrifuge. The liquid from the centrifuge is high in phosphorus, so it is sent to phosphorus recovery to reclaim the phosphorus. Sludge from the primary and secondary processes is mixed together and sent to the anaerobic digesters.

B Digestion
Anaerobic digesters function much like a human stomach. They consume what they’re fed and turn that “food” into water and biogas, which is high in methane. The biogas is captured and fed to engine generators, which produce electricity used to help run the plant. They also provide heat to keep the digesters at a healthy temperature and space heating for much of the Durham campus. During the digestion process the solids are stabilized to meet Class B biosolids criteria. Any solids left are sent to dewatering.

C Dewatering and Phosphorus Recovery
Water in the sludge from the anaerobic digesters is removed using high-speed dewatering centrifuges. This liquid has a high content of phosphorus and ammonia, so it’s sent the phosphorus recovery center to make a high quality fertilizer.
Cogeneration

In 2016, Clean Water Services (CWS), Energy Trust of Oregon and the Oregon Department of Energy dedicated a new cogeneration system that converts wastewater and food grease into clean, renewable energy. With this innovative system, the Durham Treatment Facility is the third water resource recovery plant in Oregon to co-digest fats, oils and grease.

The new system triples Durham’s renewable energy generation, producing 60 percent of the electricity needed to run the water resource recovery facility when coupled with its existing 403-kilowatt solar electric system. Renewable electricity and heat produced will be used onsite, reducing CWS’s energy costs by nearly $800,000 annually, ensuring value for ratepayers. Generating clean, renewable energy from biogas reduces greenhouse gas emissions and helps Oregon meet its carbon reduction goals.

Since 1993, Durham has operated a 500-kilowatt cogeneration system using biogas from treatment of the communities’ wastewater to offset its own energy usage. By replacing this smaller engine with two new engines, Durham now has a 1.7 megawatt cogeneration system fueled by biogas produced from the anaerobic digestion of municipal wastewater solids as well as fats, oils and grease (FOG) collected from Washington County restaurants and others. FOG, also known as “brown grease,” is pumped out of restaurant grease traps and interceptors at regular intervals.

This is just the latest project where Clean Water Services and Energy Trust have teamed up to invest in projects that save and generate energy. Since 2004, Clean Water Services has worked with Energy Trust on more than 100 energy-saving improvements throughout its facilities – everything from large-scale capital improvements to new energy-efficient lighting, pumps and drives and operations and maintenance improvements. This has resulted in more than 9 million kilowatthours of electricity saved per year for Clean Water Services, and lower utility bills and operating costs translates to saving for their ratepayers.

Size and scope

- 1.7-megawatt cogeneration system: two Jenbacher 848-kilowatt cogeneration reciprocating engines fueled by biogas, not fossil fuel
- Annual expected generation: ~12,300 megawatt-hours per year
- Combined with the 403-kilowatt solar electric system, expected generation is more than 12,800 megawatt-hours per year – enough electricity to power 1,100 homes for a year and will help avoid producing 6,000 tons of carbon dioxide
- Average gallons of fats, oils and grease (FOG) co-digested per week: 70,000, moving up to 100,000 gallons with next six months
- Cost: $16.8 million
- Energy Trust of Oregon incentive: $3 million
- Oregon Department of Energy Tax Credit for combined heat and power: $2.8 million

Benefits

- Cuts Clean Water Services operating costs saving money for ratepayers
- $690,000 first year annual estimated savings in electrical costs.
- $100,000 first year annual estimated savings in heating costs.
- Generates $340,000 annually in tipping fees for FOG disposal
- Keeps fats, oils and greases out of pipes and treatment plant, saving operating costs and preventing sewer backups
- Reduces the level of greenhouse gases released into the environment
- Recovers waste that would be otherwise be disposed of or landfilled
- Advances sustainability goals for Oregon