



LOS ANGELES COUNTY  
SANITATION DISTRICTS  
*Converting Waste Into Resources*

# A.K. WARREN

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## WATER RESOURCE FACILITY





*Overlooking primary treatment at the Warren Facility.*

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*Cryogenic facility with secondary treatment in the foreground.*

## INTRODUCTION

The Los Angeles County Sanitation Districts consist of 24 independent special districts serving about 5.5 million people in Los Angeles County. Their collective service area covers approximately 850 square miles and encompasses 78 cities and unincorporated areas in the County. This public agency provides environmentally sound, cost-effective wastewater treatment and solid waste management and, in doing so, converts waste into resources such as recycled water, energy, and recycled materials.

The Sanitation Districts operate 11 wastewater (sewage) treatment facilities. The largest of these is the A.K. Warren Water Resource Facility (Warren Facility). This facility serves 5 million people and can clean 400 million gallons of wastewater per day, making this one of the largest treatment facilities in the world.

The Warren Facility plays a critical role in protecting public health and our environment for much of Los Angeles County. The facility combines wastewater treatment with innovative resource recovery, intensive environmental monitoring programs, and a care for the surrounding community to create a state-of-the-art facility.



*Electricians maintain equipment at the Warren Facility.*





*Sanitation Districts in the Joint Outfall System.*

## JOINT OUTFALL SYSTEM

**S**eventeen of the sanitation districts in the metropolitan Los Angeles area are served by a regional, interconnected system of facilities known as the Joint Outfall System (JOS). This system spans from Long Beach to La Cañada-Flintridge and from the City of Los Angeles to Orange County. The JOS serves 5 million people in 73 cities and unincorporated territory, including small areas within the City of Los Angeles, Orange County and San Bernardino County. This system provides an efficient way to clean wastewater while maximizing the availability of recycled water.

The JOS has seven wastewater treatment plants and more than 1,200 miles of sewer. Six inland plants convert lower-salinity wastewater into high-quality recycled water that is safe for human contact and used to replenish groundwater and irrigate landscape, among other uses.

The remaining facility, the Warren Facility in Carson, treats higher-salinity wastewater along with the solids removed at the other six plants. The Warren Facility is the hub of the JOS and provides centralized processing of solids removed during wastewater treatment for all of the JOS plants, producing electricity and reusable biosolids in the process. The treated water from the Warren Facility is sent to the Pacific Ocean through a network of tunnels and outfall pipes that eventually extend approximately two miles off the Palos Verdes Peninsula to a depth of approximately 200 feet.

To reuse water from the Warren Facility, salinity must be removed using purification facilities. The Sanitation Districts and the Metropolitan Water District of Southern California are working to develop the Pure Water Southern California Program. This program would purify water to replenish local groundwater supplies and create a new source of water for 1.5 million people. This program is currently in the planning and environmental review phase.

# OUR MILESTONES

1925

## STARTING A LEGACY



Pictured here (left to right) are Assemblyman Hugh Pomeroy, County Supervisor R. F. McClellan, and A. K. Warren, the Sanitation Districts' first Chief Engineer. Mr. Warren played a critical role in the Sanitation Districts' history as he developed the vision for the agency's regional sewer system and sited the agency's first treatment plant. That plant was originally called the Joint Disposal Plant, later renamed the Joint Water Pollution Control Plant, and then renamed the A.K. Warren Water Resource Facility in honor of Mr. Warren's contributions to the agency.

1938

## EXPANDING TO THE PACIFIC



A six-mile tunnel from the Joint Disposal Plant to the Palos Verdes shoreline and a connecting outfall, extending offshore, have been completed. The plant utilizes primary treatment and the treated water is sent directly to the ocean. The Joint Disposal Plant is capable of handling 23 million gallons per day. Biogas from the digesters is used to generate all the power necessary to operate the plant.

1928

## TREATMENT BEGINS



The Joint Disposal Plant begins operation and is capable of treating 2 million gallons per day. The treated wastewater is sent to Bixby Slough. Reuse of biosolids begins when dried solids from the plant are sold as fertilizer.

1920

1930

1940

1950

**1970s**

## **PLANT AND OCEAN PROGRESS**



In 1972, the Clean Water Act is passed and attention is focused on further improving the environment. The Sanitation Districts boost ocean monitoring and research as well as investigate methods to improve treatment at the renamed Joint Water Pollution Control Plant. In the late 70s, discharge of suspended solids to the ocean is greatly reduced as advanced primary treatment begins and improved solids processing equipment is started up.

**1947-58**

## **POST-WAR BOOM**



As Los Angeles County undergoes rapid growth, so does the Joint Disposal Plant. The plant quadruples in size to handle the post-war industrial and population explosion. Another tunnel and two more ocean outfalls are built and the plant reaches a capacity of 225 million gallons per day.

**1978**

## **A GOOD NEIGHBOR**



The Sanitation Districts worked with residents in the local community around Joint Water Pollution Control Plant to form a Citizens Advisory Committee to address concerns about the treatment plant. Working with this committee created a positive relationship between the plant and its neighbors that continues today.

**1960**

**1970**

**1980**



**1983-86**

## **SECONDARY TREATMENT BEGINS**



Secondary treatment begins and provides greater removal of suspended organic material. This new system ramps up to 200 million gallons per day over a two-year time period.

**1994-2002**

## **SECONDARY TREATMENT EXPANDED**



The Sanitation Districts decide to expand secondary treatment to all facility flow (400 million gallons per day) in 1994. In 2002, the agency completed its largest single construction effort to date, on schedule and under budget.

**21<sup>ST</sup> CENTURY**

## **INCREASED FOCUS ON RESOURCE RECOVERY**

In 2014, the Sanitation Districts partnered with a private waste management company to develop a process for converting food waste into green energy using existing infrastructure at the Joint Water Pollution Control Plant. This program went fully operational in 2018 and is available to help local cities meet state organic recycling requirements.



**1990**

**2000**

**2010**

**2020**



*The Joint Disposal Plant in 1928 (left) and the Warren Facility today (right).*

## WASTEWATER TREATMENT

Nature has been purifying sewage since the beginning of time. Lakes, streams and rivers are the earth's purification system. Inspired by natural processes, the Sanitation Districts clean sewage through multiple steps in a fraction of the time required by nature.

At the Warren Facility, wastewater first flows through bar screens that remove large objects (Item 1 in the schematic on the opposite page). The removed objects are disposed in a landfill. The flow then goes into a grit chamber (Item 2) that removes abrasive materials (e.g., eggshells, sand and coffee grounds) that can damage treatment facility equipment. Each day, approximately 15 tons of grit settle to the bottom of these tanks and are disposed at a landfill. These bar screens and grit chambers provide "preliminary treatment."

The next step is primary treatment. To understand primary treatment, let's look at nature. When rain runoff enters a river, heavy particles settle to the bottom while lighter materials stay suspended and are carried away by the current. At the Warren Facility, long concrete tanks simulate natural processes found in a river (Item 3). The settled and floatable materials (primary sludge and skimmings) are pumped to digestion tanks for further treatment. The remaining wastewater contains mostly dissolved organic material and is sent to secondary treatment.

In nature, as water in a river flows downstream, naturally occurring microorganisms in the river feed on the dissolved organic material, which helps to clean the water. Oxygen from the air dissolves into water, providing fish with oxygen to breathe and helping aerobic microorganisms thrive.

At the Warren Facility, secondary treatment (Item 4) removes dissolved organic material using naturally occurring microorganisms, just like a river does. However, the Warren Facility process is supercharged by mixing pure oxygen into the wastewater within large, covered reactors.



The pure oxygen is produced by an on-site cryogenic oxygen generation system.

The microorganisms multiply as they feed on the organic materials. Most of the microorganisms are recycled to the front of the reactors for more feeding while the rest are sent to digesters for treatment.

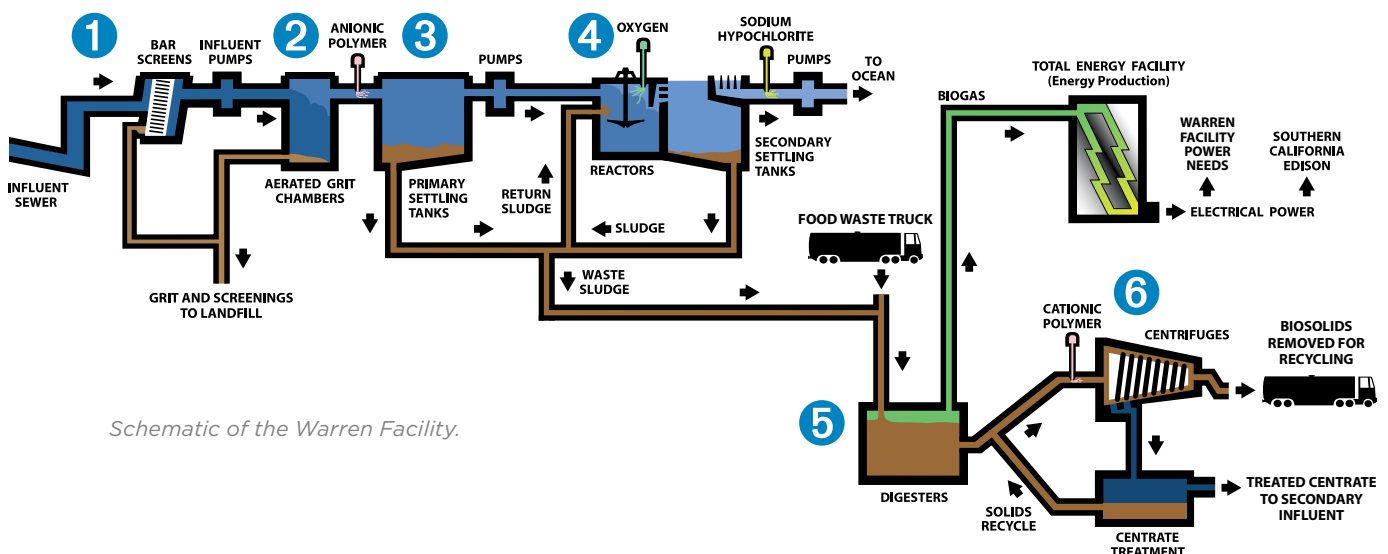
The water is then disinfected to kill bacteria and viruses for the protection of swimmers and sea life. Like swimming pools, chlorine is used to disinfect. This chlorine is consumed, or used up, before water is released to the environment. The water is now clean enough to meet permit requirements for release to the ocean and is not harmful to marine life.

The cleaned water is then carried in two 6-mile-long tunnels to White Point in San Pedro. There, the water goes into ocean outfalls. These are pipes on the bottom of the ocean that have outlets about 200 feet deep and 1.5 miles from the shoreline. These outfalls mix our cleaned water with ocean water at greater than 150 parts seawater to 1 part cleaned water.

The solids removed during primary and secondary treatment are sent to large, enclosed tanks called anaerobic digesters (Item 5). Here, anaerobic bacteria (bacteria that can live in an oxygen-free environment) feed on the organic material in the solids and produce a biogas consisting mostly of methane (natural gas). This process also mimics nature - the natural gas used by society comes from anaerobic bacteria in nature that feed on buried organic material.

After digestion is complete, the remaining solid material is pumped into centrifuges to remove as much water from the solids as possible (Item 6). Centrifuges work by spinning the solids/water mixture. The heavier solids compact on the wall of the centrifuge case and are conveyed outside of the centrifuge for collection, while the mostly solids-free liquid at the center of the case (called centrate) exits through piping. The solid material from the centrifuge is called biosolids, which are nutrient rich and can make great fertilizer.

Throughout the treatment facility, there are a variety of systems to control odors. All tanks with the potential for odor are covered. Air ducts are connected to these covered tanks and blowers pull a vacuum to move odorous air from the tanks to air treatment units like biofilters, biotrickling filters and granular activated carbon scrubbers.



*Schematic of the Warren Facility.*



*Total Energy Facility.*

## RESOURCE RECOVERY

**T**he Sanitation Districts have a long history of converting waste into resources that help society. In 1938, the biogas from the digesters was used to fuel internal combustion engines that created electricity and powered pumps. This system met all treatment facility power needs at that time. Today, the biogas is used to fuel an onsite power plant called the Total Energy Facility. Biogas is also created from food waste that is trucked to the site and digested with the solids removed during wastewater treatment. The Warren Facility now produces more energy than it needs and extra biogas is sold as fuel at a nearby vehicle fueling station. Any surplus electricity is sold to the local power company.

The Sanitation Districts have long been innovators in biosolids management. Reuse of biosolids began in 1928 when Kellogg Supply Inc. collected dried biosolids from the treatment facility and sold the dried biosolids as fertilizer. Today, the reuse of biosolids has expanded to include multiple practices that are located offsite, alleviating our neighbors' odor concerns. Warren Facility biosolids are currently composted and distributed as soil amendment, applied to agricultural land to improve the soil for farming, and disposed at landfills in Southern California and the Central Valley of California. In addition, the Sanitation Districts own and operate a composting facility and farm in the Central Valley and are co-owners of a second composting facility in Rancho Cucamonga, California. Both facilities process biosolids into compost. The Sanitation Districts continually evaluate new biosolids reuse technologies in an ongoing effort to cost effectively convert waste into resources.





*Biogas from the Warren Facility helps supply this CNG filling station.*



*Finished compost at Tulare Lake Compost.*



*Divers inspect an ocean outfall pipe.*

## OCEAN MONITORING

Since 1970, the Sanitation Districts have conducted an expanded ocean monitoring and research program to ensure protection of public health and the environment. The primary program objectives are to understand how the cleaned water from the Warren Plant affects the ocean and measure natural variations. This program includes biological, chemical and oceanographic studies in the coastal habitats off Palos Verdes as well as sophisticated laboratory analyses of samples collected and written reports of findings.

In the inshore reefs, Sanitation Districts' biologists conduct scuba dive surveys to study the diverse communities of the kelp forests and rocky reefs. Offshore, the fish and invertebrate communities who live near and within the seafloor sediments are studied, and pollutant levels in the sediments and their tissues are monitored. Sanitation Districts' scientists regularly measure the levels of bacteria in the ocean near the shoreline to ensure that all public health standards for swimming and shellfish harvesting are met. The patterns of water movement are studied to better understand the dynamic environment in which our clean water is discharged. Annually, divers and a remotely operated vehicle inspect the Sanitation Districts' ocean outfall system to monitor structural integrity and effective operation.

To do this work, the Sanitation Districts use a variety of research vessels, including the Ocean Sentinel (a 66-foot ocean research vessel) and a remotely operated vehicle.

In addition to their own monitoring and research efforts near Palos Verdes, the Sanitation Districts have contributed to collaborative regional monitoring and research studies across the entire Southern California coast since 1994. These regional surveys help us understand how Palos Verdes coastal habitats compare to those across Southern California.





*Crew brings up samples from the ocean floor (left) and laboratory staff analyzes samples (right)*

Actions taken by the Sanitation Districts, including improved treatment at the Warren Facility, have resulted in marked improvements in environmental conditions off Palos Verdes since the 1970s. Kelp forests in the area, absent prior to 1974, are now some of the healthiest and largest in the entire Southern California region. The fish community has recovered to its natural state and is as healthy as communities living elsewhere along the Southern California coast. Chemicals such as DDT and PCB from various sources had contaminated the ocean sediment over 50 years ago and have declined significantly, further contributing to the improvement in ocean conditions.

In summary, local ocean water quality has improved dramatically since the early 1970s. The Sanitation Districts will continue their ocean monitoring and research program to make sure that the ocean stays healthy.



*Overlooking the beach at White Point in Palos Verdes.*





*Staff gives a tour of Bixby Marshland.*

## BEING A GOOD NEIGHBOR

**T**he Sanitation Districts have a long history of working with and giving back to the community around the Warren Facility. In 1978, a Citizens Advisory Committee (CAC) was formed to discuss odor and dust problems associated with facility operations. The CAC is a group of neighbors who reside around the Warren Facility and represents more than 20,000 homes within a two-mile radius of the facility. The CAC meets with Sanitation Districts' staff quarterly to discuss issues concerning the Warren Facility and the surrounding community. Input from the CAC has helped to guide the Sanitation Districts in tailoring their operations and community enhancement programs to make the facility a better neighbor.

With help from the CAC, the Sanitation Districts look for ways to serve the community. One way to accomplish this is to allow buffer lands around the Warren Facility to be developed into uses that will benefit the neighbors. The Wilmington Boys and Girls Club was built on facility buffer land, as was the Wilmington Athletic Complex. Both facilities provide recreational opportunities for the neighborhoods around the facility. In addition, the Sanitation Districts worked with the City of Carson to facilitate the development of facility buffer property into a commercial shopping center that serves the local community. The Sanitation Districts improved a 17-acre marshland located on facility property. The marsh is open on the first Saturday of the month or by appointment for the public to enjoy. To enhance community aesthetics, the Sanitation Districts improved the grounds surrounding the Warren Facility. Landscaping is used to screen the facility along public travel routes. Sidewalks have been installed along portions of the facility perimeter and around the Wilmington Athletic Complex, along with parkway planting strips, to beautify the area.

Extensive odor and dust control measures have been implemented to reduce the impact of the Warren Facility's operations on the neighbors. A 24-hour telephone hotline provides a convenient way to report any concerns. The Sanitation Districts continue to work with the CAC and the surrounding community to be a good neighbor.





*Softball practice (left) and an AYSO Soccer game (right) at Wilmington Athletic Complex.*



*Residents participate in a tour of the Warren Facility.*



*A Citizens Advisory Committee meeting in 2023.*



# SUMMARY

The Warren Facility plays a critical role in the Sanitation Districts' sewer system, which serves 5 million people. Since the facility began operating in 1928, the facility has expanded and evolved to help meet the region's needs while being a good neighbor. In addition to protecting public health and the environment, the facility helps the region be more sustainable by converting waste into resources.











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