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**FOREFRONT**

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# HOT, CROWDED AND SMART

San Antonio Is Growing and the Water Supply Is Diminishing. What's the Strategy?



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Story by *Sarah Goodyear*  
Photography by *Kelly Lynn James*



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When you enter a taxi in a new city, you might expect the driver to sound off on what really matters about the place. So it is in San Antonio. The guy behind the wheel can likely tell you what is happening with the Spurs, where to find the best Mexican food and how long it will take to cross town in rush-hour traffic.

I was a little taken aback, though, that the cabbie who took me to the headquarters of the San Antonio Water System had so many opinions about the city's water. He told me what he thought of the taste and quality (excellent compared to his hometown of Washington, D.C.). He was pleased with the way the utility was managing the supply (much better since SAWS had taken over from another company that had previously covered his part of town). He expressed himself on the topic of in-ground sprinklers (they should be outlawed as wasteful). And he spoke

be damned—home of the “Most Unique Water Supply in the World Absolutely Pure.” Would-be residents could rest assured: “Water Never Sees the Light of Day Until You Turn the Faucet.”

The Edwards is indeed a remarkable aquifer. It is so vast that no one is sure how much it holds, but guesses range from 25 million to 55 million acre feet (an acre foot is equivalent to 325,851 gallons). Its porous limestone formations allow it to recharge relatively quickly during rainfall. It is considered one of the purest and largest underwater sources of drinking water on the planet.

But it is not inexhaustible. It is not magical. And it is under ever-increasing pressure, both from a booming population and climatological forces that subject the region to scorching temperatures and year after year of below-average rainfall.

“Global warming has the effect of causing subtropical regions to become increasingly arid and to expand polewards. Texas is in a latitude where it gets hit by both of those effects.”

admiringly of the unique nature of the Edwards Aquifer, which reliably quenches the city's ever-growing thirst.

Maybe his expertise shouldn't have come as a surprise. In the dry expanses of Texas, a good source of water has always been highly prized. The free-flowing springs of the Edwards have always drawn people to this place at the northern edge of the Chihuahua desert, and the seemingly endless resource made it possible for them to stay. The native inhabitants of the area, from the Payaya tribe, called it *Yanaguana*, meaning “refreshing waters.” Without the Edwards, European settlers would never have stuck around to develop this piece of South Texas.

In the arid expanse of the Southeast, San Antonio's access to the Edwards has long been one of its selling points. In 1918, some boosters got together and created a brochure touting the “Wonderful Water Supply of San Antonio.” The city was — punctuation

“Texas is getting drier,” says Richard Seager, a research professor at the Lamont-Doherty Earth Observatory of Columbia University who specializes in the study of multiyear droughts. “Global warming has the effect of causing subtropical regions to become increasingly arid and to expand polewards. Texas is in a latitude where it gets hit by both of those effects.”

Yet people continue to flock to Texas and its booming cities, trusting that water will be there for them. San Antonio currently has 1.3 million residents, making it the seventh most populous city in the United States. And it keeps growing faster than any other city in the nation's top 10. At the same time, Texas, along with the entire Southwest, is entering its third year of drought — the worst since the 1950s and one that has affected 80 percent of the region's agricultural land, according to the United Nations.

The drought has cost billions of dollars in ruined crops, slowing the U.S. economy and driving up



Swimmers at San Pedro Springs Park Pool, fed from the Edwards Aquifer.

consumer prices on everything from peanut butter to beef to clothing made from U.S. cotton. It has created the conditions for wildfires that have turned thousands of square miles to ash, burning down homes and important ecological habitats. All this is happening at a time when drought is sweeping other parts of the world from Uzbekistan to Namibia.

“Over the past quarter-century, the world has become more drought-prone, and droughts are projected to become more widespread, intense and frequent as a result of climate change,” U.N. Secretary General Ban Ki-moon [said in a public statement](#) in June.

In San Antonio, the springs that flowed from the earth here in the days of the Payaya dried up long ago. Several native species have already been endangered by the diminishment of the aquifer. And as the population continues to grow, development poses a threat to other animals. This year, public authorities gave the green light to new housing developments that could endanger the world’s largest colony of bats at Bracken Cave, a mere 28 miles northeast of the Alamo in downtown San Antonio.

And for the past three years, water levels in

the Edwards have been hovering at uncomfortably low levels.

Alyssa Burgin is the co-founder of a non-profit advocacy group called the [Texas Drought Project](#). She says that San Antonio, along with the entire state of Texas, is headed for an era in which extended periods of drought will become the norm, even as the population continues to boom. “It’s not just Africa that is desertifying,” she says. “It’s Texas, too.” Without increasingly innovative methods of recycling, reusing and conserving water, Burgin says, her beloved home state could watch vast regions shrivel under scorching sun and relentless winds.

“We have not seen the worst,” she says. “We’re not going to have much time.”

In this grim context, San Antonio provides some reason for hope. “What is there left in San Antonio for a community organization to do,” the promoters of 1918 asked, “except to say to the rest of the world — COME!” Indeed, the people came. Nearly 100 years after that hard-selling brochure, they are still coming. But it turns out there is plenty left for civic leaders to do. In the past 25 years, San Antonio has reduced its per-capita water usage by 42 percent. So despite a 67

percent increase in population, the city has seen little to no increase in water use. Today, San Antonio **bills itself** as “Water’s Most Resourceful City.” Against the odds, this sunbaked former cattle-ranching capital has become a leader in water conservation and regulation. And now as cities across the world face increasingly pressing threats of drought, San Antonio has become a model of how to do more with less.

As part of a six-month exploration of the relationship between cities and water, Next City is

haze. As the roads loop and swirl through town, their overpasses gleaming white in the noonday sun, they give drivers glimpses of a fragmented landscape: The green flash of a golf course in a city park; a quiet suburban street with tidy yards; a big-box mall afloat in a sea of surface parking; a heat-seared field with a dry dam in the middle of it, waiting for the next flood.

Dust, cacti, trees, river — a city of contradictions, where droughts are measured in years, but on one recent day nearly 10 inches of rain fell in



Karen Guz, director of water conservation for the San Antonio Water System, at the San Antonio Botanical Garden’s “Watersaver Lane” exhibit.

taking a close look at San Antonio and learning how a fast-growing city on the edge of the desert keeps from exhausting its water supply.

## SUSTAINABILITY AHEAD OF ITS TIME

San Antonio, like most American cities, is dominated in large part by its enormous freeways, carrying commuters to and from its sprawling neighborhoods in a shimmering, traffic-generated

24 hours.

Numbers like that define Karen Guz’s job. The director of conservation at San Antonio Water System talks in terms of acre feet (that’s the amount of water it takes to cover an acre of area one foot in depth), gallons per household and miles of pipes — of which there are 9,000 running under the streets of San Antonio.

Yes, she’s good with all kinds of numbers. But



Medina Lake just west of San Antonio has seen extreme low water levels recently.

there are two in particular that Guz could probably tell you in her sleep.

One is the Official Edwards Aquifer level above mean sea level at any given moment. That indicator is measured at a place known as the **J-17 Bexar index well**, located inside a nondescript concrete building near the Sam Houston cemetery. It's been used as a reference point for how well the aquifer is doing since 1956, and in that time it has ranged from 612 feet during the crippling multi-year drought of the 1950s to 703 feet after epic rains in the early 1990s.

The other number on Guz's mind these days is the drought stage level, tied directly to the aquifer level. On the day that I visit with her, San Antonio is in what is known as Stage 2 drought restrictions, with one eye warily looking at the possibility of Stage 3.

Stage 2 drought restrictions are triggered when the level at the J-17 well reaches below an average of 650 feet on a rolling basis for a 10-day stretch. The level has to stay above 650 feet for at least 15 days before SAWS recommends that the city manager lift the restrictions — which means that the city has been locked into this state of affairs since April 2012, despite a relatively cool and wet spring in 2013. One of San

Antonio's major water sources for agriculture, Medina Lake, is effectively empty, with bluebonnets growing where water once flowed. In some areas, the lakebed has become a dry-earth dumping ground for wrecked cars, plastic chairs and other human junk. Drive due south of the city and see scorched cotton fields scarred with fissures three inches wide and a foot deep.

All of this is preferable to the record drought year of 2011, which Guz nicknames “the convection-oven year.” “The wind was blowing constantly,” she says. “The soils were so dry. It was just a vicious, vicious summer to live through.”

None of this is apparent today walking through San Antonio's pleasant residential neighborhoods or its historic downtown. Lush vegetation thrives along the Riverwalk that runs through the city center. Golfers stroll the emerald carpets of the city's popular golf courses. And in places you can't see — the factories and technology centers and power plants — the water flows as well.

The relative abundance must be in part credited to the natural wonder that is the Edwards Aquifer. But every natural resource has its limits, and the aquifer is no exception. “It is finite,” Guz says. “There's only so

much of it to go around.”

And so there are the rules. Not only must residents abide by limits on water use, but the cost of water increases when they use more: \$0.0948 per 100 gallons for the first 5,985 gallons, \$0.1372 for the next 6,732, and so on. This financial disincentive sets San Antonio apart. “Many water utilities treat water as a commodity to be sold,” Burgin says. “That’s completely contradictory, especially in drought-prone areas.”

It doesn’t end there. Households can run their sprinkler systems on only one designated day per week. Similarly, it’s only legal to wash your car once a week, on the weekend. Private pools must be at least 25 percent covered. And if you’re thinking of sluicing down your driveway, don’t.

There has been little relief from the rules of late. Periodic rains have raised the aquifer level above the trigger temporarily, but as quickly as the Edwards has been replenished each time, the water has dipped again. This past May alone, the level started at 648 feet, dipped down to 641.2, rose to as high as 658.4 and started falling again, before ending the 30-day stretch at 657.1. The trigger point for Stage 3 restrictions, which would mean sprinkler systems and the like could only operate for one day every other week, is 640 feet. So far, the city has dodged that bullet, but there are more hot months ahead.

“We have lucked out in 2013,” says Guz, a petite, precise woman who speaks in complete paragraphs packed with information. “The forecast was frankly dire. It was looking grim. But we’ve gotten this lovely cool, wet spring, and so it’s hard for people to fathom we’re still in drought, we’re still in deficit.”

The roots of San Antonio’s aggressive conservation efforts — which ultimately make the city more self-reliant and in control of its own destiny — ironically lie in a historic event that was, at the time, galling to its Texan ethos of independence. A federal judge ruled in 1993 that San Antonio’s unregulated pumping of the Edwards was endangering native species, including the two-inch-long fountain darter, a spotted freshwater fish found in the headwaters of only two Texas rivers. The judge, responding to a lawsuit filed by the Sierra Club, mandated that the city develop a 50-year water plan for water usage.

Grudgingly developed at a time when most politicians were happy to pretend that environmental

threats like drought had nothing to do with their activities, the plan provided a blueprint for the nascent San Antonio Water System, then less than a year old.

From its beginning, SAWS saw the advantage of reducing water use, as well as of finding new sources of water. It devised a rate structure that provided solid financial support for a full array of conservation measures, including a comprehensive education program that ensures every San Antonian grows up well aware of the precious and fragile nature of the water resource.

“They determined that conservation was going to be a source of water,” Guz says. “They put dedicated rates in place to fund a long-term conservation program, and they set some goals to say, ‘let’s reduce our per-capita consumption over time.’”

“I’m sure there were people who thought it was just lip service,” she goes on, “who thought, ‘sure, we’ll go out and get more water and get past this annoying political issue of the Endangered Species Act.’ But over time that ethic of saying conservation is a water supply has stuck.”

Saving water became popular among municipal leaders because, it turns out, conserving water costs far less than finding new sources of it.

The conservation effort enabled by those dedicated funds is vast. It includes up to two free water-efficient toilets for residential customers who replace old fixtures; rebates for homeowners who improve the efficiency of their irrigation systems; and coupons for landscaping supplies for those who take out lawns in favor of less thirsty greenery. Commercial users can claim large-scale retrofit rebates and receive free audits of infrastructure like cooling towers. These policies may seem obvious but they are far from common. In Phoenix, which faces a comparable water shortage, the city recommends residents maintain and modernize their old fixtures, but does not pay for it.

Burgin says it is frustrating to try and convince other cities to consider these policies that have become standard in San Antonio. “Buying out people’s lawns and irrigation systems, which is essentially what they’re doing, is an inexpensive way to get water,” she says. “I truly do find the practices of SAWS to be a model for other cities.”

Locally, at least, the messaging is working. Using too much water can expose you to public shaming

in San Antonio. In 2012, *the San Antonio Express-News* published a list of the top 100 water consumers from May to November of that year who, all combined, consumed as much as 1,611 average households.

Some were embarrassed about their usage, such as Sean Elliott, a former player on the Spurs and now a commentator for the city’s beloved NBA team. Elliott lives on five acres that include a manmade lake with catfish in it. His home used 1.7 million gallons of water over the six-month period. “As people who value

hydration such “vanity lakes” require. Business owner Harvey Najim used 675,000 gallons over the period, making him 94th on the list. “That’s a list I don’t like being on,” Najim told the *Express-News*. “But I have five water features.... I can’t help it if it is hot and dry in the summer.”

As more people settle in San Antonio, there are bound to others with ideas for fake lakes and manmade springs. Whether they will be allowed to indulge their taste for artificial oases remains to be seen.



Gregg Eckhardt, senior resource analyst with the San Antonio Water System, atop an anaerobic digester tank at Dos Rios Water Recycling Center.

water conservation efforts in our community, my wife and I are absolutely mortified to be on this list,” Elliott wrote the paper in an email.

Guz says that some people act quickly when they realize how much water they’re running through. She cites one customer who started working with SAWS to understand his water use. He fixed some underground and indoor leaks, and went from using 100,000 gallons per month to 12,000.

Other are less apologetic about the amount of

## THE GREENEST PLACE IN TEXAS

Gregg Eckhardt has the squint of a man who has spent a lot of time outside in the hard sun of South Texas, and the wry smile of someone used to thinking more than he lets on. A senior analyst with San Antonio Water System, he spends his days analyzing, modeling, upgrading and monitoring every aspect of the city’s wastewater recycling program.

“I took the job for the glamour and excitement of working in a sewer plant,” he tells me with that little smile, as we survey the vast, open expanse of the

Dos Rios Water Recycling Center.

Dos Rios is about 15 miles from downtown, past the Latino neighborhoods of San Antonio's South Side, where the sky starts opening up and the city begins to fall away. The open-air facility takes in 75 million gallons of sewage every day. San Antonio, like all municipalities in the nation, must comply with the regulations of the federal Clean Water Act. But what sets it apart from many other cities is the way it uses the result.

After the sewage is cleaned nearly to drinking water standards, it is pumped back out again — some into the San Antonio River, some into the city's lauded "purple pipe" system. Both uses are important: The treated water that goes into the river helps maintain the flow, and the water that goes into the pipes and gets pumped back to San Antonio keeps the city from using water drawn straight from Edwards for uses

water treatment looks like. Then he leads me over to the place where the bubbling brown stew of San Antonio's waste is entering the plant.

"I want you to see what 75 million gallons of raw sewage looks like," he says.

We spend the next hour walking from one end of the plant to the other, as Eckhardt explains the process that turns San Antonio's sewage into clear, clean water every day. The daily load that the plant handles is exactly the same flow as it took in when the plant was built, thanks to conservation measures, even though the population of the city has increased by about 40 percent since then.

"Conservation is a twofer," Eckhardt says. "You save on the water end, and you save on the wastewater end that you don't have to treat."

First, the water is strained through grates that remove the bigger stuff, like condoms, sticks, Doritos

The daily load that the plant handles is exactly the same flow as it took in when the plant was built, even though the population of the city has increased by about 40 percent since then.

that don't require absolute purity.

"I'm a big fan of the purple pipes," says Burgin, from the Texas Drought Project. "There are so many cities in Texas that could benefit from that."

Those purple pipes crisscross the city, delivering the recycled water — or "highly treated effluent," in technical terms — to the Toyota plant for its manufacturing processes, to the Microsoft complex for its cooling towers, to the golf courses for their greens, to the baseball diamonds for their outfields and, most visibly, to the San Antonio Riverwalk, the city's prime tourist destination.

"It really is the front lines of environmental protection out here," Eckhardt says. As we step out of the water company SUV, he tells me that he's just hosted delegations from Mongolia and Korea who have come all this way to see what state-of-the-art

bags and, Eckhardt jokes, "Volkswagens." Then it sits for a couple of hours in huge tanks to let the solids settle before they are sent to a different part of the plant, where they are further processed.

Next, the water is aerated to allow the bacteria that consume the remaining solids to do their work. Those "bugs," as Eckhardt calls them, are the descendants from a culture that was originally brought to the plant in 1987. Every couple of hours, the plant operators check water samples under a microscope to see if the micro-ecology of the tanks is in good working order.

"Usually if there's some kind of upset, you can trace it back to some illegal dumping that disrupted the biological process," Eckhardt says.

Then the water settles and is strained yet again. As we walk through the plant, swallows swoop

and chatter over the bubbling waters. Cattle egrets perch on the pipes, rousing themselves to flap away only when we draw near. There aren't any people out here with us, except for a couple of brave souls jogging on their lunch hours in the noontime heat. Eckhardt explains that the operation of the plant is completely computerized, run by workers in a small square building amid the welter of infrastructure, where they monitor every valve and pipe from complex computer dashboards.

Dos Rios is a model facility that has evolved over the years thanks to the continuous tinkering and innovations of Eckhardt and his colleagues. "SAWS' entire operation is based on science," Burgin says. "It's so refreshing. It fascinates me how they're always open to learning about and investing in new technology."

Many other cities in Texas, she says, don't have such a flexible, iterative culture. They dig in their heels and keep doing things the same way year after year. "I tell them, maybe you should let down your defenses

composted — Dos Rios produces about 400 tons of compost a day. He explains the methane extraction facility run by a company called Ameresco, which harvests 1.5 million cubic feet of gas daily to sell on the open market.

The brown sheets of sludge bake in the sun, their surfaces cracked, and a faint, not unpleasant organic odor fills the air. Eckhardt points out several trim birdhouses around the caked sludge. Built by Dos Rios workers, they are designed to attract purple martins, and the birds that flock here have solved the problem of insects attracted to the drying sludge better than any pesticide.

We climb steel steps to the top of the huge, cylindrical holding tanks where the sludge awaits processing and look out over the pipes and pools and concrete that stretch out in front of us. It is a staggeringly complex and remarkably orderly array of manmade structures in the middle of the flat South Texas landscape. Overhead in the bright blue sky, a

**We climb steel steps to the top of the huge, cylindrical holding tanks where the sludge awaits processing and look out over the pipes and pools and concrete that stretch out in front of us.**

and look at what [San Antonio] is doing," Burgin says.

When we come to the last stage of the water process, where the cleansed water is given a final chemical, you can see the satisfaction in Eckhardt's face. A limpid, sparkling stream gushes mightily over the spillway into a valley that is lush with vegetation. The water quality downstream from the plant is actually better than what you find upstream. The highly sensitive log perch has returned to this part of the river since Dos Rios began operations, along with other delicate creatures such as the long-eared sunfish.

The water may be the plant's most beautiful product, but Eckhardt is no less proud of the more homely solids and gases that Dos Rios turns out. He shows me the fields where the sludge that's been separated from the sewage dries before being

cloud drifts idly by, with no intention of raining on us.

"This is the greenest place in Texas," Eckhardt says. He smiles again, but he isn't joking this time.

**"OTHER CITIES ARE TAKING BABY STEPS, AND WE'RE RUNNING MARATHONS"**

One thing that sets San Antonio apart from some other parts of the Southwest is the relatively wet weather it sees in some years. Neither desert nor plains, the region can get heavy rainfalls that quickly recharge the porous limestone aquifer. Water can be so abundant, in fact, that it has caused epic floods many times in the city's history. Those deluges inspired the construction of the Riverwalk to tame the San Antonio River as it flows through town.

The question has long been how best to harvest



Roberto Macias of the San Antonio Water System in front of the cascade aerators at the Twin Oaks Aquifer Storage and Recovery Center.

the bounty of the Edwards during wet years and store it up for dry times. Now the city has built an answer: The 3,200-acre Twin Oaks Aquifer Storage and Recovery (ASR) site in southern Bexar County, Texas, about 30 miles south of downtown San Antonio.

Twin Oaks doesn't look like an enormous piece of infrastructure, because most of the working parts are deep underground. Mostly, it looks like a ranch anywhere in this part of Texas, with the exception of some scattered pumps behind chain-link fences, a small office building and a bank of structures called cascade aerators that look like stadium bleachers with water flowing over them. Otherwise, it's just green grazing land (irrigated by the water from beneath), a few live oaks and clusters of cattle.

This was ranch land when SAWS bought it in 1999, and so it is still, leased back to the previous owners whose modest houses are on the property. Hidden from view under the hooves of grazing cows is another aquifer, the Carrizo. Unlike the Edwards, which is made of limestone karst, the Carrizo is a pressurized sand aquifer, which means that it can easily hold water in place. Think of the way a glass of water

would be trapped when you pour it into a bowl full of sand.

The man in charge here is Roberto Macias, another SAWS veteran with a barbed wit and a staggering knowledge of the complicated system under his stewardship. His title is manager of water production and, like Eckhardt, he is clearly proud of the work he does here.

"Other cities are taking baby steps," Macias says, "and we're running marathons."

San Antonio's aquifer storage and recovery, opened in 2004, is the second largest in the nation, after the system in Las Vegas. Macias says that it can hold an estimated 130 billion gallons, "although we don't really know the limit."

Twin Oaks is a crucial element in the city's ability to manage a water supply that is subject to extremes of temperature and rainfall. When the weather is wet and cool, supply is at its highest and demand at its lowest. The karst formations of the Edwards absorb water quickly during rainfall. That's when SAWS pumps Edwards water into the ASR. Then, during droughts, it gets pumped back out of

the ground and into town.

Storing water in an ASR system makes much more sense than storing it in a reservoir, according to Burgin. “I’m one of the biggest proponents of that,” she says. “Water doesn’t evaporate as it does from aboveground reservoirs.” With the increasingly intense winds and higher temperatures that Texas sees on a regular basis, she says, that will only become truer in the future. “ASR is made for a 21st century that is moving into climate change.” On the day that I visit Twin Oaks, the pumps are sending water to San Antonio at a rate of 30 million gallons a day. It goes a

sewer line serving newer neighborhoods to the west and south of the city. There may be more extensions to come.

In a controversial decision, SAWS this year approved water and sewer hookups that would enable a 1,545-acre subdivision in nearby Comal County, adjacent to famed Bracken Cave — home of a colony of 10 to 20 million Mexican free-tailed bats, the largest bat colony in the world. The development would be on what is known as the “recharge zone” for the Edwards, or the place where rainfall seeps into the ground and replenishes the underground stores of water.



A dry creek bed and drainage/water management structure in the Edwards Aquifer Recharge Zone.

long way toward solving the city’s 65 billion gallon-per-year water needs.

But more people are coming, and fast. They will need water, too.

When that happens, Macias and others will have to grapple with the limitations of their system. No amount of conservation or clever management can create a boundless supply of water.

When I was at the Dos Rios sewage plant, I saw workers completing a connection to a 30-mile

In addition to threatening the water supply, opponents of that plan say that bringing humans to the area would create myriad conflicts with the bats, which eat 25 tons of insects every night, at incalculable benefit to local agriculture.

“Aside from the ecological issues,” went **one open letter** on the website Bat Conservation International, “we’re concerned about putting 10,000 people next to millions of building-loving adult bats and millions more juvenile bats learning to fly that will

be attracted to the insects gathering around the porch and street lights of these homes. Should some poor child or parent come into contact with a sick bat or a pet that picked up a sick bat and contract rabies, it won't matter that the bats have been there for 10,000 or more years. There will be a growing call for the city health department to deal with 'this threat to public safety.'"

The bat problem is yet another familiar conundrum for San Antonio. Water attracts growth. Growth demands water. The Edwards Aquifer is one of the most remarkable geological features on the planet, an ecosystem of incomprehensible delicacy and complexity. The city's water management policy and infrastructure is also enormously complex. Can it sustain the uneasy balance between "humans and species," as one newspaper headline from the 1980s put it? Where is the tipping point? Can the city innovate its way out of the problem?

"There's always the understandable urge to go for, 'Ah, there you are, there's the solution, we all just need to do that!'" Karen Guz says. "Well, generally, in my life experience with these complex problems, there are no, 'Ah, that's it!' solutions that avoid having to

rethink and retool processes."

Thousands of SAWS employees, like Gregg Eckhardt at Do Rios and Roberto Macias at Twin Oaks, are trying to figure out how to keep the water clean and flowing as San Antonio's boom goes on, so that people like the cabdriver who took me to SAWS headquarters will continue to be impressed at what flows from their tap.

Meanwhile, the drought stretches on. No one knows yet if it will match the "drought of record," the nine-year period from the 1950s that informs the city's planning. That's a real possibility. And even if it doesn't, the burden of demand is greater than it was then, when the population was roughly one-third what it is today.

"You're supposed to ask yourself the worst-case scenario question," Guz says. "If the drought of record had already started, what do we think will happen to our supplies? And then we model that against how much would our population grow, and our per-capita use. And then we ask ourselves the hard question: Do we have enough water to get through that?"

## ABOUT THE AUTHOR



Sarah Goodyear has written about cities for a variety of publications, including *Grist* and *Streetsblog*. She lives in Brooklyn. She's also on [Twitter](#).



Kelly Lynn James is an Austin, Texas-based photographer working with publications, businesses and non-profit organizations in both the U.S. and Central America.