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TOP: NATHAN LINDSTROM; BOTTOM: MICHAEL LIGHT STUDIO

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SUSTAINABILITY

WATERSHED MOMENT

THE L.A. AQUEDUCT USHERED IN THE ERA OF BIG WATER INFRASTRUCTURE IN THE WEST. NOW HADLEY AND PETER ARNOLD AT WOODBURY'S ARID LANDS INSTITUTE ARE TRYING TO MAP A NEW COURSE.

Text by **Reed Karaim**
Aerial photos by **Michael Light**
Portrait by **Andy J. Scott**

EVERY GREAT CITY has its defining mythology and its pantheon of local gods. In Los Angeles, no figure looms larger than William Mulholland. One hundred years ago, Mulholland, a self-taught Irish immigrant and former ditch cleaner who rose to head the Los Angeles water department through unstinting work and sheer force of personality, stood at the bottom of the brand new Los Angeles aqueduct. The aqueduct, a marvel of both engineering and political manipulation, had been built to bring the young city a plentiful supply of water from the Owens Valley, set against the Sierra Nevada Mountains 220 miles to the north. More than anyone else, Mulholland had made this happen. On Nov. 5, 1913, a crowd had gathered to celebrate the aqueduct's opening. It had already been a long day full of speeches when Mulholland rose to address them. All he did was gesture to the water flowing from the aqueduct. "There it is," he said. "Take it."

With those five words, Mulholland wrote the history of the American West for the next century. As the region filled with millions of people, water would be moved, stored, stolen, used, and reused through a massive remaking of the landscape that may be without equal in human history. Dams larger than any attempted before would be built, canals would stretch hundreds of miles to reach cities such as Phoenix, rivers would be dredged, straightened, and even made to run backwards. Whole communities would be submerged beneath huge reservoirs. All this to create an illusion in the largely arid land that extends west from the Great Plains that water was as plentiful as it was in the East—you didn't have to think about it, you could just take it.

Home building and landscape and urban design throughout much of the West have proceeded from the idea implicit in Mulholland's proclamation. But on the 100th anniversary of the aqueduct that started it all, Peter and Hadley Arnold, who founded the Arid Lands Institute at Woodbury University in Burbank, Calif., are proposing an alternate vision for the future. They're calling their initiative "Divining LA: Drylands City Design for the Next 100 Years," and it seeks to fundamentally change the way western cities view water. The Arnolds hope to gather experts from a variety of disciplines, including the sciences, architecture, landscape architecture, and urban planning, to rethink how we design our buildings, neighborhoods, and cities. As climate change and continued growth squeeze the West's water infrastructure, "Divining LA" stands in opposition to the fantasy of limitless freshwater flowing from some distant source. "It's a paradigm shift," says Peter Arnold. "Given the excessive demand on our imported water supply, it's really looking at how we can better manage and locate water locally."

The effort asks architects to think more carefully about how buildings fit into a larger

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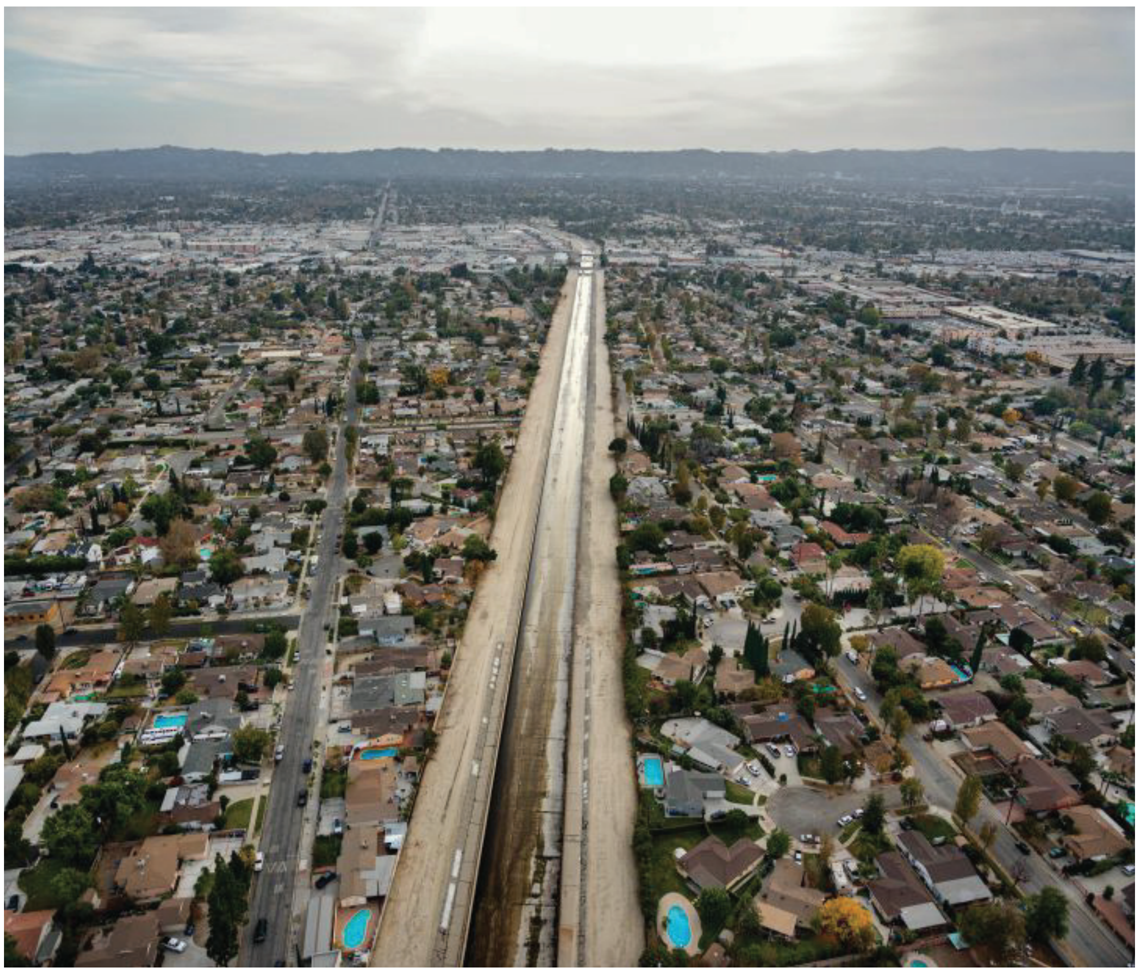


picture: the mostly unnoticed passage of water as it falls on, moves across, and sinks into the ground. "We first have to break through the invisibility of water systems," says Hadley Arnold, "the idea that water is just something that shows up in a pipe."

THE HYDROLOGY OF ANY CITY, or even neighborhood, can be complicated. As a case study, the Arnolds have worked out a series of detailed maps of the San Fernando Valley, where Burbank is located. One map traces the path of rain runoff through the valley, showing how it moves, where it settles. Combined with maps of the aquifer, including areas where groundwater is unsuitable for consumption because of past contamination, the study reveals a complicated hydrological system, and how every acre of the valley fits into it. The effort is intensive, requiring careful study of soil types, land contours, the built environment, and the history of previous development. "The idea is we really want to capture as much water as possible," says Peter, "but we also need to capture it in the right places." The combined maps show "us the best places for water infiltration."

In fact, the rain lost to runoff in much of the urban West is the difference between a never-ending search for water and largely sustainable communities. "Local water provided by water recycling and stormwater capture could provide 82 percent of Los Angeles's current needs," says Peter. "That's not [our statistic]; that's from the Metropolitan Water District."

The implications are profound for designers. First, rooftop water capture becomes much more significant when you realize the importance of precipitation in arid or semi-arid regions. In the 85 percent of Los Angeles now impermeable to water, "a whole lot of that area is a whole lot of roofs," says Hadley.

Second, understanding local hydrology provides a roadmap to sustainable design. Lots in natural infiltration areas should be designed to hold water, while streets or parking lots should be permeable or built to capture and channel water into the ground. Above contaminated parts of the local aquifer, water needs to be carried away to a spot where it can be safely captured. "Architects like to look at the object in the field," Peter says. "Our approach is to look at the field of objects." Hadley notes that a benefit is communities built to "a specificity of place" that escapes the homogeneity of so many western cities built in defiance of their actual location and climate.

The Arid Lands Institute, which operates as an independent education and research center, works closely with Woodbury's architecture school. Among the institute's programs is a graduate degree in Drylands Design open to

Big water infrastructure in L.A. dates back to the opening of the aqueduct in 1913. To increase its water supply, the city also constructed a second aqueduct, completed in 1970. **Opposite top:** The cascades near Sylmar, Calif., where both aqueducts terminate. When the nearby hydroelectric plants are offline, the water flows down the cascades before entering the Van Norman Reservoir. **Opposite bottom:** The Tujunga Wash, a tributary of the Los Angeles River. **Left:** The Yarnell Debris Basin, located between the Upper Van Normal and Lower Van Normal Lakes in Granda Hills, Calif., captures soil runoff and diverts stormwater to the Santa Monica Bay.

applications who hold a first professional degree in architecture or landscape architecture. Student research explores the implications of working with sustainable water use in building and landscape design. "Divining LA" hopes to take that exploration even further, bringing scholars and others together to broaden the understanding of how the built environment, landscape, and changing climate interact. If the modern West was built on water, then many designers across the region are starting to take a fresh look at that foundation.

THE WATER THAT FIRST FLOWED down the L.A. aqueduct in 1913 was a tumbling blue cascade that looked good enough to drink right from the chute. But there was nothing pure about the way the city had wrestled control of it from the farmers and towns in the Owens Valley. As outlined in *Cadillac Desert*, Marc Reisner's definitive history of western water battles: "Los Angeles employed chicanery, subterfuge, spies, bribery, a campaign of divide-and-conquer, and a strategy of lies to get the water it needed. In the end, it milked the valley bone-dry."

Today, Owens Lake, once the heart of a rich agricultural valley, is largely an arid alkaline flat. Los Angeles has to use 30 million gallons per year to keep down the dust in the valley, enough water to meet the needs of the entire city of San Francisco. The story of the Owens Valley is the story of the West in miniature: a bitter struggle over a scarce resource with the biggest players—usually cities and large-scale agriculture—winning out over the less powerful.

The irony of this history is that even in the desert Southwest, most communities do almost nothing to capture what precipitation they get. Because rain rarely falls, cities were often built without drainage systems. In Tucson, Ariz., annual rainfall measures only 11 inches or so, but much of it comes during torrential summer monsoons, flooding streets and washes before running off into the surrounding Sonoran Desert too quickly to do much good.

Yet even in Tucson, a local water guru named Brad Lancaster has become famous in sustainability circles for living almost completely on the water that falls on his small urban lot. He captures and stores rainfall from his roof, recycles wastewater, and has carefully contoured his yard so that the city's scant precipitation feeds a verdant garden. Ron Stoltz, a professor of landscape architecture at the University of Arizona in Tucson, says what Lancaster has accomplished isn't an illusion. "There's enough water that falls in Tucson that if we used it all, we wouldn't need to import water," he says. Capturing every drop of precipitation is "an engineering impossibility," Stoltz adds, "but, obviously, the more we can capture and use, the less we need to import."

In 2007, when the University of Arizona's Department of Architecture, Planning, and Landscape Architecture built a major addition to its building, it decided to make the structure and grounds a model of intelligent water use. "We claim that this is the most integrated landscape and structure in the arid Southwest," says Stoltz. "The building is a classroom."

The new addition, designed by Jones Studio in Phoenix, captures rain from the roof and condensate from air-conditioning units, storing it all in an 11,600-gallon storage tank integrated into the structure. The rooftop yields about 85,000 gallons per year, while the air conditioners provide another 95,000 gallons. "We get more water from condensate than anything else," Stoltz says. An additional 45,000 gallons comes from water back-flushed from drinking fountains.

The water is used to irrigate the 1.2-acre Underwood Family Sonoran Landscape Laboratory on the building's grounds. The Underwood Garden, as it's known, includes an 8,000-gallon pond fed by captured water that functions as a desert wetlands, complete with a stock of local fish and amphibians. The wetlands is one of five different Sonoran habitats incorporated into the garden, which has been designed to illustrate how landscapes can be contoured to control runoff and allow for maximum infiltration. In a heavy rain, the pond floods other parts of the garden in a sequence that allows water to pool and soak into the soil efficiently. Microbasins in the landscape capture an additional 10,000 gallons a year.

The result is a desert oasis, rich with native vegetation, which is almost completely self-sustaining. The project required close collaboration between Jones Studio and the firm that designed the landscape, Austin-based Ten Eyck Landscape Architects. Stoltz believes this approach will become more common in the future. "Every student that leaves here is drilled with water sustainability as one of the core values," he says. "We didn't invent this stuff," he adds. "The Native Americans were doing it first. The early settlers were doing it."

PETER ARNOLD FIRST FELL IN LOVE with the mysteries of the western landscape growing up in Lakewood, Colo. He was fascinated by the way dams and other manmade water management features in the countryside were so taken for granted by residents that they went largely unnoticed. He and Hadley, who both attended the Southern California Institute of Architecture in Los Angeles, took long trips through the region so he could photograph this infrastructure and its relationship to the natural terrain. Hadley says she realized that if she was going to be out roughing it with her husband, she might as well learn something in the process. When you look closely, she says, "the land offers up its own set of lessons, and those lessons connect back to the native peoples."

The Puebloan peoples in Southwest, who date back hundreds if not thousands of years, were masters of shaping the earth to capture and channel rainfall, allowing them to grow hardy, indigenous crops in the desert. The Arnolds regularly take groups of students on extended trips into the American outback to study how the land was shaped by native cultures and the modern water infrastructure on which we now depend. Philip Burkhardt, a research fellow at the institute in 2011, remembers a field trip to New Mexico vividly. He was struck by the applicability of many ancient practices, which couldn't depend on pumps or electrical energy, but used "gravity, rocks, and whatever was there" for water management. "There's a local mind-set to the way the pre-Columbian civilizations had to deal with water. ... When you start talking about collecting water on a neighborhood scale those kinds of technologies become really interesting," he says.

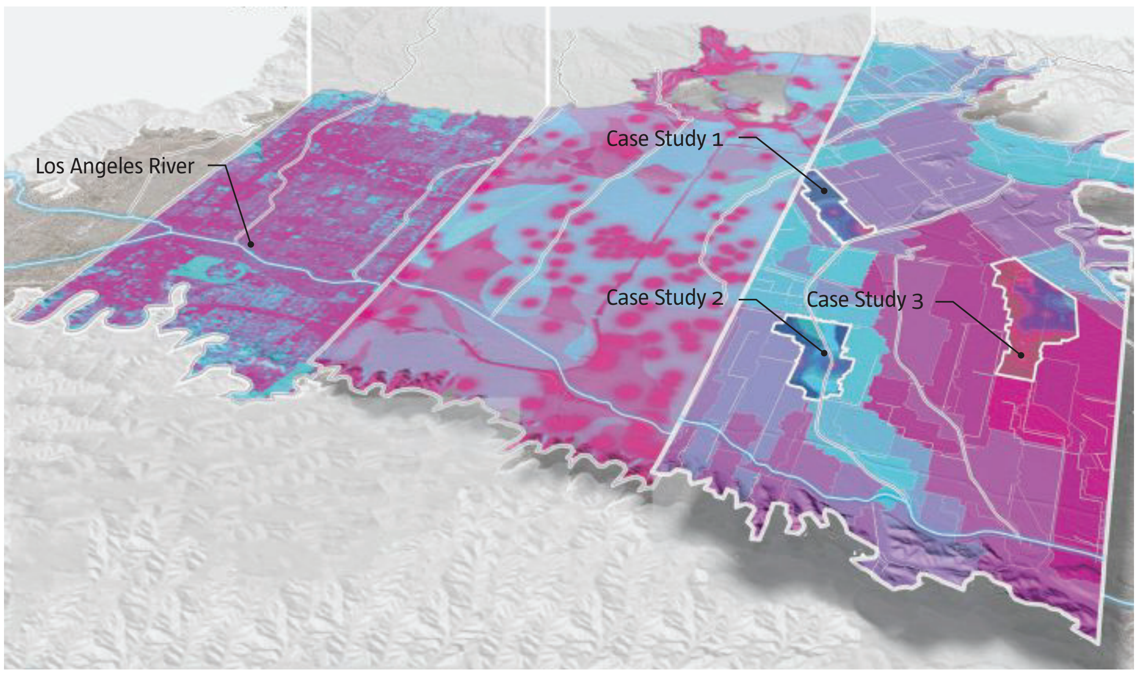
Students at the institute also study how other western cultures integrated an awareness of water's scarcity and value into building. The original Trevi Fountain, for example, wasn't just an object of beauty to the Romans, it also conveyed information about the volume of water flowing down the 21-kilometer Virgo aqueduct, one of 11 aqueducts that brought water into the city.

By relearning these values, Hadley imagines a future in which the interplay between place and water is more transparent and widely appreciated. "For example, your eyes would register that a particular spot is a capture zone because of the green space you'd see and the other material used there to hold water and help it infiltrate," she says.

Architecture would also incorporate water systems in such a way that they become part of the beauty of a building while imparting information to occupants. "I'm always dreaming of a house where the roof would capture the water and then you'd store it in a way that it would be visible in the walls," she says. "An awareness of the whole system from the sky to the earth would be part of how we build."

A century ago, William Mulholland gave expression to the western notion that an endless bounty of water waits just over the next mountain. If "Divining LA" is successful, the next century may be marked by a recognition that answers to the West's water needs, like all the best solutions, are found close to home.

Stormwater Retention in the San Fernando Valley



The Arnolds created a stormwater runoff model based on 30-year precipitation data, assessed soil types and ground surface impermeability, and analyzed zones contaminated with chemicals to pinpoint areas in the valley best suited for stormwater infiltration and capture. Case studies explore areas that have extensive contamination, sites that are well suited to infiltration, and sites that are a combination of the two.

COURTESY ARID LANDS INSTITUTE