City of Sunnyvale
Water Pollution Control Plant

1444 Borregas Avenue/P.O. Box 3707
Sunnyvale, CA 94088-3707
408-730-7260

THE ORGANIZATION

The Donald M. Somers Water Pollution Control Plant (the Plant) is a tertiary treatment facility serving the City of Sunnyvale. The objective of the Plant is to remove pollutants and produce a high quality *effluent* suitable either for safe discharge to the South San Francisco Bay or for *non-potable* uses.

New ideas are being researched and studied to develop better materials and methods to treat wastewater. Educating the public about pollution prevention is also an important tool to maintain a high quality effluent. Both are essential to protect the Bay and maintain a healthy environment.

FUNDING

The Plant is operated as a separate enterprise fund within the City. This means that it must support itself through *sewer service fees* without any tax dollars being used. Bond issues and government grants, along with service fees, provide funding for operation, maintenance, and future development.

Costs for wastewater treatment continue to rise with new *permit* requirements, labor and product cost increases, development of new technologies, and maintenance of the Plant's aging infrastructure. In addition, current state and federally mandated requirements compel the City to earmark funds to cover large future expenditures.

Continued research into wastewater recycling and applications is costly, but necessary, to find the most effective ways to operate the Plant and meet regulatory requirements.

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Finding additional uses for *recycled water* and planning for a more extensive distribution system are important to the whole region since the supply of fresh water is a limited resource.

MAKING WATER WORK

Sunnyvale Water Reclamation Program

STAFFING

Many types of expertise are needed to operate the Plant. More than 60 people are employed in Operations, Maintenance, Pretreatment, Laboratory, and Administration.

Plant operators keep the processes flowing and are on duty 24 hours a day. They continually monitor all process parameters and are responsible for maintaining compliance with all state and federally mandated discharge limits designed to protect South San Francisco Bay.

Maintenance mechanics ensure that the equipment is dependable and implement changes as needed to assist the overall efficiency of the plant.

Pretreatment Inspectors work closely with industries and businesses to aid in their compliance with City requirements on the quality of *industrial wastewater* they discharge into sewers. Many local industries are involved in electronics manufacturing and their wastewater may contain chemical and metal contaminants that cannot be removed at the Plant. To avoid exceeding the pollutants discharge limits for the Plant, inspectors take frequent on-site samples of wastewater from these companies to ensure that certain pollutants have been removed before their wastewater is discharged into the City sewer system.

Pretreatment Inspectors

Laboratory Chemists analyze industrial waste pretreatment samples as well as samples taken throughout the treatment process. The lab is equipped to detect amounts of solvents, metals and other hazardous materials down to parts per billion (ppb). In addition to testing the wastewater samples, Chemists test the drinking water for the City of Sunnyvale. They also conduct research projects and prepare sample tests for state and other regulatory agencies.

Laboratory Chemists

Support Services staff the front office, assist the general public, vendors, and other City staff, provide administrative support to Plant personnel, and prepare a variety of reports to meet regulatory requirements.

Environmental Outreach staff provide education on water pollution prevention, conservation, and watershed stewardship to schools and youth, businesses and industries, and the community. Groups are informed about how to reduce the impact of their daily activities on *sanitary sewer systems* (carry wastewater to treatment plants before discharge to the Bay) and on *storm drains* (carry outdoor water runoff, without treatment, directly to creeks and the Bay).

Environmental Outreach Staff

PLANT OPERATIONS

The Plant is designed to combine physical, chemical, and natural biological processes. This unique combination allows the Plant to consistently produce a high-quality effluent from which more than 85 percent of the pollutants have been removed from the *influent.*

Wastewater is treated at three distinct levels: *primary, secondary,* and *tertiary.* Following is a brief explanation of each step.

Primary Treatment:

The goal of primary treatment is to remove solid matter from the influent. Wastewater first enters the Plant 30 feet below ground where large debris is reduced in size by *grinders.* Next, the wastewater is pumped up to ground level by three large pumps, driven by engines fueled with *methane* gas (a byproduct of the digester process).

Primary Pump Engines

The wastewater then flows into *grit chambers* where compressed air is injected into the water. The air causes the grit (inorganic solids such as sand, gravel, and other large particles) to drop to the bottom of the chamber while keeping the lighter *organic solids* in suspension. The grit is then sent through a washer and finally emptied into a trailer for disposal in a landfill.

Grit Chambers and Sedimentation Basins

The wastewater continues on to the *sedimentation basins.* Heavier organic materials settle to the bottom *(sludge),* and lighter materials such as oils and grease *(scum)* float to the top. The remaining wastewater, almost free of solid matter, is now called primary effluent, and flows to the oxidation ponds for further treatment.

At this point there are important ancillary steps that occur which affect the total process. Sludge and scum are removed from the wastewater in the primary treatment process and are pumped into large structures called *anaerobic digesters.*

Anaerobic Digesters

In these digesters (an oxygen-free environment) bacteria consume the solid material, breaking down organics in much the same way that human stomachs and intestines digest food. The result of this bacterial action is the production of methane gas (CH_4), carbon dioxide (CO_2), stabilized organic solids, and water. This ongoing stabilization process continues in the digesters for approximately 25 days at a constant temperature of 100°F.

Power Generator

The methane gas produced in the digesters is used as a fuel for the plant's engines and generators. The plant also uses methane gas produced by the Sunnyvale landfill to generate electrical power. The Plant currently exports surplus electricity produced by the power generation facility to the California power grid.

After the scum and sludge are processed in the digesters, they are called *biosolids.* They are then pumped to *dewatering beds* and spread over slotted tiles that allow the water to drain through. The drained water flows back into the system for further processing.

Biosolids Dewatering Beds

After 1-5 days on the beds, biosolids are spread on a tarmac and allowed to dry further. They can then be used as an alternative daily cover for landfills or as soil amendment in agriculture.

Secondary Treatment:

After most of the heavy solids have been removed, the primary effluent is ready for the second step that begins by letting the water flow by gravity into 440 acres of *oxidation ponds.*

The goal of secondary treatment is to remove most of the remaining dissolved and suspended (non-settleable) solids.

Oxidation Ponds

As wastewater circulates through the pond system, *microorganisms* such as aerobic and anaerobic bacteria and *algae biodegrade* the organic nutrients present in the wastewater as dissolved solids. The algae and bacteria use the solids in the water as a food source, thus cleansing the water of these pollutants. Through *photo-synthesis,* the algae produce oxygen that other organisms in the pond can use. Additional *aeration* is also provided mechanically. Detention time in the ponds is approximately 30 to 45 days.

Tertiary Treatment:

At this point, the effluent is almost free of all original pollutants. Most of the pollutants (algae, ammonia, and bacteria) left in the water after secondary treatment are removed in tertiary treatment.

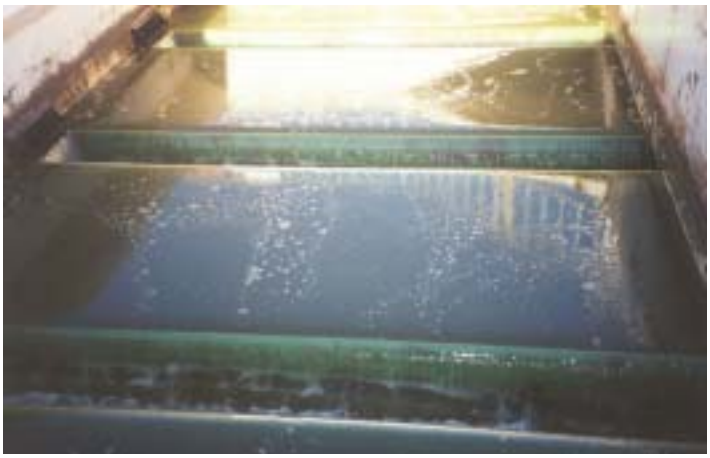
Fixed Growth Reactor

The first step of tertiary treatment is the *fixed growth reactor.* The wastewater is pumped up 30 feet into a tank filled with corrugated plates on which ammonia-consuming bacteria live. At the top of the tank, a large wand rotates and trickles wastewater down over the plates. The bacteria convert the ammonia (NH_3) to nitrate (NO_3), which is not toxic to aquatic life at concentrations present in the effluent.

Air Flotation Tank

Next, the wastewater flows by gravity to the *air floatation tanks. Polymer* and air are injected into the wastewater to cause the algae and other particulate matter to *coagulate* and *flocculate* and rise to the top of the tank for easier removal. The algae floc is skimmed off the top and sent to the digesters or back to the oxidation ponds.

The flocculation process removes most, but not all of the algae. As a final polishing step, the wastewater is sent to percolate through *dual media filters.* These filters are made up of a layer each of sand and anthracite coal, supported on a layer of gravel. This filtration process removes most of the remaining algae and particulate matter.



Dual Media Filters

From the filters, the wastewater flows to the *chlorine contact channels,* where chlorine (Cl_2) is added as a disinfectant. The chlorine remains in contact with the wastewater for at least one hour to achieve disinfection. Finally, sulfur dioxide (SO_2) is added to render the chlorine harmless, and the fully treated effluent is discharged to the Bay.

Chlorine Contact Channels

The final product, tertiary effluent, has more than 85 percent of all pollutants removed.

A portion of the daily flow is treated beyond tertiary standards to the higher standard of Title 22 Unrestricted Recycled water for non-potable use. Currently about 10 percent of the daily flow is diverted for reuse.

Recycled Water Pipes

The recycled water is distributed through a separate purple colored piping system. It is used by businesses and the City of Sunnyvale for landscape and golf course irrigation, and decorative ponds. By reusing water in this way, valuable potable (drinking) water is conserved. The rest of the tertiary effluent is discharged into the Guadalupe Slough, which flows to the Bay.

Effluent Discharge

San Francisco Bay supports both fresh and salt water plants and animals that require a delicate balance of fresh and salt water to survive. If too much fresh water from treatment is discharged into the Bay, it may upset the balance. That is one of the many reasons why it is important for people to reduce water usage.

GLOSSARY

AERATION – Process by which air is added to wastewater to raise its dissolved oxygen level

AIR FLOTATION TANKS – Tanks of wastewater into which compressed air and polymer are added to cause algae to form masses that float to the surface for easier removal

ALGAE – A microscopic green plant in water that provides oxygen through photosynthesis

ANAEROBIC DIGESTER – Tank in which anaerobic bacteria, which do not require oxygen, convert organic matter in sludge to a stable, relatively odor-free material

BIODEGRADE – Natural process through which matter decays

BIOSOLIDS – The organic solid product produced by wastewater treatment processes that can be beneficially recycled

CHLORINE CONTACT CHANNELS – Narrow concrete channels that detain the wastewater to allow sufficient time for adequate disinfection

COAGULATE – Chemical process that allows particles to congeal

DEWATERING BEDS – Slotted tile beds where water drains away from biosolids

DUAL MEDIA FILTERS – Layers of anthracite coal and sand supported on a bed of gravel through which wastewater percolates to remove solids

EFFLUENT – Wastewater treated for discharge

FIXED GROWTH REACTOR – Tanks containing honeycombed plates covered with nitrifying bacteria over which water is sprayed to allow the conversion of ammonia to nitrate

FLOCCULATE – Slow mixing process that binds particles together into a thickened mass

GRINDERS – Mechanical device used to reduce the size of debris as it enters the treatment plant to prevent fouling of pumps, pipelines, and conveyances

GRIT CHAMBERS – Tanks in which compressed air is added to the wastewater to decrease its density and cause primarily inorganic solids to sink to the bottom for removal

INDUSTRIAL WASTEWATER – Water requiring treatment at its source before discharge to municipal sewage collection systems

INFLUENT – Untreated wastewater entering the treatment plant from the sewer system

METHANE – Natural gas formed by the anaerobic degradation of organic wastes

MICROORGANISMS – Microscopic plants or animals such as algae, bacteria, fungi, protozoa, and viruses

NITRATE – (NO_3) Stable compound resulting from the oxidation of ammonia in the wastewater

NON-POTABLE WATER – Water not suitable for drinking

ORGANIC SOLIDS – Natural materials produced by plants and animals including humans

OXIDATION POND – Body of wastewater where oxygen is added to promote the growth of algae and microorganisms which consume solids and bionutrients

PERMIT – The government document allowing wastewater treatment plants to discharge effluent into receiving waters after achieving specific water quality standards and discharge limits

PHOTOSYNTHESIS – Process by which plants/algae convert carbon dioxide and water to oxygen in the presence of sunlight

POLLUTANT – Any substance in water that causes it to be impure

POLYMER– A long chain-like carbon compound used in the treatment of wastewater to bind algae and other organic particles into a mass for easier removal

PRIMARY – The first stage in the treatment process to remove solids

RECYCLED WATER – Tertiary treated wastewater diverted from discharge and treated for reuse in industrial processes, landscape irrigation, and other non-potable uses

SANITARY SEWER SYSTEM – The pipes that carry indoor wastewater to a treatment plant

SCUM – Lighter solids floating to the top of the sedimentation basins

SECONDARY – The second stage in the treatment process where oxygen is added to help remove remaining solids and bionutrients

SEDIMENTATION BASINS – Large tank for settling solid organic particles out of sewage

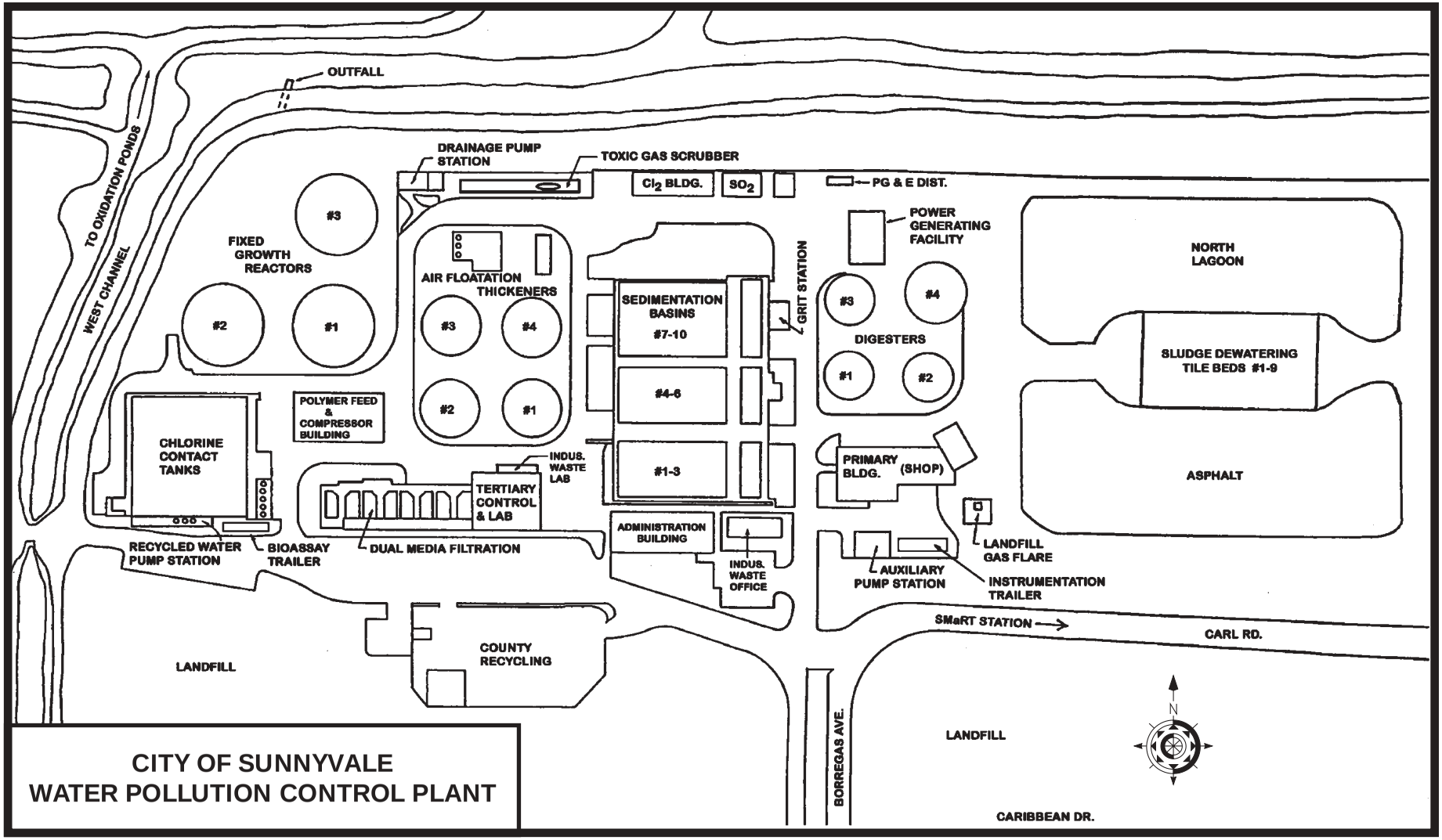
SEWER SERVICE FEES – Fees charged to users of wastewater systems to support services provided

SLUDGE – Accumulated solids in wastewater separated from liquids

STORM DRAINS – Pipes that carry untreated water runoff from outdoor surfaces directly to creeks and the Bay

TERTIARY – The third stage in the treatment process to remove ammonia, algae, and bacteria

WASTEWATER – Water containing dissolved or suspended matter after use that enters the sanitary sewer system



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