Seawater Desalination The Carlsbad Desalination Project

The power plant’s cooling water pumps will remain in service while Poseidon installs and commissions the new intake pumps.

The Pipeline
A 10-mile pipeline delivers water from the desalination plant to the Water Authority’s Second Aqueduct. The Water Authority owns the pipeline, which cost an estimated $1.59 million. Pipeline installation began in spring 2013 in San Marcos, then expanded to include work in the neighboring city of Vista and in Carlsbad, home to the largest portion of the pipeline.

The Second Aqueduct conveys desalinated water to the Water Authority’s Twin Oaks Valley Water Treatment Plant north of San Marcos, where it is mixed with existing drinking water supplies for regional distribution.

Water Authority Improvements
To integrate desalinated water into the regional water delivery system, the Water Authority made several upgrades to its existing conveyance system and the Twin Oaks plant. A five-mile section of Pipeline 3 (part of the Second Aqueduct) was relined to accommodate increased water pressures (part of the Second Aqueduct) was relined to accommodate increased water pressures.

The new pipeline is part of the Water Authority’s overall Water Supply Diversification initiative, a multi-decade water supply diversification plan, major infrastructure investments and forward-thinking policies that promote fiscal and environmental responsibility. A public agency created in 1944, the Water Authority delivers wholesale water supplies to 24 retail water providers, including cities, special districts and a military base.

Suppliers
Water from the Twin Oaks desalination plant, which meets approximately 10 percent of the region’s water demand, is pumped through a pipeline and improvements to Water Authority facilities for distribution to the regional water delivery system, the Water Authority’s Twin Oaks Valley Water Treatment Plant north of San Marcos, where it is mixed with existing drinking water supplies for regional distribution.

Economic Benefits
During construction, the Carlsbad Desalination Project supported an estimated 2,500 indirect jobs now that it is operational. Poseidon also is restoring 66 acres of wetlands in San Diego Bay. The project involves excavating and grading a former salt pond to create a mosaic of coastal habitats beneficial for a variety of fish and bird species, along with recreational trails. In addition, Poseidon is preserving the 400-acre Agua Hedionda Lagoon by assuming responsibility for the continued stewardship of the lagoon and restoration of 37 acres of wetland habitat.

Environmental Enhancements
The Carlsbad Desalination Project meets rigorous environmental standards set by state and local agencies, including the California Coastal Commission. By boosting the project’s energy efficiency, offsetting greenhouse gas emissions and enhancing coastal habitat, the project is among the most environmentally friendly projects of its kind in the world.

Poseidon’s Climate Action Plan calls for the plant to be net carbon neutral over 30 years by offsetting greenhouse gas emissions from project operations. It is the first major California infrastructure project to eliminate its carbon footprint. This has been done through the purchase of carbon offsets and energy recovery technology at the desalination plant. Energy recovery devices are saving an estimated 116 million kilowatt-hours of energy per year, reducing CO₂ emissions by 42,000 metric tons annually — roughly equivalent to the annual greenhouse gas emissions from 9,000 passenger vehicles.

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Economic Benefits
During construction, the Carlsbad Desalination Project supported an estimated 2,500 jobs and infused an estimated $350 million into the local economy. The plant supports approximately 36 full-time employees and 124 indirect jobs now that it is operational. Poseidon also anticipates $45 million in direct annual spending related to plant operations throughout the region.

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Seawater Desalination - The Carlsbad Desalination Project

The San Diego County Water Authority and Poseidon Water dedicated the Claude “Bud” Lewis Carlsbad Desalination Plant on Dec. 14, 2015, joined by more than 500 dignitaries and supporters from across California. The plant produces up to 54 million gallons per day of locally controlled water for San Diego County, helping to minimize the region’s vulnerability to statewide drought conditions. It is part of a $1 billion project that includes the nation’s largest and most technologically advanced and energy-efficient seawater desalination plant, a 10-mile large-diameter pipeline and improvements to Water Authority facilities for distributing desalinated seawater throughout San Diego County.

The plant meets approximately 10 percent of the region’s water demand — about one third of all the water generated in the country. This water supply and its cost are combined with the Water Authority’s other supplies serving 24 local water agencies, 3.3 million people and a $245 billion regional economy.

The plant delivers several environmental benefits by using cutting-edge technology to capture energy from the desalination process, offsetting carbon emissions and developing extensive wetlands to enhance fish populations along the San Diego County coastline. The entire project was developed through a rigorous environmental permitting process, and the project’s environmental compliance was upheld through 14 legal challenges. Poseidon Water, a private, investor-owned company, developed and owns the project. A joint venture of Kiewit Infrastructure West and J.F. Shea Construction, Inc., designed and constructed the desalination plant and pipeline. IDE Technologies, a world leader in desalination technology and operations, engineered the plant’s desalination process and related equipment. IDE also operates the plant under a 30-year contract with Poseidon.

Project Background
For more than two decades, the Water Authority has viewed seawater desalination as an important part of a diversified water supply portfolio that also includes potable reuse, recycled water, groundwater, independent transfers from across California. The project was developed through a rigorous environmental permitting process, and the project’s environmental compliance was upheld through 14 legal challenges. Poseidon Water, a private, investor-owned company, developed and owns the project. A joint venture of Kiewit Infrastructure West and J.F. Shea Construction, Inc.

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The Claude “Bud” Lewis Carlsbad Desalination Plant was 2.5 single-family homes, enough to supply 325,900 gallons, or 82 percent of respondents saying it is important for the reliability of the water supply.

### The Water Purchase Agreement

The Water Authority’s goal during the negotiations was to assign appropriate risks to Poseidon while keeping costs for water rate-payers as low as possible. After more than 40 public meetings about the project, the Board of Directors on Nov. 29, 2012, voted to approve a contract with Poseidon for the purchase of between 48,000 acre-feet and 56,000 acre-feet of desalinated seawater per year for 30 years. That’s enough water for approximately 400,000 people each year.

The purchase agreement transferred to Poseidon and its investors the risks associated with design, construction and operation of the desalination plant. It also transferred risks associated with the design and construction of the pipeline to deliver the desalinated water from the plant to the Water Authority’s Second Aqueduct in San Marcos.

The Water Authority has the option, but not the obligation, to buy the project starting in 2026. In 2046, the Water Authority has the right, but not the obligation, to purchase the desalination plant for $1. That would provide for public ownership of the plant, intake and discharge facilities, and rights to the long-term lease with NRG, which owns the plant site.

### Financing Terms

After the Water Purchase Agreement was signed, the Water Authority teamed with Poseidon to secure financing for the desalination plant and pipeline via tax-exempt construction bonds. Financing closed in December 2012 at a favorable interest rate, bringing financing costs $200 million below the Water Authority’s projections. The Carlsbad Desalination Project was honored as the “North American Water Deal of the Year” for 2012 by Project Finance, the publisher of periodicals for the international water industry.

### Water Purchase Price

Based on current electricity cost estimates, the Water Purchase Agreement sets the price of water at $2,513 to $2,796 per acre-foot in fiscal year 2020, depending on how much is purchased. This includes the cost to convey desalinated water from the plant to the Water Authority’s system. The first 48,000 acre-feet of water purchased each year will pay for the fixed costs of the project and the variable costs of water production. The Water Authority has the option to purchase an additional 8,000 acre-feet per year at a lower rate that reflects only the variable costs of incremental water production.

Typical monthly costs are about $5 per household, at the low end of the Water Authority’s 2012 forecast.

The Water Purchase Agreement allows for annual price increases for inflation estimated to average 2.5 percent per year. This compares favorably to the average compound annual increase of more than 6 percent in imported treated water rates imposed by the Metropolitan Water District of Southern California over the past ten years. In addition, Poseidon will be allowed to increase its price to accommodate changes in law or regulations that generally apply industry-wide to water treatment facilities or wastewater dischargers. These cumulative increases are capped at 30 percent over the 30-year term of the agreement.

### The Plant and Desalination Process

The desalination plant sits on about six acres of public utility zoned land next to NRG’s Encina Power Station on Agua Hedionda Lagoon in Carlsbad. It cost an estimated $537 million.

The heart of the desalination plant is a reverse-osmosis system designed by IDE Technologies. Ocean water is pumped to the desalination plant, where it undergoes a sand/anthracite filtration process to remove suspended particles from the water. Then, the water is pumped through reverse-osmosis membranes that remove salts and other dissolved particles. Essential minerals are added back into the water before it is piped to the Water Authority’s aqueduct as drinking water.

On December 12, 2018, the Encina Power Station ceased power production and was replaced by a power plant set back from the coastline. Because the plant is no longer operating its cooling water system for power production, the construction of new intake and discharge facilities is necessary to allow a transition to “stand-alone” operation of the desalination plant.

### Desalination Plant Earns Top Honors

- The Claude “Bud” Lewis Carlsbad Desalination Plant was honored with a Global Water Award as the Desalination Plant of the Year for 2016 by Global Water Intelligence, publisher of periodicals for the international water industry. The award was given to “the desalination plant, commissioned during 2015, that represents the most impressive technical or ecologically sustainable achievement in the industry.”

- The Water Authority was recognized in 2017 by the nation’s largest statewide coalition of water agencies for innovation and excellence in water resources management with its addition of supplies from the Carlsbad Desalination Project. The Clair A. Hill Water Agency Award for Excellence, presented by the Association of California Water Agencies, has been awarded annually since 1988 to exemplary programs developed by ACWA member agencies for managing and protecting water supplies in California.