

the
Future
of
Water

A STARTLING LOOK AHEAD

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*I*t was late October, in the year 2111. As the early sun streamed into his bedroom window, Joe awakened to another hot, sweaty morning, in one of the still populated areas of northwest Los Angeles. As his wife rolled over and threw off the sheet, Joe lay in bed for a few minutes, reflecting on the events of the past few weeks before dragging himself to the water room. Today he was going to find out if he was one of the lucky ones or if he was one of the guys who would be laid off, as his company continued to cut back its West Coast water trading presence.

They didn't have much reason to stay in L.A. these days anyway, thought Joe. The last few family members that he and his wife Ellen had in the area had recently picked up and moved back to the booming Cleveland–Buffalo corridor, where a good bit of US manufacturing was now concentrated. And many of their other long-term friends had long since migrated back to the Midwest or found jobs with the North American government in the Winnipeg area.

In the water room, Joe flipped on the solar fan, then relieved himself into the male urine recycler. He heard the ultrasonic distillation tank kick in behind the wall—the low sound that, much to her consternation, always woke up Ellen. Joe listened as the tank disgorged a pint or so of clean water into the column above the sink. A few seconds later, he could hear the concentrated by-product stream discharge through the filter and into the crystallization reactor in the basement.

Joe rubbed his eyes and tried to remember what day it was. Tuesday—his day for a shower. He jumped into the moisture compartment, sealed the door and hit the “wet” button so that he could lather up. A couple minutes later, he hit the “rinse” button and luxuriated in a full 30-second stream of nice hot water (it had been sunny all day yesterday, and the water in the rooftop tank was still nice and warm).

A small electric pump kicked in after the rinse cycle and sucked the water through a floor pipe and over to the flush tank on top of the female urine recycling system on the other side of the bathroom. “OK, honey, you can get up now,” said Joe as he stepped out of the compartment and started

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to dry off with his nanosorb wipes. Then he threw on some shorts and went into the kitchen, pulled out a bottle of fresh REWater, and mixed up some milk for his morning cereal. “Non-Fossil—100% Recycled—Save Our Continent” said the label on the side of the bottle.

Joe knew that it was probably going to be trouble at the office today. He’d been wrestling back and forth in his mind for several weeks about what to do when the time came. As a water trader, he knew the situation was only getting worse, and there was no longer much sense in pretending that much of a market remained in the L.A. area. There just wasn’t that much trading activity going on anymore.

Joe chewed on his cereal. It was only about two hundred years ago, he thought, that this whole place was just a big pile of sand, with maybe a few palm trees. And it may not be too long before it’s just a pile of sand again. We came in and dumped some water on it, and almost overnight it became one of the most heavily populated and concentrated centers of economic power anywhere in the world, or for that matter, in the history of the world. But those days are over. That was sort of a mirage.

Now, Joe worried, Southern California seemed to be dying almost as quickly as it had been built. An armed insurrection in Colorado in the late 2050s had eventually led to the landmark Supreme Court case in 2066 that cut California’s share of the declining Colorado River flows, and soon thereafter the massive Southern California economy began to decline. And after the protracted drought and the huge population losses of the 2080s, many of the area cities decided they could no longer afford to provide the public with water, and they shut down many of the water distribution systems in the Inland Empire. Thankfully, Joe’s home was in the Hollywood Hills area—one of the few that still had a centralized water distribution system of sorts, albeit in a state of ominous disrepair.

Extensive water pipelines from the Northwestern United States and Canada were built during the middle years of the century to try to maintain irrigation in the Central Valley and to support other population centers in the American Southwest. However, as problems worsened, Americans had finally recognized what skeptics had been saying for decades: the Southwestern oasis had been a mirage from day one.

With rising seas, Los Angeles experienced wide-scale seawater intrusion into its key coastal freshwater aquifers, exacerbating the surface water

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shortages that were already a tightening noose around the city's neck. That pretty much killed the coastal communities. Then the ill-fated effort to take down the Hoover Dam in the 2080s caused vast and unforeseen ecological impacts downstream and further depressed the economy—and perhaps more importantly, the general mood—of Los Angeles. It was sort of like an historical swing of the pendulum, thought Joe—but opposite to the way it had swung a hundred and fifty years earlier, when the new dam buoyed the development of Southern California, and an American victory in World War II brought the United States out of the Great Depression.

By the late 2090s, the rich people were beginning to have water trucked into their neighborhoods from the north. As the oasis of beautiful gardens and golf courses dried out and decayed, the basin was once more gradually turning back into a desert. Joe remembered once when he had been able to fly into L.A. from a meeting back east; he had looked down as they came in above the virtual ghost town areas of eastern San Bernardino and Riverside counties. From the air, Los Angeles was starting to resemble a mummified skeleton; the freeways looked like aging, brittle bones pushing out against a stretched and drying skin. As more people left for Vancouver, Ketchikan, Winnipeg, and beyond, some of their abandoned homes were being taken over by squatters arriving from farther south in Mexico and Central America.

The once-blooming desert cities of Phoenix, Tucson, and Las Vegas also fell into decay quite quickly; once the major reservoirs began to decline, and a couple of the key pipelines were shut down, they couldn't hope to survive. Other smaller Southwestern cities dependent on external water sources were turning into ghost towns by the end of the century—reminiscent of the time, two centuries earlier, when the gold and silver veins ran dry. After the nationalization of the energy industry, the Southwest became even less habitable; a ban on air-conditioning and widespread water shortages essentially left no alternative to northward migration.

As the climate slowly dried across the southern United States, agricultural fertility—and later, large segments of the human population—started slowly but surely to migrate to the North. As the winters shortened, the forests of the American West were decimated, first by pine beetles and later by massive wildland fires that attacked the weakened forests. In fact, the Western skies were so darkened with smoke for many years in the

late century that some scientists even predicted a long-term reversal in the warming trend.

Winter snowpack declined, and with that many of the Western cities saw their primary source of water decline. Year after year, the streams ran dry by midsummer, reservoirs dipped, and fires overran the ecosystem. In earlier days, glacial melt had helped supplement the river flow in dry years, but now the glaciers were mostly gone as well.

In some regions sufficient water still ran, but reservoirs couldn't be built fast enough to store the spring runoff. Water storage capacity started to become the key driver behind commerce and demographics. Most of the Rocky Mountain area population was beginning to migrate toward the Midwest or into Canada by the end of the century for just this reason. The net result was that experts were predicting that by the year 2120, the demographic center of the North American continent would be located somewhere just southeast of the capital of Winnipeg—a huge shift in bodies to the north.

The major financial institutions were among the first to truly understand and recognize the eventual economic impact of the warming climate and the rising seas. Several of them helped to underwrite the forty-niners—the firms that led the great “Ice Rush” of Greenland in 2049, two hundred years after the gold rush. The big financial firms began to withdraw from New York, with several firms moving their people to Cleveland in 2061. Joe's own employer moved to Buffalo a couple of years later. The economic power and cultural dominance of the major Eastern cities began to decline, while what had long been called the “rust belt” cities enjoyed a measured revitalization.

Joe was jolted from his thoughts when he heard the female recycling system clank several times and discharge a quick shot of water onto the tomato plants on the south side of the house, outside the kitchen window. Ellen emerged from the bedroom dabbing her face with a damp nanosorb that she had retrieved from the walls of the water compartment. “I don't know if I can stand another day of these temperatures,” she announced. “It's almost November, for God's sake.” “It's supposed to cool down by the weekend,” Joe replied.

It wasn't much of a surprise, mused Joe, as he downed his last few sips of coffee and started to dress for work, when the United States finally

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“invaded” Canada in 2083. Actually, it wasn’t so much an invasion as a friendly takeover. The president of the United States at the time, Jon-Michael Simpson, was from northern Vermont and of partly French-Canadian ancestry. He’d called his Canadian counterpart to tell him of the impending action, and then made a rare digital holographic address to the nation prior to sending troops over the border on a warm Sunday evening.

Despite a few isolated pockets of token resistance in the Great Plains region, the American soldiers quickly took command of the key water and energy resources in Ontario, Alberta, and British Columbia. Once these critical resources were secured, the United States and an agreeable Canadian prime minister sat down at a negotiating table in Minneapolis and decided that—acting together with the combined military and economic resources of the United States and the natural resources of Canada—they would form the dominant political entity in the new world order.

It later turned out that Canadian premier Roland Garth, weeks earlier, had essentially asked the United States to invade his country—to do what many practical people in both countries realized should be done in order for them both to better survive in the rapidly changing geopolitical balance. For the Canadian nationalists, this came to be considered the greatest act of political treachery since 1941, when President Roosevelt reportedly ignored clear warnings of an impending attack and let Pearl Harbor be decimated in order to build public support and draw the United States into World War II.

Compared to other more fragile water- and energy-based coalitions that were emerging in other corners of the world, the Canadians and the Americans meshed quite well. Between them, they had the wealth of water and natural resources and the ingenuity and drive to build a commanding political presence. For decades, the North American population had been gradually migrating north and toward the center of the continent. The migrants sensed that a central locus might provide them some level of protection in the future and looked over their shoulders: Winnipeg was declared the capital in 2091. Winnipeg could probably be a pretty livable place if we had to move there, thought Joe. It still got a little cold in the middle of the winter, but it was pleasant most of the year, and was still a comfortable thousand miles or so from the deserts encroaching from the south.

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The Canadian water and energy resources were extensive, enough to support the continent's population for a while, but the North American long-range planners were beginning to realize that they would eventually need more. With that in mind, they had begun, actually many years before, to eye Central Africa—the world's poorest and economically most dysfunctional area. The northern half of Africa was basically unpopulated by the beginning of the twenty-second century. Many of its original people were gone; the more resourceful fled the continent entirely, while most of those from the more impoverished countries perished during the interminable trek southward. The southern tip of Africa also dried and then politically disintegrated during the latter half of the century, with the wealthier people moving north. Now, the steamy and formerly backward center of the continent held out an allure as one of the world's richest sources of water and minerals—and many predicted it would become a key economic and financial center of the future.

Kinshasa as a key economic center of the world—who would have guessed that a hundred years ago, Joe asked himself. And all just because it happens to have a lot of water. Nowadays, Joe and Ellen had gotten comfortable using about 20 gallons of water per day. Joe's grandfather, on the other hand, even in the drought of the 2030s, had used close to 200 gallons a day. But no matter how much they used, water was still expensive; they were spending a lot more on water these days than on food. If water climbs above \$7 a gallon, Joe thought, we can't afford to stay here—even if I do manage to keep my job for a while longer. We're already spending almost \$150 a day on it. We'll simply have to follow the crowd and move to where the jobs are—where the water is.

And Ellen was very worried about another issue that was starting to hit the news around L.A. For decades, scientists had been routinely testing the local surface waters, and they were finding higher and higher concentrations of various man-made pharmaceutical compounds and a multitude of industrial chemicals. Sure, the water only contained minuscule amounts—one part per trillion, or so—but modern instruments were finding this stuff in waterways all over the state, even up in the mountains. It appeared that people had unknowingly ingested these materials for years, if not decades, and the scientists were concerned that it was having a grave impact on human reproductive and endocrine systems. Everyone knew that sperm

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counts among young males were falling dramatically—and now the experts were blaming these mystery water contaminants for the sharp drop in birth rates in the United States.

No one really understands what the hell is going on here, thought Joe, but something is definitely happening. Over time, mankind was clearly becoming less fertile. That's why the Continental Government had recently mandated separate male and female urine recyclers. Apparently, the female body was better at processing and withstanding these tiny contaminants than the male body was, and the government—in all of its wisdom—determined that the concentrated male by-product stream should not be used in the direct recycling system or to irrigate plants for human consumption. Hence the crystallizer in the basement. If current trends continued, said the scientists, human fertility may be doomed. Maybe all of this was just God's way of solving all the problems we've created for ourselves, Joe thought wryly.

Why did humans ever decide they wanted to live in this place anyway, Joe wondered. All you've got to do is just look outside and you can see that it's going to turn back into one big damn desert. It was a pretty inhospitable desert when those first folks showed up, too. And now they're actually talking about turning off the Vancouver pipeline. Joe and Ellen both knew there was no way they could afford to have their water trucked in, like the remaining wealthy families down in Hancock Park were doing.

He looked out the window at the gravel in the yard and the small green patch of artificial turf where he and the kids wrestled on the ground and putted a golf ball around. The cactus plants that he and Ellen had planted almost a year ago looked wilted. We'll probably have to dig those up and toss them before long, he thought. Not enough water. Maybe those idiots who are talking about opening up a water resort on the moon aren't as crazy as everybody thinks they are, Joe muttered under his breath, as he got up to head to the office. Maybe I should see if they're hiring.

OK, maybe not the moon, but Joe was increasingly thinking about following a couple of his buddies, and moving to Northern Canada, or maybe even to Africa. There were good water jobs in both places. That's where the water is; that's where the opportunities are, his friends had said. That's where the future is. One of these days, I really am going to have to sit down and talk with Ellen about all of this. She wants to get the kids out of here,

anyway. But not today. "Bye, honey, I'll see you tonight," Joe said, as he slipped out the door and into the heat.



Does this scenario sound a little crazy and a little scary? Scary—certainly. Crazy—maybe not.

Hopefully, our future will not turn into this kind of dystopia. Maybe it will turn out that with smarter water conservation systems and with wiser water management policies, the California lifestyle that we know today can remain vibrant. Maybe in a hundred years, California's economy will be driven by a vast array of solar panels in the Mojave Desert. Perhaps the Central Valley of California will be returned to its original state, and people will buy most of their food from the Midwest, acknowledging that rain-fed agriculture is more sustainable. Maybe millions of rooftop harvesting systems will collect rainwaters and direct them through the home's internal uses and then onto extensive vegetable gardens in the front yard. Perhaps a hundred years from now, desalination powered by the waves will help provide enough freshwater to keep homes and industry functioning just fine. Perhaps we'll have genetically modified grass that can be irrigated with seawater, so the children of the future can play on grass, not plastic. Maybe storm waters will be collected and delivered to distributed neighborhood water treatment plants, rather than running unused to the sea. Perhaps the word waste itself will fade from our vocabulary, and we will see in everything a resource—a possibility. Perhaps.

As we will see in the following pages, the availability and the price of water will increasingly come to dominate economic, political, and social trends in the future. Unlike other commodities, water is infinitely renewable, but its supply is essentially fixed, and we have no substitutes whatsoever for the critical role that water plays in each of our lives. And no matter how many people end up living on this small planet, we are always going to have exactly the same amount of water.

