

Water for Tomorrow

California's Water, Our Responsibility

Volume Two • Number One

Water Recycling: Making the Most of Every Drop

The New Era of Desalination

A Word with Dusty Baker



NATIONAL
GEOGRAPHIC

A Custom Publication



Purple pipes deliver recycled water for non-potable uses.

dear READERS,

Recent winter storm activity has swelled streams and raised reservoir levels enough to make anyone cheer. And while the return of a healthy snowpack and increased rainfall has been very welcome after three disappointing years, it's only the beginning of the road to recovery. Water managers are well aware that even a blockbuster winter is not enough to restore the state's normal supplies.

For instance, key reservoirs in the State Water Project's system are still below normal. It will take time and a continuation of favorable weather conditions to achieve full recovery. Yet even then, restrictions to protect species will result in minimized deliveries to water agencies. So all of us, from government to agriculture, as well as businesses and individuals, must continue to be vigilant in seeking innovations and in changing our water use habits.

In this issue of *Water for Tomorrow* we take a closer look at some of the new strategies designed to do just that. "Water Recycling: Making the Most of Every Drop" describes how "used" water is being systematically recaptured, treated and recycled to stretch existing fresh water supplies. "The New Era of Desalination" takes a look at another

method in the water management toolbox. Desalting brackish water has been practiced on a small scale for years, but thanks to new technology desalination of seawater has recently begun to make inroads in coastal water management.

Finally, in "A Century of Leadership," you can learn more about other efforts to ensure sufficient water for the future. The story begins with the organizing of the first water districts a century ago under ACWA's umbrella and continues with the all-important comprehensive water package of 2009. This five-part plan is designed to improve the state's water supply reliability and restore the Sacramento-San Joaquin River Delta ecosystem. A key element, the "Safe, Clean and Reliable Drinking Water Supply Act," goes before voters in November 2010.

In reading these stories, we hope you'll gain a clearer understanding of how water management innovations are helping to secure California's water future.

Sincerely,

Wendy B. Murphy
Editor-in-Chief

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Water for Tomorrow is published exclusively
for ACWA by:
Onward Publishing, Inc.
in partnership with National Geographic
6 Bayview Avenue, Northport, NY 11768
Phone: 631.757.8300
www.onwardpublishing.com
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NEXT ISSUE

Find out more about the quality of your water and the various stages it goes through from the watershed to the tap. Plus, we will examine the overwhelming need to provide clean, safe water to communities around the globe.

Visit us online at
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for helpful links and to learn
more about California's water.

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Water Recycling:

MAKING THE MOST OF EVERY DROP

We've long recycled aluminum, plastic, glass, and newspaper. But what about water? The economic and environmental benefits are surprising.

One of the chief concerns on every Californian's mind right now is water: How can we make the most of this precious natural resource? It's crucial that freshwater reserves are managed appropriately, but it's just as critical to maximize the reward of those supplies that have already been used. Recycling water is all about efficiency — making sure gallons that might otherwise go to waste are instead cleaned, treated, and used again through innovative technologies. If California is to satisfy its future water needs, reclaiming and reusing this increasingly scarce treasure is imperative.

Mother Nature's Model

Recycling water is nothing new. Nature has been recycling the earth's water since the beginning of time. Through a never-ending cycle, drops of water fall from the sky as rain, snow, sleet and hail. This water either flows

down to the sea via streams and rivers or it soaks directly into the soil. Roots of plants and trees take their share. Another portion of the precipitation percolates slowly down through pores and crevices in underlying bedrock to recharge vast aquifers, those groundwater reservoirs that lie deep beneath the surface. These aquifers may store the water for centuries, even thousands of years, until natural springs or some manmade activity — these days it's most likely to be a powerful well pump — brings the water up again to repeat the cycle.

Meanwhile, the sun is relentlessly reclaiming surface moisture through evaporation. The evaporated moisture becomes lighter-than-air water vapor, rising into the atmosphere until it is transformed into those wonderfully varied wisps and puffs of condensed droplets we know as clouds. When the burden of moisture becomes more than the clouds

can bear, they drop the water back to ground or sea. In this closed-loop journey no water is ever really lost and no new water is added; it just assumes different forms in different locations over and over.

Often the water picks up impurities along the way — dust, smoke, salt, sulfur, arsenic, acids, assorted organic chemicals and bacteria. Fortunately, over many, many years and cycles, natural filtration through topsoil to the sand, clay, gravel and bedrock below separates out most of the impurities. Wetlands and aquifers, for example, are among the most important natural filtering systems we have for purifying water, but to perform at their best they need to be left undisturbed and given plenty of time to do their work.

Changing Incentives

As long as there was a supply of clean, fresh water, Californians had little incentive to explore methods of recycling water.



The San Joaquin Marsh, operated by the Irvine Ranch Water District. www.irwd.com

But several decades ago the picture changed dramatically. The 1970s brought us the federal Clean Water Act, the Safe Drinking Water Act, the Endangered Species Act, and in California a severe drought took its toll. Our population swelled beyond our water infrastructure's ability to provide for everyone. California also grew exponentially as an agricultural and manufacturing powerhouse, with water being a key ingredient.

Today, California is among the major players worldwide in water recycling. There are over 250 water recycling plants currently operating, with more planned for the future. The State Legislature has set a goal for California to recycle over one million acre-feet of water annually, enough to meet the needs of the 17 million additional residents California is projected to have by 2030.

Recycled water is defined as wastewater treated to a specified quality in order to be used again for a specified purpose. Until recently, California's water agencies focused on processing wastewater mainly for irrigation and landscaping. Only a small share — about 14 percent — was further purified for more advanced uses such as groundwater recharge.

Water Recycling 101

California's Department of Public Health is charged with maintaining the standards of three types of water. Their regulations are among the most rigorous in the U.S.

- **Secondary Treated Recycled Water** is used for surface irrigation of orchards, vineyards, trees and vines, and landscaping areas not subject to constant human use, such as highway roadsides.
- **Tertiary Treated Recycled Water** is used for spray irrigation on parks, playgrounds, golf courses, schoolyards, industrial uses, and on edible food crops. Both secondary and tertiary water is distributed in purple pipes, clearly designated as "non-potable."
- **Advanced Water Purification Recycled Water** goes through additional steps to remove or deactivate remaining organic chemicals, pathogens, pharmaceutical waste, and other chemicals of concern that ultimately find their way into our streams, rivers and wastewater. AWP water can be used for the replenishment of groundwater and surface reservoirs, which are classed as potable water sources.



Orange County's Groundwater Replenishment System is the most extensive water recycling and purification project in the world.

Orange County's Bright Example

A dramatic example of water recycling is Orange County Water District's Groundwater Replenishment System in Fountain Valley. Right now, it's the largest water recycling and purification project of its kind anywhere. The system owes its origins to a water crisis that took place in 1965, when local officials found that the groundwater level had fallen so low that salt water from the Pacific was seeping into their underground aquifer.

To prevent this, the district began a pilot project known as Water Factory 21. First, wastewater was put through a stringent, multi-step treatment process that brought it up to drinking water standards. Next, it was injected into a series of wells that were drilled along the coast to create a barrier to the sea. This barrier worked, protecting hundreds of threatened freshwater wells as far inland as 10 miles. After lying underground for a period of months, the treated water percolated back into the local deepwater aquifer to recharge the municipal water supply. Water Factory 21 garnered all sorts of international awards for innovation and it proved that advanced water recycling could greatly benefit large municipalities.

Today's system provides enough drinking-quality water to supply 500,000 Orange County residents annually. It uses an innovative three-stage process that involves microfiltration, reverse osmosis, and an ultraviolet light and hydrogen peroxide treatment to deactivate any remaining organic compounds.

Once the purification process is completed, half the potable water is injected into Orange County's underground pressure ridge to recharge the seawater barrier.

The remaining drinking water is piped to lakes in Anaheim where it takes the natural path of rainwater, filtering through sand and gravel to the deep aquifers below. As if these are not benefits enough, the system also reduces the amount of waste and storm water lost in discharge to the ocean. Furthermore, the process uses an estimated 50 percent less energy than it takes to transport water imported from the north and the Colorado River.

www.ocwd.com

"Designer Waters" to Go

The West Basin Municipal Water District in Carson operates what may be the only water recycling plant in the world that converts wastewater into five different "designer waters," each with characteristics suited to the needs of its more than 300 industrial, commercial and municipal customers.

West Basin, for example, produces two kinds of recycled water to feed the refining process at Chevron; a third custom water for cooling towers at American Honda and Toyota; irrigation water for golf courses, street medians, and ball fields; and dual-plumbed water for flushing toilets at several "green" facilities. Some water is also treated

through the reverse osmosis process and ultraviolet sterilization before being injected into LA's seawater intrusion barrier. From there it eventually finds its way to local groundwater basins and potable supplies.

The designer waters are dispersed via 100 miles of buried purple pipe. This year marks the beginning of the plant's fifth expansion since 1995. All told, West Basin produces about 30 million gallons a day. By 2020, the plant will double capacity, saving enough fresh water to serve more than 500,000 people yearly.

www.westbasin.org

The New Era of DESALINATION

With desalination entering the mainstream, California has found another tool to add to its portfolio of water resources.

The most populous state in the country, California requires a significant supply of water. Despite major strides in water conservation, the state's 12 million households, 25 million acres of farmland, and hundreds of specialized companies continue to place ever-growing demand on a limited resource. Southern California, where water is in shorter supply and more costly, relies on a combination of water from the Colorado River, regional groundwater, reservoirs, and the State Water Project (a water storage and delivery system of aqueducts, power plants, and pumping stations). Unfortunately, the water provided by these sources cannot reliably meet the region's water demand. With ever-increasing pressure on freshwater supplies, there is a renewed interest in the promise of salt water.

For decades, small plants around California have been desalting brackish groundwater (groundwater with a salt

content lower than seawater but still too high for consumption), for use in irrigation and industry. But taking this one step further — processing brackish water to meet the standards of drinking water — is an idea that's catching on. A prime example is the Chino Basin Desalter Authority, which operates two state-of-the-art desalination facilities that help serve the needs of customers of the Inland Empire Utilities Agency.

The plants produce 25 million gallons of pure drinking water per day, with a third plant planned that would start operation in 2015. The cost of desalting the relatively low-saline water in the local aquifer is about half that of importing water, and the benefits are immediate. Desalination increases the drinking water supply, cleans up groundwater, and improves the health of the Santa Ana River. Numbers of other communities with brackish aquifers are getting set to do the same.

Carlsbad Embraces Desal

Seawater desalination, more technically challenging than processing brackish water, has been slower to develop in California. Processing the saltier water means higher energy costs and there's the issue of protecting coastal marine habitats. But as needs grow and technology improves, things are changing: A vast facility recently approved in Carlsbad in late 2009 will join six new facilities operating along the coast, with another 16 in design or construction. This plant — to be the largest in the western hemisphere to date — is slated to yield 50 million gallons of drinking water daily, or about ten percent of the county's drinking water needs for at least the next 30 years.

California can fairly call itself an early pioneer in the development of desalination technology, specifically reverse osmosis (see sidebar on page 9). In 1967, with the help of federal seed

money, San Diego’s General Atomics patented a game-changing filtering membrane technology that is credited with helping reverse osmosis catch on. Today, there are about 30 companies in San Diego County alone working on desalination.

Despite the county’s long association with desalination, it took the public-private partnership behind the Carlsbad project nearly 11 years to clear all the planning, permitting and political hurdles. Some technical and environmental challenges were solved through co-location — the Carlsbad plant rises on a saltwater lagoon adjacent to a shore-sited power plant. This allows the desal facility to take advantage of the intake and discharge facilities that handle the seawater needed to cool the power plant’s operation, a steady source of warmed water that also makes the process more energy efficient. It also provides a way to manage briny discharge resulting from desalination: While half of processed seawater becomes ultra-high-quality fresh water, the other half is mixed with the filtered salt to dilute it to habitat-safe levels before it’s returned to the Pacific.

The California Coastal Commission, the final decision-makers in the Carlsbad approval process, was particularly mindful of the potential for environmental damage that a desal plant might pose to more fragile forms of marine life. It required the plant construction partnership to include in its application a “Coastal Habitat Restoration and Enhancement

Plan” that involves restoring nearly 37 acres of previously degraded wetlands within the lagoon. The restoration not only creates the natural conditions for the return of more at-risk marine species than are estimated to be threatened by the Carlsbad operations, but it also provides new foraging, nesting, and cover for numbers of birds, reptiles, mammals and other species that were never at risk.

Desalination is being pursued throughout Northern California as well, where 12 agencies are working on projects that start with source waters as diverse as Pacific Ocean water and brackish groundwater. The projects include a 5 to 15 million-gallons-per-day (mgd) desalination facility by Marin Municipal Water District, a 5-mgd brackish water expansion project by Alameda County Water District, a 2.5-mgd seawater desalination project by the City of Santa Cruz and Soquel Creek Water District, and a brackish to seawater desalination plant with a 71-mgd total capacity being investigated by the San Francisco Bay Area’s four largest water agencies. Additional projects by California American Water, Marina Coast Water District, Sand City, and Cambria Community Services District are also in different stages of development.

Desalination is not a silver bullet solution for the state’s water woes. But increasingly, it will be an important asset in the diversified water portfolio of systems that will serve California’s future.

The Long Road to Approval

In addition to the costs and technical challenges associated with these futuristic plants, it takes years of hearings and permit applications to get a desal plant fully approved. Each project must not only show value locally but it must be considered from a region-wide perspective. Like any costly project, many private and public stakeholder groups must be given the opportunity to weigh in on the benefits and liabilities, including consideration of such matters as greenhouse emissions and global climate change. Below, is a list of the major groups involved in the permitting process:

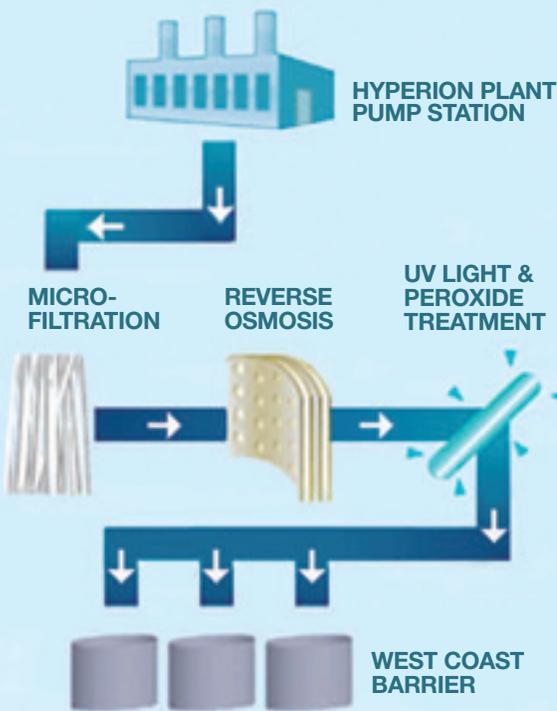
Federal: U.S. Coast Guard, National Marine Fisheries Service, National Oceanic & Atmospheric Administration, U.S. Fish & Wildlife Service, Monterey Bay National Marine Sanctuary, U.S. Environmental Protection Agency

State: California Coastal Commission, Department of Public Health, Department of Parks & Recreation, Department of Transportation, Department of Water Resources, Public Utilities Commission, State and Regional Water Resources Control Boards, Department of Fish and Game

Local and Regional: City or County/ Local utilities, water management districts



A frothy shoreline in Carlsbad
Photo Credit:
Phillip Colla



How Desalination Works

Of all the water on Earth’s surface, just 2.5 percent is fresh water. The remainder has salt content too high for human use, and requires additional processing beyond the capabilities of traditional water treatment plants. Evaporation-distillation and reverse osmosis are the two main methods used to remove salt from both seawater and brackish water.

Evaporation-distillation

In the process of distillation, seawater is heated to a boil in a pan or vessel, the evaporated part rising as salt-free steam; this steam is diverted to a cooler where it is condensed and reconstituted as salt-free water suitable for drinking and other purposes. Meanwhile, the salts and other heavier contaminants sink to the bottom of the boiler and are either discarded or used as table salt, a precious commodity in its own right. All in all, evaporation-distillation is slow and the yield small, making this low-tech desalination process suitable chiefly for shipboard operations and other small capacity installations.

Reverse osmosis

This method forces seawater or brackish water through a filter-like membrane to remove the salt particles. To drive the pure water molecules across that extremely fine-pore membrane and leave the salts behind, the process requires incredible pressure and is energy intensive. The freshwater product in the final stream is then stabilized by adjusting its pH level and adding back desirable minerals so that the “finished” water has all the characteristics of natural drinking water. The destination is often a working aquifer, where the final product gets mixed in with the mainstream freshwater supply before reaching users. Reverse osmosis is favored in the more advanced large-scale facilities in the U.S. and abroad. By recent estimates, the method is used in 46 percent of world capacity and gaining market share rapidly.



Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves. All things are bound together. All things connect.

— Chief Seattle (1786 – 1866)

This page, clockwise from top left:

Wetlands in Stone Lakes National Wildlife Refuge; Death Valley National Park; California poppies; A snowy egret in Los Cerritos Wetlands; Moonrise over Mono Lake

Opposite, clockwise from top left:

Ventura River; a hot spring near Mammoth Lakes; Turquoise Bay in the Sea of Cortez; the Sierra Nevada Mountains; the Colorado River Delta





Cut Waste, Use Less Water to Grow More

Water News HI-LIGHTS

STATE OF CALIFORNIA
BUREAU OF WATER RESOURCES

DEPARTMENT OF WATER RESOURCES
March 7, 1968, Volume 1

GOVERNORS SIX YEAR CONFERENCE SESSION

Conferences Told Need to Inform Public

Index of Conference Topics

Continuing the growth of public water supply, the water resources conference sessions are being held in the state capital building, Sacramento, California, on the 6th and 7th of March, 1968. The sessions are being held in the state capital building, Sacramento, California, on the 6th and 7th of March, 1968. The sessions are being held in the state capital building, Sacramento, California, on the 6th and 7th of March, 1968.



A Century of Leadership

The story of California has always been about water — and how managing this treasured resource has allowed the state to flourish into one of the most prosperous economies in the world. This spring, the state’s largest and oldest water organization — the Association of California Water Agencies (ACWA) — is celebrating 100 years of being a guiding force in California water policy. Organized in 1910 by just five irrigation districts in the San Joaquin Valley and growing to a membership of 450 public water agencies and special districts today, ACWA is the largest coalition of public water agencies in the country. From early 20th century irrigation statutes to the historic legislative package signed by Governor Arnold Schwarzenegger in November

2009, ACWA and California have been on a clear mission together.

Creating One Voice

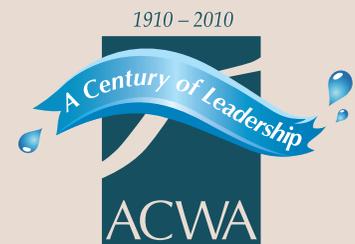
California is known for its modern-day complexities, but even in 1910 it was clear that water could not be taken for granted. With a population of just over two million people, the state’s urban areas were beginning to grow while productive agricultural regions were looking to expand with vast new orchards, vines and an array of fresh produce.

Cities such as Los Angeles and San Francisco were reaching out to distant watersheds to satisfy their growing thirsts, while newly formed irrigation districts were planning projects to bring more water for their burgeoning acreage.

The leaders of five irrigation districts — Modesto, Turlock, Oakdale, South San Joaquin and Alta (Fresno County) — came together in the spring of 1910 to discuss common issues and create one voice for addressing them. They called this newly minted alliance the Irrigation Districts Association (renamed the Association of California Water Agencies in 1973) and began laying the groundwork for planning and developing California’s water supply and delivery system.

Investments in Our Future

As the agricultural districts grew, so too did the urban centers of the state. Periodic droughts revealed the unpredictable nature of California’s hydrology, and crystallized the need



Vision for the Future

Association of California Water Agencies

for more robust systems to capture water during wet times for use in dry periods.

Local and regional projects such as the Los Angeles Aqueduct, San Francisco's Hetch Hetchy System and later the Colorado River Aqueduct set the tone for an era of growth and water development. Later, the federal Central Valley Project and the State Water Project came on line and brought snowmelt from the Northern Sierra to communities and farms as far south as San Diego.

Local water agencies continued to develop new thinking and tools, however, to keep water supplies flowing in the face of prolonged drought, relentless demands for water and a raft of new environmental laws and regulations.

By the early years of the 21st century, ACWA members were calling for a comprehensive approach to the state's water problems to meet the needs of the economy as well as the environmentally troubled Sacramento-

San Joaquin Delta, a critical estuary and hub of California's water system. The call for solutions came to a crescendo in 2005 as the water community urged significant re-investments in the state's backbone water infrastructure as well as local strategies such as conservation, recycling, and groundwater management.

The California State Legislature took a historic step toward that comprehensive approach with passage of a far-reaching package of water legislation in November 2009. Signed into law by Governor Arnold Schwarzenegger, the package commits the state for the first time to the *co-equal goals of a reliable water supply and a healthy Delta ecosystem*. It also establishes a new management structure for the Delta and sets new requirements for water conservation, groundwater monitoring, and water rights enforcement.

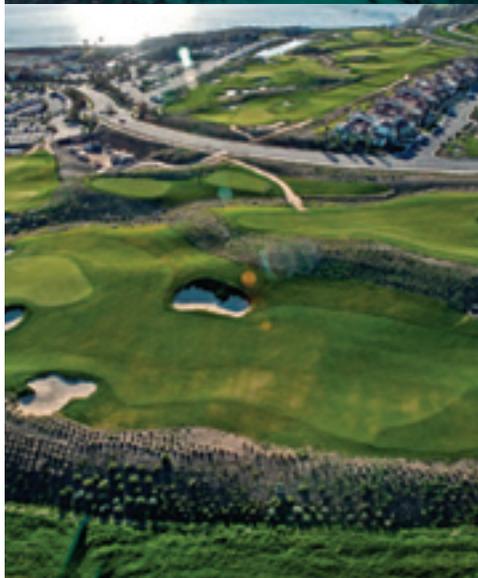
A key element of the package is the "Safe, Clean and Reliable Drinking

Water Supply Act" of 2010, an \$11.14 billion bond measure targeted for the November 2010 ballot. If approved by voters, the measure would provide funding for water supply reliability programs, above- and below-ground water storage projects, Delta restoration, water recycling, conservation, watershed restoration, groundwater protection and cleanup, and drought relief.

After a century of leadership, ACWA continues to be on the front lines in Sacramento and in Washington, DC, as a constant and respected advocate for California's public water agencies. As ACWA president Paul Kelley remarked recently, "This is no time to relax. Passage of the legislative package last fall was historic, but the real history will be made when we implement these important new policies and make the critically needed investments in our system outlined in the water bond."

www.acwa.com

STUDYING THE GREEN: TERRANEA BRINGS WATER MANAGEMENT TO THE FORE



Keeping the fairways and putting surfaces of California's 1,130 golf courses looking healthy and emerald green is a daunting task that requires an abundance of water. But water use restrictions, rising costs, and budget-conscious patrons have forced the industry to reassess its business models.

On the Palos Verdes Peninsula, a new golf course boasting spectacular views of Catalina Island has embraced a concept known as turf reduction. Designers of The Links at Terranea have fused turf and native palettes to slash water and maintenance costs, while offering golfers challenging play in the heart of one of California's most naturally scenic coastal settings — all at a fraction of the price.

"We created a nine-hole par-three course in a 30-acre golf corridor. Roughly half of it is actual turf. The rest reflects drought-resistant palettes and sand traps that require little or no water," said course architect Todd Eckenrode of Origins Golf Design.

"Terranea wanted to reflect principles of sustainability in its development, from water use to storm water runoff," noted Eckenrode. "We didn't want an artificial resort setting with imported palm trees. We wanted to reflect the natural palettes of this treasure in a way that would delight golfers of all skills and allow them to play a challenging round of golf without having to devote an entire day to it."

Terranea's director of golf John Fitzpatrick is a believer: "My initial response to a par-three design was, 'This can't be glamorous.' Then I saw the nuances and elevation changes of Todd's design. Terranea offers great golf with elements you'd expect to see at courses like Pebble Beach; the greens have a lot of movement, which adds

to the fun and challenge of the golf. And with a fraction of the turf of larger courses, you can deduce what kind of reduced water use — and improved economics — it creates for owners."

The economics of development, time constraints with work and family, and the relevance of golf's price point in this economy suggest more family-friendly courses like Terranea are on the horizon. Using water more efficiently is key.

Pat Gross, southwest director of the U.S. Golf Association's Greens Section, says California's \$4 billion golf industry has had water on its radar for decades. Smart irrigation technology, concerns about cost and availability are driving efforts to cut consumption and eliminate waste.

"Golf courses are high visibility properties; they're used to being water wasters," said Gross. "But the talented superintendents I work with are striving to be a part of the solution. When you use water wisely, you have a better golf course with better playing quality — it's firmer and faster."

Eckenrode is spearheading turf reduction techniques with larger courses across California. Transforming turf to naturally landscaped waste bunkers reduces water, fuel, and maintenance costs while demanding fewer chemicals. It limits over-seeding to tees and roughs, further cutting costs. Water savings can be 100 percent in turf areas that are returned to native plantings.

"This achieves our goal of being responsive to the water situation in our state," said Eckenrode. "And it's representative that solutions can be world-class and appeal to a broad number of individuals."

Photo Credits: Todd Eckenrode; Redtail Media

WATER SURVEYS: CREATING SOLUTIONS FOR CALIFORNIA HOUSEHOLDS

As the cost of metered water is rising, water districts are helping households trim consumption and *lower* costs through conservation assistance programs. Under the program, water specialists are dispatched to conduct on-site evaluations that pinpoint leaks and rectify inefficiencies. By recommending water-wise hardware, gardening techniques, and rebate programs, these specialists are helping Californians eliminate water waste and cut monthly bills.

San Rafael resident Bonnie Nixon was quick to accept her district's offer. Fortunately, when Marin Municipal Water District's Greg Van Trump first arrived at Nixon's home, he brought along her five-year water history and some encouraging news. "Your usage rates this year are already considerably better than in years past," he told her, noting a consumption spike from the previous year. An irrigation pipe had broken at that time, but Nixon used the opportunity to replace her spray irrigation system with a more efficient drip system. By making this change, and adding mulch into the landscape to inhibit weed growth and evaporation, and by exchanging water-hogging plants for native varieties, Nixon qualified for water agency rebates.

"Water bill spikes often reflect leaks or improperly programmed irrigation timers," said Van Trump. One easy way to identify leaks is to look at the water meter periodically. "If there is little movement on the meter, you're probably dealing with a minor leak. If the triangle on the

meter is spinning faster, the problem is more substantial," he explained.

People can isolate a leak's location by closing the main valve to their homes. If the meter continues to run, the problem is outside the house. If the meter stops after the valve is closed, the problem is inside.

With indoor leaks, toilets are often the culprit. Van Trump recommends dropping a coloring tablet in the tank. If color seeps into the bowl without being flushed, there's a problem. "The biggest leak I ever saw was a toilet running 2,300 gallons a day. That's fifty to sixty dollars per day!" he said.

Van Trump then examined the flow rate from faucets and showerheads. Nixon's were all in great shape, which illustrates how low-flow showerheads and simple, inexpensive faucet aerators are becoming more popular in California households.

Though Nixon's drip irrigation system met the newer standards for water delivery efficiency, Van Trump did a walk-around inspection. "Sprayers get tilted, mowers hit nozzles, and spray heads get blocked — all easy fixes," he said. Satisfied that hers were functioning well, he cautioned that systems needed to be tuned up yearly and timers adjusted to seasonal changes.

"Water surveys encourage practices that improve properties and save money," says Van Trump. And Bonnie Nixon knows the smallest of improvements can make a notable difference.

For an in-home water survey checklist visit saveourh2o.org.



Photo Credit: Wheeler Imaging

Bring Change Home

Improve your lifestyle and make a better California with these five products designed to conserve water and protect the Earth's fragile environment.



Dr. Bronner's eco-friendly soaps

Keep chemicals out of the water supply by using these all-natural soaps, cleaners, and detergents made from biodegradable ingredients. \$3–53, drbronner.com



Save Our H₂O's shower timer

This helpful and affordable tool will encourage you to conserve water by managing the duration of your showers. saveourh2o.org



Pacific Interlock Pavingstone's Hydro-Flo pavers

Surfaces designed with 100-percent permeable paving stones allow rainwater, which would otherwise flow down storm drains, to return to underground aquifers. For an estimate, visit pacinterlock.com



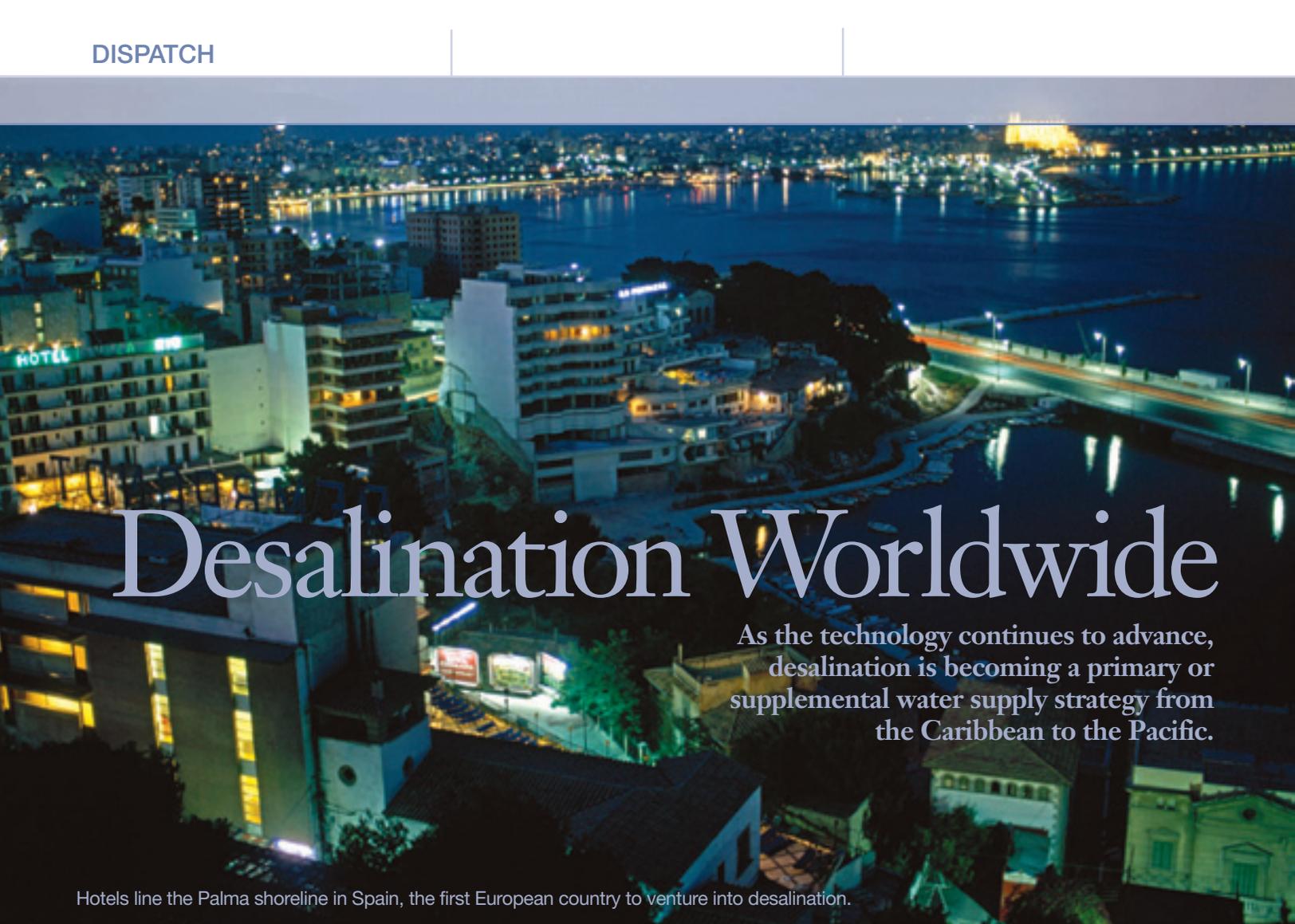
Klean Kanteen's stainless steel bottles

Countless plastic bottles end up in landfills each year. Help reduce the waste by hydrating with one of these ultra-high-quality reusable bottles constructed from toxin-free materials. \$15–33, kleankanteen.com



RainXchange's rain barrel

Harvesting valuable rainfall from your roof is an easy way to create a secondary water source for irrigation while lowering your water bill. \$200, greenhome.com



Desalination Worldwide

As the technology continues to advance, desalination is becoming a primary or supplemental water supply strategy from the Caribbean to the Pacific.

Hotels line the Palma shoreline in Spain, the first European country to venture into desalination.

Recent reports indicate that around 12,500 industrial-scale desal plants are now operating worldwide.

Spain was the first European country to venture into modern desalination, installing its first plant on the water-poor Canary Islands in 1964. Today, Spain is the fourth largest user in the world. Spain's more than 700 desal plants, the majority along the Mediterranean coast, produce enough water daily to take care of about 8 million inhabitants in the country's "breadbasket" region.

In recent years, as Australia's drought reached crisis proportions, this nation also has embraced desalination solutions. The cities of Perth, Sydney and Melbourne currently rely heavily on new desalination facilities, and the state of Victoria is getting set to open

a plant in 2011 that will dwarf all others in the country.

Saudi Arabia, even before today's booming economy and growing population, has always been plagued with water shortages. Until relatively recently, an estimated 90 percent of Saudi Arabia's water was drawn from wells that tap nonrenewable "fossil water" lying deep in ancient aquifers. Another 10 percent was surface water from seasonal *wadis*, or streams. Tribal conflicts over water rights, diminishing water yields, and the growing inability of the nation to feed its population through wasteful ditch irrigation farming, made a water crisis inevitable.

In the 1970s, the royal family went looking for alternative strategies. They even floated the notion of towing icebergs

from Antarctica to supplement supplies. But over time, modern reverse osmosis desalination was seen to hold the best promise. Plans were drawn to build a series of coastal plants, coupled with miles of distribution pipelines. By 2000, 27 desalination plants were producing more than 600 million gallons of fresh water daily in Saudi Arabia, enough to provide more than 70 percent of the nation's water. The majority were dual-purpose plants that also generated electricity. But water shortages continued, and in 2007 the new Shoaiba III began rising on the shores of the Persian Gulf. When it became operational in 2009, it was reportedly the world's largest desalination plant with a capacity of 232 million gallons per day (almost five times that of the Carlsbad, California facility).

Fountain of Knowledge

By Rich Norris © 2010, Rich Norris

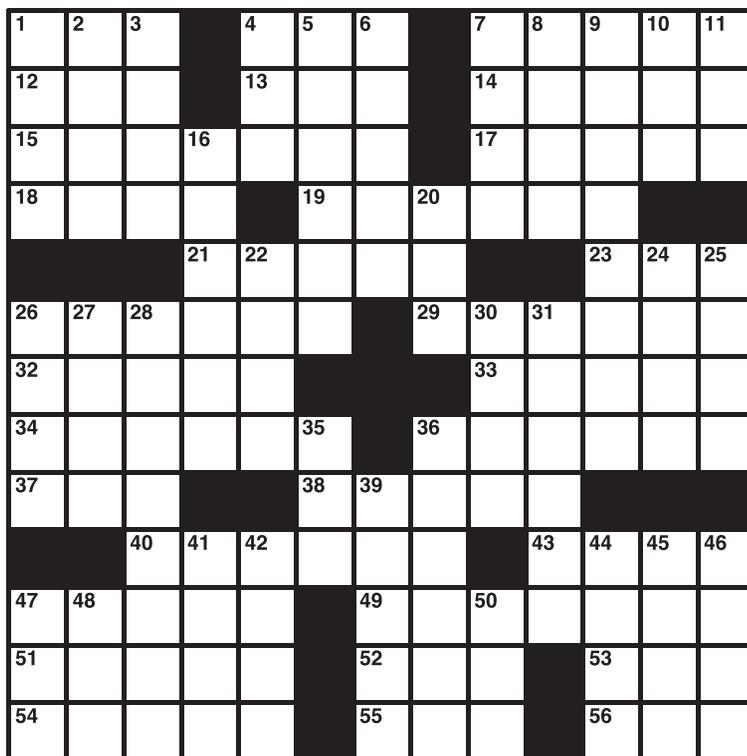
ACROSS

- 1. PC monitor, for short
- 4. Occupation
- 7. *Electricity
- 12. That woman
- 13. Hosp. area for acute conditions
- 14. Foe
- 15. *Well feeder
- 17. Fix, as Junior's shoelaces
- 18. As above, in footnotes
- 19. Dog or cat, e.g.
- 21. Quart halves
- 23. Mil. pilot's home
- 26. Oil industry leaders
- 29. Young sensation
- 32. Prevent
- 33. Provide with funding
- 34. Get pushy in a crowd
- 36. Takes by force
- 37. Spanish year
- 38. Drummer Ringo
- 40. Cheery
- 43. Shocked response
- 47. Ballerina's rail
- 49. *Put trash to good use

- 51. Disney World acronym
- 52. Rap's Dr. ___
- 53. Sexy
- 54. *Essentials
- 55. French designer's monogram
- 56. Female sheep

DOWN

- 1. Indian spiced tea
- 2. Like courses that aren't optional: Abbr.
- 3. 50-50 test answer
- 4. Peanut butter for "Choosy moms"
- 5. *Atlantic and Pacific
- 6. More than dark, in a toaster
- 7. Salon offering
- 8. Top draft status
- 9. *Areas often protected
- 10. U.K. record label
- 11. Bakery bread
- 16. *Bring in from abroad
- 20. MSN or AOL
- 22. Like many JFK flights



- 24. Part of a yard
- 25. Autobahn autos
- 26. Mexicali's peninsula, familiarly
- 27. Bell-ringing company
- 28. *5-Down are a natural one
- 30. German "Mister"
- 31. *Get-up-and-go
- 35. Language suffix
- 36. *Seas
- 39. Late
- 41. Cattle poker
- 42. Wagers
- 44. Massage target
- 45. School zone sign
- 46. Sampras of tennis
- 47. London's Big ___
- 48. Chimp, for one
- 50. Cartoonist's frame

Spouting SUMS

ANSWERS



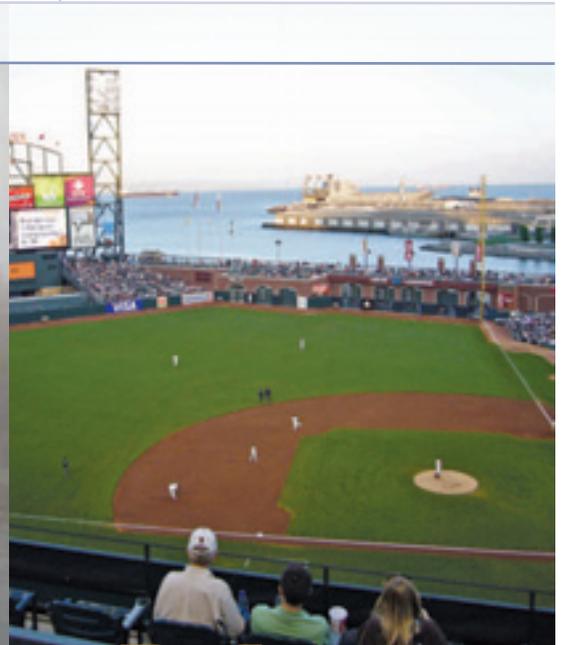
18 gallons of water are required to grow one apple

It takes **50 gallons** of water to wash a car in the driveway

In normal years, groundwater provides about **40 percent** of California's water supply.

About **70 percent** of the state's available water occurs north of Sacramento

80 percent of California's water demand occurs in the southern two-thirds of the state



A Word with . . . **Dusty Baker**

The Major League Baseball hero looks to all of us to join in solving California's water worries.

Q. What got you interested in California's water needs?

A. I'm a native Californian. I grew up fishing and hunting up and down the state with my dad, on the banks of the Santa Ana River in Riverside, and later on the American River near my family's house in Carmichael. My idea of fun then was to go striper fishing in season. I'd stop in at the fish hatcheries in late fall to see the spawners coming upstream, watching the salmon and steelheads leaping their way up the fish ladders to lay their eggs. But the fish aren't there in the numbers I used to see. And when I go down to the Delta with my fishing buddies, I observe the general decline in the habitat there. Up at Folsom Lake, I see the water level down so far sometimes that the launch ramps are a half-mile back from the water. Like any parent, I want to imagine my kids growing up to enjoy the outdoor pleasures I had, but what will our legacy be?

Q. Do you think the message is getting through?

A. I don't think so. I can remember back to 1984, when I was complaining one day about the price of gasoline to my teammate Joe Price's father. Joe's father had a water bottling company, and he said to me, "Dusty, mark my word, one day you'll be paying more for a gallon of water than for a gallon of gas!" Of course, I thought he was crazy then, but it comes back to me now how close to the truth he was. A lot of people are still back where I was then, thinking this shortage we're going through is some temporary thing, or that if some other guy would just stop taking more than his share we'd be all right. But no one group is more deserving than any other. There's hardship ahead for everyone if we don't buckle down and solve these competing issues together. One thing is sure, we can't keep going the way we have been.

Q. Are you and your family doing anything special at home to save water?

A. For starters, we're just being more aware of where the water goes. We take shorter showers, flush less often, are more careful doing the laundry, check for leaks in the sprinkler system, and fix anything that drips. My 10-year-old is getting the same reminders at school, so he comes home and bugs us, which is good. I made a public service announcement about saving water this past fall, so I'm in the funny position now of turning on the TV and lecturing myself sometimes!

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A Clear Mission An Essential Resource

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