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# Key Issues in Seawater Desalination in California: Proposed Seawater Desalination Facilities

Heather Cooley and Kristina Donnelly  
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## Proposed Seawater Desalination Facilities in California

Interest in seawater desalination remains high in California. In 2006, there were 21 active seawater desalination proposals along the California coast, which are described in Cooley et al. (2006). Since that time, only one project – a small plant in Sand City – has been permitted and built. Another – the Carlsbad Seawater Desalination Plant – has secured all of the necessary federal, state, and local permits, although project financing and contracting details remain uncertain. While some industry experts have noted the “sluggish pace of development in California and the rest of the US” (Pankratz 2009), others contend that the situation in California is not so dire, as evidenced by the many agencies that continue to conduct technical and environmental studies and pilot projects to determine whether to develop full-scale facilities.

This short white paper provides an update of the proposed seawater desalination plants in California. As of July 2012, there are 17 seawater desalination plants proposed for development along the California coast (Table 1). Two additional plants that would provide water to southern California residents are also under consideration in Baja Mexico. The total combined capacity of the proposed plants ranges from 390 to 570 million gallons per day (MGD), which is about 50 MGD more than was proposed in 2006. If all of these plants were built and fully utilized, seawater desalination would supply 5% to 7% of average urban water demand in California between 2000 and 2005. Some of the plants under consideration are the same, or similar, to those proposed in 2006. Others, including plants in Long Beach and in Crockett, are no longer under consideration. Still others are entirely new proposals. In the following section, we summarize the major proposed projects and their status as of mid-2012. Note that details on each plant can change rapidly, and readers interested in the status of specific plants should seek more up-to-date information.

Table 1. Proposed Desalination Plants in California, Summer 2012

Project Partners	Location	Capacity (MGD)	Intake	Brine Discharge
East Bay Municipal Utilities District/San Francisco Public Utilities Commission/Contra Costa Water District/Santa Clara Valley Water District/Zone 7 Water Agency	Pittsburg	19.2 to 19.8	Surface	Undetermined but may be mixed with wastewater
California Water Service Company	Not known	5	Undetermined	Undetermined
City of Santa Cruz/Soquel Creek Water District	Santa Cruz	2.5, possible expansion to 4.5	Evaluating both surface and subsurface	Mixed with wastewater
DeepWater, LLC	Moss Landing	25	Surface	Mixed with cooling water
The People's Moss Landing Water Desal Project	Moss Landing	10	Surface	Surface
California American Water	North Marina	5.4 to 9.0	Subsurface	Surface
Ocean View Plaza	Monterey	0.25	Subsurface	Surface
Monterey Peninsula Water Management District	Del Monte Beach, Monterey	2	Undetermined	Undetermined
Seawater Desalination Vessel	Monterey Bay	10 to 20	Surface	Surface
Cambria Community Services District/U.S. Army Corps of Engineers	Cambria	0.6	Subsurface	Subsurface
Arroyo Grande/Grover Beach/Oceano Community Services District	Oceano	2	Subsurface	Mixed with wastewater
West Basin Municipal Water District	El Segundo	18	Evaluating both surface and subsurface	Surface
Poseidon Resources	Huntington Beach	50	Surface	Surface
Municipal Water District of Orange County, Laguna Beach County Water District, Moulton Niguel Water District, City of San Clemente, City of San Juan Capistrano, South Coast Water District	Dana Point	15	Subsurface	Mixed with wastewater
City of Oceanside	City of Oceanside	5 to 10	Subsurface	Undetermined
Poseidon Resources/San Diego County Water Authority	Carlsbad	50	Surface	Surface
San Diego County Water Authority	Camp Pendleton	50, expanding to 150	Evaluating both surface and subsurface	Surface
NSC Agua	Rosarito, Mexico	100	Undetermined	Undetermined
San Diego County Water Authority	Rosarito, Mexico	25, possible expansion to 75	Undetermined	Undetermined

## Northern California

In 2006, there were four active desalination proposals in northern California – three for municipal supply and one for industrial purposes. Today, there are only two active proposals. Previously proposed projects, including in Marin and in Montara, are no longer under consideration due to reduced demand for water following the drought and economic recession and the high cost of desalination. The remaining proposed projects, including a regional facility that is considerably smaller than was originally proposed, are described in more detail in the following section.

### **East Bay Municipal Utilities District, Contra Costa Water District, San Francisco Public Utilities Commission, Santa Clara Valley Water District, Zone 7 Water Agency**

Estimated Completion Date: 2020

Five water agencies in the San Francisco Bay area are jointly developing a desalination project. These agencies include Contra Costa Water District (CCWD); East Bay Municipal Utility District (EBMUD); San Francisco Public Utilities Commission (SFPUC); Santa Clara Valley Water District (SCVWD); and Zone 7 Water Agency. Between 2003 and 2006, the agencies completed both a pre-feasibility and a feasibility study, concluding that Contra Costa County would be the best location for a brackish water desalination facility. The agencies built a 72,000 gallon-per-day (gpd) pilot facility in 2008 at the Mallard Slough Pump Station in Pittsburg. The pilot project evaluated two alternatives and concluded that a facility that would produce 19.2 to 19.8 million gallons per day (MGD) would cost about \$168.5 million. Annual operation and maintenance (O&M) costs would be about \$10.45 million, and the cost of the produced water is estimated at \$550 per acre-foot (MWH 2010). This is considerably less than water from a typical seawater desalination plant because this facility would treat brackish water.

Several options for the proposed facility are currently being evaluated. The facility would withdraw water from the Sacramento-San Joaquin Delta through Contra Costa Water District's existing Mallard Slough Pump Station.<sup>1</sup> A number of brine disposal options are under consideration, including blending it with treated wastewater from a nearby facility. The project partners are working on a site-specific analysis, which includes modeling of fisheries and brine discharge, a greenhouse gas reduction analysis, and an outreach strategy. It is anticipated that this work will be completed by the end of 2012, with a final report published in February or March 2013. Depending on the results of the study, the next step would be to conduct an environmental impact review (Abdullah 2012).

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<sup>1</sup> A previous version of this report mistakenly stated that the desalination plant might withdraw water from a nearby power plant cooling water intake. This version of the report corrects that error.

## **California Water Service Company**

Estimated Completion Date: 2025

The California Water Service Company (Cal Water) is considering a desalination facility to treat either brackish groundwater or water from the San Francisco Bay.<sup>2</sup> The proposed plant would produce up to 5 MGD of freshwater. In order to conduct a more detailed feasibility study for this project, Cal Water must obtain approval from the California Public Utilities Commission, which would not occur until at least 2013. Although Cal Water is not aggressively pursuing the project at this time, they are moving forward on the discussion as part of their long-term planning (California Water Service Company 2011). The earliest a project would come online would be 2025.

## **Central California**

In 2006, there were nine separate proposals for desalination plants along the central California coast. Only one of those plants – a small facility in Sand City – has been built. Interest in seawater desalination, however, remains high in the region. Today, there are nine proposed projects in central California. Concerns about drought and water-supply constraints are prevalent in the region, and in some cases, growth moratoriums have been instituted. The total capacity of the proposed plants ranges from 58 MGD to 73 MGD, but the size of individual proposed plants ranges from less than 0.3 MGD to 20 MGD. Five of the nine proposed plants are fully or partly supported by private companies. Proposed plants are described in more detail in the following section.

### **City of Santa Cruz/Soquel Creek Water District**

Estimated Completion Date: 2016

The City of Santa Cruz Water Department and Soquel Creek Water District are proposing to build a desalination project in Santa Cruz, referred to as the scwd<sup>2</sup> Regional Seawater Desalination Project. The desalination plant, with a capacity of up to 2.5 MGD, is expected to run at half capacity in non-drought years and at full capacity during drought periods. The estimated cost of the project is \$115 million, which includes a 30% contingency. Intake design remains uncertain, although the project proponents are considering either an open ocean intake, subsurface intake using slant wells, or an infiltration gallery. Brine would be discharged through existing wastewater outfalls (scwd2 2012). The project partners operated a pilot plant at the University of California Santa Cruz Long Marine Laboratory from March 2008 to April 2009 (scwd2 2011). A draft Environmental Impact Report (EIR) is expected to be released in fall 2012 for public review and comment. Public concerns have been expressed over the energy use and the overall cost of the project compared to other alternatives (White 2011). In March 2012, the City of Santa Cruz adopted an ordinance that requires voter approval prior to construction of the plant.

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<sup>2</sup> A previous version of this report mistakenly stated that water would be withdrawn from the Monterey Bay. This version of the report corrects that error.

## **DeepWater Desal, LLC**

Estimated Completion Date: 2015

DeepWater Desal, LLC is proposing to build a 25 MGD desalination facility at Capuerro Ranch, near Moss Landing. Seawater would be withdrawn through a surface intake from a deep sea location near Moss Landing, and the brine would be mixed with cooling water from the Moss Landing power plant and discharged through the power plant's outfall. The cost to build the project is estimated at \$350 million, which the project partners hope to finance using tax-free municipal bonds. The cost to produce and distribute water from the desalination plant to communities in Santa Cruz, San Benito, and Monterey Counties is estimated at \$2,100 per acre-foot (Deepwater Desal, LLC 2011).

## **The People's Moss Landing Water Desal Project**

Estimated Completion Date: 2015

Nader Agha, a wealthy businessman, is proposing to build a 10 MGD desalination facility adjacent to the Moss Landing Power Plant (Abraham and Rubin 2011). The project would use existing surface intake and outfall structures, and would include a 6 MW solar energy system. The project cost is estimated at \$129 million. The unit cost of water is estimated at \$1,317 per acre-foot. In April 2012, the Pacific Grove City Council agreed to serve as lead agency for the project (The People's Moss Landing Water Desal Project 2012).

## **California American Water**

Estimate Completion Date: 2016

California American Water (Cal Am) is proposing to build a 5.4 - 9.0 MGD desalination plant in North Marina. The desalination facility would withdraw seawater using subsurface slant wells. The water provided by the desalination facility would offset water diversions from the Carmel River to comply with state-ordered pumping reductions. The desalination facility and related infrastructure are projected to cost between \$320 million and \$370 million (in 2012 dollars), depending on the size of the facility. Estimated O&M costs are \$9.9 million to \$12.7 million per year (in 2012 dollars) (California-American Water Company 2012).

## **Ocean View Plaza**

Estimated Completion Date: 2015

Developers of Ocean View Plaza, a mixed-use development along Cannery Row in Monterey, are proposing to build a 250,000-gpd desalination facility to provide water to businesses and residents in the development. The desalination plant would use a subsurface intake (with an emergency open-ocean intake) and an above-surface outfall to discharge brine. In August 2008, the California Coastal Commission approved, with conditions, the Coastal Development Permit (California Coastal Commission 2008), although funding has not yet been secured.

## **Monterey Peninsula Water Management District**

Estimated Completion Date: Not Known

The Monterey Peninsula Water Management District (MPWMD) is considering building a desalination facility at an abandoned treatment plant on U.S. Navy property at Del Monte Beach in Monterey. Constructing a desalination facility at this location has been discussed periodically for decades. A special workshop in August 2011 discussed the prospect of building a 2 MGD facility at the Navy property (MPWMD 2011). MPWMD has determined that the Navy site is the only feasible location for a facility within their service area, and staff indicated they will include a feasibility analysis of intake and discharge options in their Fiscal Year 2012-13 budget. The District is now waiting for Navy officials to decide whether and how they would enter into an arrangement for a desalination facility on their property (Hampson 2012).

## **Seawater Desalination Vessel**

Estimated Completion Date: Unknown

The Water Standard Company is a private company that designs and constructs ocean-going ships that have a self-contained seawater desalination plant – the Seawater Desalination Vessel (SDV) – and is seeking partners along the central California coast. The SDV would desalinate water offshore and transport water to coastal communities using a barge. The plant would use an open-ocean intake although it can purportedly move to less productive areas to minimize impingement and entrainment impacts. The Water Standard Company reports that the SDV could potentially deliver up to 200 MGD of drinking water. An analysis commissioned by the Monterey Peninsula Water Management District estimates that the capital cost of a 10-20 MGD project would be \$185 million and have an annual O&M cost of \$21 million. The unit cost of water is estimated at \$1,600 to \$1,800 per acre-foot (GEI/Bookman Edmonston et al. 2008). Although some agencies have expressed interest in the project, the project has not been endorsed by agencies in the area.

## **Cambria Community Services District/U.S. Army Corps of Engineers**

Estimated Completion Date: Unknown

The Cambria Community Services District (CCSD) provides water and wastewater services to residents and businesses in Cambria, a coastal community of about 6,000 people in San Luis Obispo County. CCSD first proposed a desalination facility in the early 1990s and completed an Environmental Impact Report and several other design analyses. Their 2008 Water Master Plan recommended pursuing a desalination option and examined different size options (Kennedy/Jenks Consultants 2004). Desalination costs are estimated at \$16.4 million (in 2012 dollars). A renewable energy system would cost an additional \$3.7 million. The desalination plant is not expected to run all year but would produce around 600 acre-feet per year during a typical dry season, equivalent to an average of 0.6 MGD (CCSD n.d.). Although the project has not been fully designed, most of the analyses suggest that the desalination plant would use subsurface intakes and a subsurface exfiltration gallery for brine discharge.

Cambria received a \$10.3 million Federal Water Resources Development Act (WRDA) authorization for its desalination project. The WRDA program is administered by the Army Corps and requires that the Army Corps take the lead on project development. In 2006, CCSD

and the Army Corps entered into a cooperative agreement for the design and construction of the desalination facility. The Army Corps of Engineers is in the process of developing an Environmental Impact Statement and Environmental Impact Report for various water supply options, including desalination (Tanner 2012).

### **Arroyo Grande/Grover Beach/Oceano Community Services District**

Estimated Completion Date: at least 2016

The project partners are proposing to build a 2 MGD desalination plant in Oceano at the site of the South San Luis Obispo County Sanitation District wastewater treatment plant. The proposed plant would withdraw seawater from a series of subsurface wells on or near the beach and mix the brine with wastewater prior to discharge. The first feasibility study for desalination in San Luis Obispo County was conducted in 2006, and a detailed cost evaluation was completed in 2008. The capital costs for the project are estimated to be \$37.5 million, with an additional \$4.5 million in O&M costs each year (Wallace Group 2008).

## **Southern California/Mexico**

In 2006, there were eight desalination plants proposed in southern California. Today, there are six proposed plants in southern California and two in Mexico. All would provide water to residents in southern California. Although central California continues to have a larger number of proposed plants, the plants in southern California are considerably bigger. The total combined capacity of the proposed plants in southern California ranges from 310 MGD to 470 MGD, four-to-eight times greater than in central California. About half of the proposed plants are fully or partly supported by private companies. Details on the proposed plants are described in the following section.

### **West Basin Municipal Water District**

Estimated Completion Date: 2017

West Basin Municipal Water District (West Basin) is seeking to develop a seawater desalination facility. Between 2002 and 2008, West Basin operated a 14,000 gpd desalination pilot facility at the El Segundo Power Plant (West Basin Municipal Water District 2010). In November 2010, West Basin opened a 50,000 gpd demonstration facility in Redondo Beach to conduct research and develop data for the permitting, design, construction, and operation of a full-scale facility. A full-scale facility, if constructed, would produce up to 18 MGD and could be operational as soon as 2017 (RMC Water and Environment 2011). West Basin is currently developing a desalination master plan to evaluate siting options for a full-scale facility (RMC Water and Environment 2011).

### **Poseidon Resources (Huntington Beach)**

Estimated Completion Date: 2013

Poseidon Resources is proposing to build a 50 MGD desalination plant near the AES Power Plant in Huntington Beach. The proposed desalination facility would withdraw seawater directly from the power plant's surface water intake, bypassing the power plant entirely. The Huntington

Beach City Council denied certification of the EIR in 2003. An updated EIR was narrowly approved (4-3 vote) by the City Council in 2005 and again in May 2010 when it was altered to reflect changes to the project design (Dudek 2010). Poseidon has received several permits for the plant, but has not yet received approval from the California Coastal Commission. Poseidon has not yet established water purchase agreements with local water agencies (Gerda 2011), although once these are secured, the company will seek financing for the project.

### **The South Orange Coastal Ocean Desalination Project**

Estimated Completion Date: 2020

The Municipal Water District of Orange County (MWDOC), in partnership with Laguna Beach County Water District (LBCWD); Moulton Niguel Water District (MNWD); City of San Clemente; City of San Juan Capistrano; and the South Coast Water District (SCWD), are proposing to build a 15 MGD desalination facility in Dana Point – referred to as the South Orange Coastal Ocean Desalination Project. Feasibility studies have been ongoing since 2002, including a pilot plant that operated until May 2012. Although the project design elements have not been finalized, the feasibility studies have been focused on using subsurface slant wells and mixing the brine with treated wastewater from the South Orange County Wastewater Authority treatment plant in Dana Point and discharging it through existing outfall structures (Seckel 2008). The estimated project construction costs are \$175 million, and the unit cost of water is estimated at \$1,300 per acre-foot (MWDOC n.d.).

### **City of Oceanside**

Estimated Completion Date: 2020

The City of Oceanside operates the Mission Basin Groundwater Purification Facility (MBGPF), which produces 6.4 MGD of desalinated groundwater. The City is considering expanding this facility to include a seawater desalination component, where seawater would be extracted from wells near the mouth of the San Luis Rey River and treated at the MBGPF site. The capacity of the seawater desalination facility would range from 5 to 10 MGD. A pilot plant was built at the site, and a preliminary feasibility study was completed in October 2010. A more comprehensive feasibility study is expected in 2013, although the plant would likely not begin operation until 2020 (Infrastructure Engineering Corporation 2011; Dafforn 2012).

### **Poseidon Resources/San Diego County Water Authority (Carlsbad)**

Estimated Completion Date: 2014-2016

Poseidon Resources is proposing to build a 50 MGD desalination facility at the Encina Power Station in the City of Carlsbad. The project would utilize the Encina Power Station's existing surface intake and outfalls. Poseidon Resources began working on the project in 1998 and in 2003 constructed a demonstration facility at the site (Poseidon Resources n.d.). The facility was approved by the California Coastal Commission in 2008 (Perry 2008) and by the San Diego Regional Water Quality Control Board in 2009 (Perry 2009). Construction began in November 2009 in order to ensure an existing California Coastal Commission permit would not expire, though no progress has been made since then (Fikes 2010). The project has been highly contested, with local and environmental groups filing more than a dozen legal challenges, including lawsuits and permit appeals, against the project.

By early 2011, Poseidon had negotiated 30-year contracts for long-term, fixed-price water purchase with the City of Carlsbad and eight other local water agencies. However, the water districts waived these agreements to allow the San Diego County Water Authority (SDCWA), a regional wholesaler, to negotiate price and delivery requirements with Poseidon (Rosenfeld 2011). SDCWA expects to present its final agreement by summer 2012. As of June 2012, total capital costs for the project, including financing costs, range from \$870 million to \$970 million; O&M costs are estimated at \$49 million to \$56 million per year. The unit cost of water, including conveyance costs and associated district improvements, would range from \$2,062 to \$2,329 per acre-foot (SDCWA 2012).

### **San Diego County Water Authority (Camp Pendleton)**

Estimated Completion Date: 2020

The San Diego County Water Authority (SDCWA) is proposing to build a desalination facility at Camp Pendleton. The proposed plant would have a capacity of 50 MGD and a planned expansion to 150 MGD. The facility was initially proposed to be co-located with the San Onofre Nuclear Generating Station; however, there were public perception issues associated with the nuclear facility and concerns about the compatibility with power plant operations. A 2009 feasibility study identified two alternative sites and a variety of configurations, including a surface intake, subsurface intake, and a co-generation facility to provide electricity for the desalination plant. The facility would use either an open-ocean or subsurface intake, and brine would be discharged using a surface water diffuser. According to the feasibility study, construction costs would range from \$1.3 to \$1.9 billion, and the O&M costs would range from \$45 million to \$157 million per year. These cost estimates include the intake facility, desalination plant, and conveyance facilities needed to transport desalinated water 19 miles to the SDCWA distribution system (RBF Consulting 2009). The unit cost of water is estimated to range from \$1,900 to \$2,340 per acre-foot (SDCWA 2012). SDCWA is currently conducting technical studies, which are expected to be completed by October 2012.

### **San Diego County Water Authority, Metropolitan Water District, Southern Nevada Water Authority, Central Arizona Water Conservation District, Republic of Mexico**

Estimated Completion Date: 2020

The San Diego County Water Authority; Metropolitan Water District of Southern California; Southern Nevada Water Authority; Central Arizona Water Conservation District; and the Republic of Mexico are considering developing a desalination facility with a capacity of up to 75 MGD at Rosarito Beach in Baja, Mexico (Water Resources Department 2011). Water produced by the desalination plant would either be pumped directly to the United States or exchanged with Mexico for a portion of their share of water from the Colorado River. Project partners have completed a study that evaluated potential sites in or near Rosarito Beach, reviewed the environmental permitting requirements, and conducted a preliminary analysis of pipeline routes. A second study will assess environmental and regulatory issues and provide cost estimates for the project (San Diego County Water Authority 2011). Funding for the second study has not yet been secured, and it is unclear when the research would be completed (Fogerson 2012).

## **NSC Agua (Rosarito Beach)**

Estimated Completion Date: Unknown

NSC Agua – which is composed of a publicly traded water utility (Consolidated Water) and a group of Mexican and American investors – is proposing to build a desalination facility at Rosarito Beach in Baja, Mexico. The 100 MGD desalination plant is estimated to cost \$500 million and would be co-located with the Presidente Juarez power plant. In November 2011, Consolidated Water announced that it would be selling its shares in NSC Agua; however, by March 2012, Consolidated Water announced that it had secured a controlling interest in the partnership (Burgin 2012). The Otay Water District, located in Spring Valley, California, is considering purchasing 15 to 25 MGD of water from the facility (Burgin 2011).

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