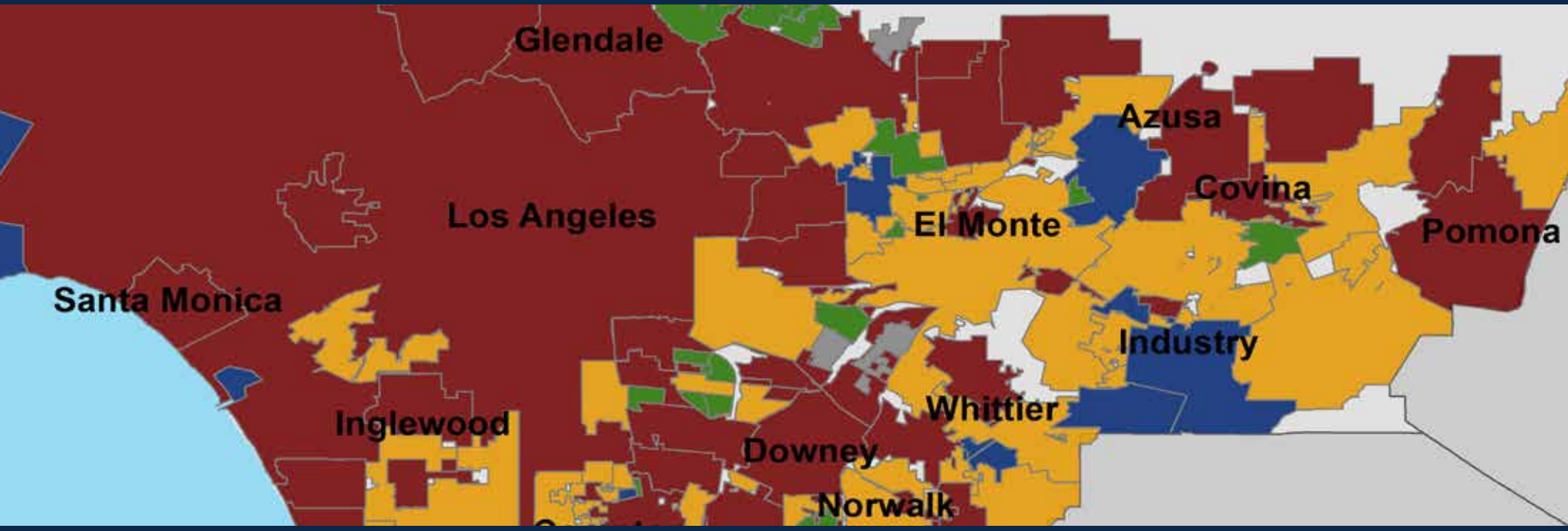
LOS ANGELES COUNTY COMMUNITY WATER SYSTEMS



ATLAS AND POLICY GUIDE

Supply Vulnerabilities, At-Risk Populations, Conservation Opportunities, Pricing Policies, and Customer Assistance Programs

UCLA Luskin School *of* Public Affairs

Luskin Center FOR INNOVATION


WATER

Los Angeles County Community Water Systems:

Atlas and Policy Guide

Supply Vulnerabilities, At-Risk Populations, Conservation Opportunities, Pricing Policies, and Customer Assistance Programs

UCLA Luskin Center for Innovation

Established with a gift from Meyer and Renee Luskin, the UCLA Luskin Center for Innovation translates world-class research into real-world policy and planning solutions. Organized around initiatives, the Luskin Center addresses pressing issues of energy, water, transportation and sustainability. The Luskin Center is based in the UCLA Luskin School of Public Affairs.

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Building Blocks of LA's Water Supply Network

Community water systems are the fundamental building blocks of California's drinking water supply network.

Despite the essential role water plays in Los Angeles County, surprisingly little is known about our community water systems. Community water systems are the fundamental building blocks of California's water supply network.[1] These systems are responsible for providing households, businesses, and governments with a reliable supply of clean water at a reasonable price. They are on the front lines of adapting to drought and climate change. They manage lifeline programs for the County's many low-income households. These systems are the portals through which federal, state, and regional officials implement water policies supporting water supply reliability, conservation, efficiency, affordability, environmental protection, and public health. Our analysis of these systems can be used to directly inform state-wide initiatives formed to address pressing drinking water concerns, such as emergency assistance efforts, the Water Energy Technology program, the recently-legislated Low Income Water Assistance Program and the work of the office of Sustainable Water Solutions.

Few people know that Los Angeles County currently has 228 community water systems. Each community water system is mapped in the Gazetteer on page 70. As we show, they vary dramatically in their size, geography, the types of communities they serve, and their technical, managerial, and financial capacities: ranging from a mobile home park of twenty-five residents in Antelope Valley to the Los Angeles Department of Water and Power with nearly four million customers. Every community water system has adopted one of eight governance structures, which are governed by five distinct bodies of state law. Adding to this complexity, smaller water systems are often exempted from statewide water conservation and consumption reporting regulations. As a result, federal and state oversight and knowledge of these community water systems is fragmented and often limited.

By providing this Atlas and Policy Guide we seek to improve policymakers' understanding of the population of community water systems within Los Angeles County and to provide a data resource for future researchers.

Number of Community Water Systems by Size and Governance Type

The guide begins by characterizing the number of community water systems by size and governance type. By understanding how many community water systems of each governance type serve the County, we may understand the scope of local impacts when California policymakers change the water, government, public utilities, municipal, or corporations codes. Similarly, by understanding the number of smaller water systems and the populations served by them, we may better appreciate local consequences of exempting these water systems from planning best practices and usage reporting regulations. This analysis recognizes that technical and managerial capacities of water systems vary across system size and governance type—setting the stage for evaluating their ability to adapt to emerging threats and opportunities as well as meet the needs of their vulnerable customers.

Threats and system Vulnerabilities

We characterize several important threats facing community water systems in Los Angeles County. By identifying which water systems are entirely dependent on local groundwater or imported water, we can begin to assess water supply risks. Those systems entirely dependent on local groundwater may be especially vulnerable to local sources of groundwater contamination and a changing climate, which we will also describe. Those systems entirely dependent on imported water will be vulnerable to changes in the quantity, quality, and costs of these outside sources. This characterization of supply dependence is essential if we are to appreciate the local impacts of state policy decisions such as the pass-through costs of the Bay Delta Conservation Plan, a reduction in the Department of Water Resources emergency aid to distressed water systems, or increased conveyance costs associated with climate change or energy policies.

California's community water systems spend millions of dollars annually on treating surface and groundwater sources before delivering drinking water to customers. Using a state database, we highlight community water systems in LA County that rely on contaminated groundwater sources. Community water systems with large customer bases and access to technical and managerial support can continuously protect their customers from harmful contaminants found in water sources. Small water systems often struggle to meet even basic water quality compliance rules and are more likely to expose their customers to unhealthy drinking water. This Atlas and Policy Guide will help federal, state, and local regulators as they consider the impact of subsidizing technical, financial, or managerial support for smaller water systems or tightening the drinking water quality standards.

We characterize how mid-21st century climate changes will impact each of the County's water systems differently by utilizing recently downscaled high-resolution climate predictions. By describing system-level changes in extreme heat days and average temperature, we can assist the planning efforts of water system managers in several ways. For example, increased average temperatures and extreme heat days will exacerbate drought conditions, increasing pressure on local groundwater supplies. Systems that contain irrigated landscaping, agriculture, or stock animals will experience elevated evapotranspiration rates, and thus increased consumption, if these water uses are retained.

Vulnerable Populations

We also characterize the vulnerability of customers served by the County's community water systems. We identify those systems with high concentrations of disadvantaged communities, low-income households, and populations with disproportionate number of very young and old residents. By doing so, we identify where high water prices, shortages and water contamination may have their most adverse economic, social, and public health impacts. This enhanced understanding may empower regional and state policymakers to more effectively protect the rights of these populations to accessible, clean, and affordable water.

Built Environment Influences on Opportunities for Conservation

The opportunities for additional outdoor and indoor water conservation will depend upon the nature of the built environment served by each water system. Water systems with a larger number of single-family and owner-occupied homes may be able to significantly reduce their outdoor water consumption with incentives and rebates. Similarly, the larger the share of older residential buildings within a water system service area, the greater the potential for indoor water efficiency improvements, since older water fixtures and appliances tend to be less water efficient. We describe how these features of the built environment vary across water systems serving the County.

Public Access to System Information

We also assess whether and to what extent water systems provide their customers with access to vital information about water. As our primary accessibility indicator, we identify whether systems maintain a publicly-available website. Moreover, we assess the quality and depth of information displayed on system websites, including data on water conservation opportunities and rebates, pricing for water use, and low-income customer assistance. System websites should serve as reliable repositories for all customer information which systems also provide via less dynamic media, such as mailings and billboards. Websites also serve the vital and unique function of delivering up-to-date messages from state agencies to customers regarding water use restrictions and other emergency measures related to the drought. Maintaining a website should be relatively easy for systems, and will only become more important as the ubiquity of internet use increases among system customers.

Water Conservation Programs

In addition to outlining opportunities for conservation presented by the nature of the built environment served by each water system, we describe the range of conservation rebates and incentives which individual systems offer to customers to reduce both indoor and outdoor water use. Conservation incentive programs generally offer customers discounts to purchase water saving devices or rebates to make changes to their residence which lower water consumption. We also discuss differences in the ease of enrolling in such incentive programs.

Many water systems are already supported by the Metropolitan Water District's SoCal Water Smart program in providing conservation rebates to customers. However, the urgency of enhancing rebate programs and customer uptake is heightened in current drought conditions. Governor Brown's April, 1, 2015 Executive Order mandating that cities and large water districts reduce water usage by 25% below 2013 levels has brought the issue of conservation even more abruptly to the forefront of water systems' priorities across California. The state is also providing funding for the implementation of new conservation technologies, most notably through the Water Energy Technology Program launched in Summer 2015. This program may provide new forms of support for individual water systems, or retail agencies such as the Metropolitan Water District, to offer attractive conservation opportunities to customers. Our analysis suggests where and how state agencies may best target investment in conservation programs.

Water Pricing, Cost and Affordability

We also describe the water pricing policies maintained by community water systems in LA County. We calculate an average price level of water for households in each system, as well as consider whether the water service provided by systems is affordable for households. We also utilize the pricing data to assess the stability of revenue streams for systems. The structure of water pricing directly influences customer expenditure on water. The price of water in turn directly influences conservation behavior and affordability, which are two foci of this policy guide. From the perspective of households, higher water prices incentivize conservation and the adoption of water-saving technologies, but reduce affordability. From the perspective of community water systems, however, maintaining stable revenue is also a priority. Different water pricing structures enable systems to satisfy the three goals of affordability, conservation and revenue stability to varying extents. While there is a growing consensus that the best practice for system water pricing is a carefully-designed increasing block tariff structure with lifeline rates for basic consumption, the use of this pricing structure by systems is actually under threat across the state due to a recent court ruling on Proposition 218.

Without intervention, affordability is likely to become worse for customers due to always-increasing demands on water quantity across the state and the reliance on poorer quality water as older supplies dry up. Both of these factors drive up source costs for systems, which are ultimately passed on to customers in the form of price increases. In order to avoid affordability or health crises, systems will increasingly need to rely on the technical, financial and managerial assistance programs offered by the State Water Resources Board. If technical assistance is insufficient to make maintaining revenue and affordability goals viable for individual systems, the board must be proactive in encouraging consolidation of these systems with those which are better equipped. A more comprehensive data collection and analysis effort on the challenges facing systems statewide, however, is needed to enable the board to proactively assess and target systems which need these types of assistance.

Needs-Based Customer Assistance Programs

We conclude the report by assessing the types of needs-based customer assistance programs maintained by individual water systems to reduce the cost burden to vulnerable customers. We also analyze the ease of enrolling in assistance programs, which may serve as a significant enabler or barrier to households in need. There are few, if any, other direct means of public assistance available to support households to pay for water service. Eligibility for system-run assistance programs varies, but is most often based on income. The type of benefit offered also depends on the system, although fixed rebates or proportional discounts to regular water prices are the most common programs. Systems are not currently required by the state to maintain needs-based customer assistance programs, except if they are regulated by the California Public Utilities Commission. However, Assembly Bill 401, signed by Governor Brown in October 2015, calls for the establishment of a statewide Low-Income Water Rate Assistance Program by January 1, 2018.

Essential Functions of Community Water Systems

Essential Functions of Community Water Systems
Water Quality, Quantity, and Price

At the core of every community water system is the responsibility to provide customers with a reliable supply of clean water at an affordable price. The following section presents background knowledge on these essential functions in terms of the quality, quantity, and price of drinking water for residential customers.

Quantity

Essential potable water consumption in California takes place indoors, including water used for drinking, bathing, cleaning, and cooking. However, discretionary outdoor water use is the largest part of residential water use in California; at least half of all residential water use in the state is used for watering landscapes. The amount of potable water consumed by residential water users varies between different hydrologic regions in California. Estimates of daily residential water use range from 154 gallons per capita per day in the Central Coast area to 346 gallons per capita per day in the southeastern corner of the state. [2]

Quality

The Safe Drinking Water Act of 1974 established federal regulation of drinking water quality standards for bacterial and chemical substances known to impair public health. In California, the quality of drinking water sources and water in distribution systems is regulated by the State Water Resources Control Board. Testing for bacterial and chemical contamination in each community water system takes place over defined compliance periods. In general, bacteria levels in community water systems are monitored monthly, nitrates are measured annually and chemicals are monitored every three years. Water quality standards, called Maximum Contaminant Levels (MCLs) are designed to account for health risk, detectability, treatability, and cost-of-treatment.

Price

Most Californians live in community water systems that collect revenue through the sale of drinking water. Water sales revenue makes up an important part of community water systems' financial resources for funding operation and maintenance, regulatory compliance activities, conservation programs, and capital projects. With the exception of some large private community water systems, community water systems may establish water rates without state regulatory oversight. The affordability of water rates for households is determined by measuring the percent of household income spent on water service annually. Annual water service costs that exceed 1.5% of annual household income are considered unaffordable and "high-burden" by the California Department of Public Health.[3]

A future of climate change and intermittent drought in California will challenge the technical, managerial, and financial capacities of many community water systems. Confronted with significant uncertainty in consumption and available water supplies, community water systems may be forced to change the available quality, quantity, and price of water service. In the Threats and System Vulnerabilities section, we describe how supply characteristics of community water systems can compromise these essential functions in the face of climate change. In the Vulnerable Populations Served by Community Water Systems section, we describe how certain population groups are adversely impacted by the breakdown of a community water system's core functions.

Community Water Systems in Los Angeles County: Overview

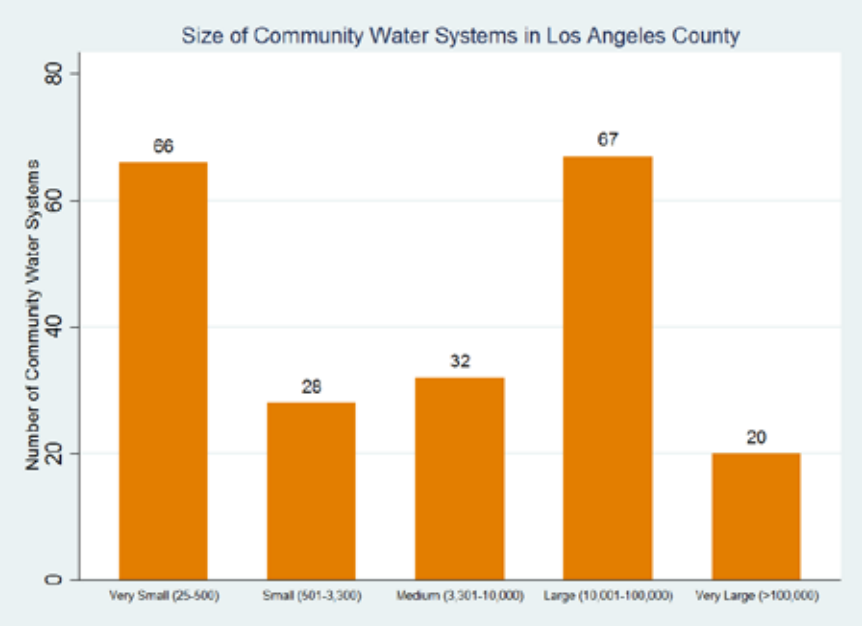
Los Angeles County is the most populous county in the United States and contains the City of Los Angeles, the largest city in California and the second largest in the United States. This study focuses on 213 community water systems that serve drinking water to the residents of Los Angeles County.[4] Population served per system ranges from twenty-five (Winterhaven Mobile Estates in Antelope Valley) to nearly four million (Los Angeles Department of Water and Power).

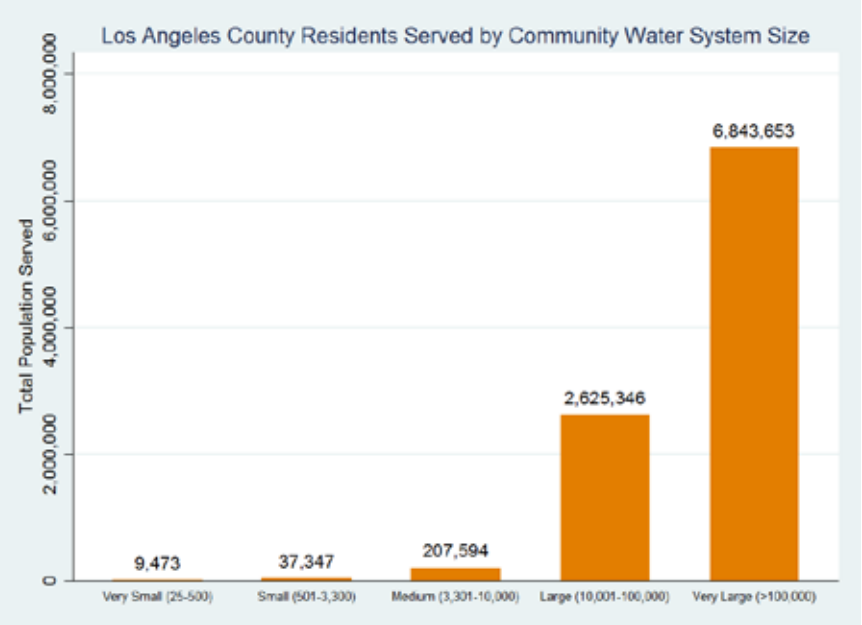
The size of a community water system is determined by the number of customers it serves. Very Small (25-500 customers) and Small (501-3,300 customers) water systems represent 44 percent of community water systems in the County. In terms of population served, over ninety percent of County residents are served by Large (10,001-100,000 customers) or Very Large (>100,000 customers) water systems.

Community water systems vary considerably with respect to water supply sources, governance types, technical, managerial and financial capacities, demographics, geography, and built environment. This Atlas and Policy Guide for LA County serves as a tool for understanding these key dimensions of community water systems.

This Community Water Systems Atlas and Policy Guide enables:

- ***Evaluation of local and regional impact of federal and state water policies;***
- ***Assessment of local and regional need for federal, state, and local financial resources;***
- ***Efficient deployment of water programs, and;***
- ***Identification of emerging issues related to climate change.***





Community Water Systems in Los Angeles County
Governance Structures

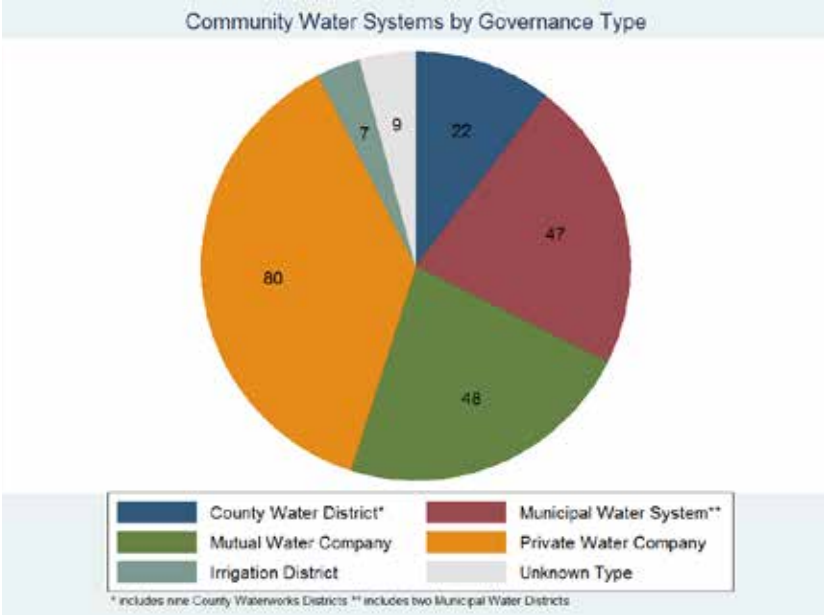
Every community water system balances complex infrastructure operations, stakeholder issues, regulatory compliance, and financial management in order to provide reliable and safe drinking water. The decision-making protocols that govern operation and management of community water systems fall into two principal categories: governmental entities and privately owned entities that provide drinking water.

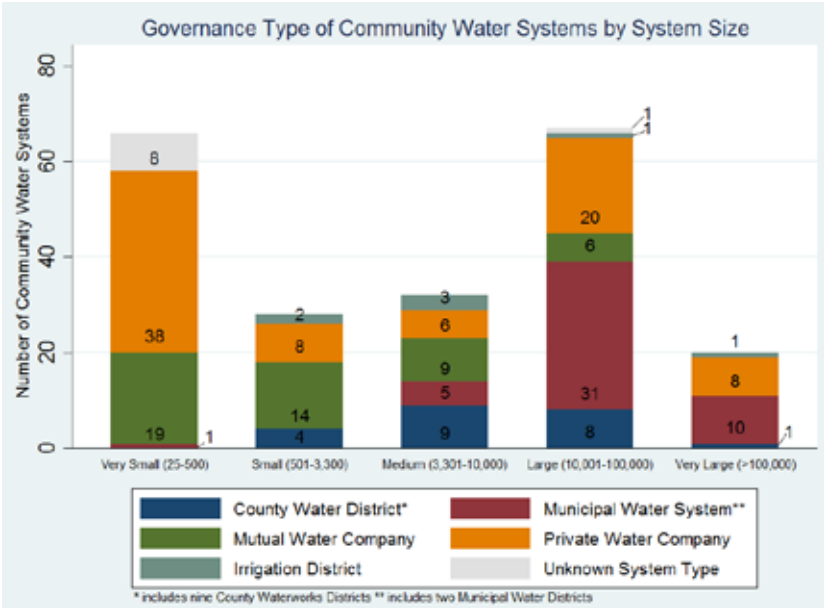
Each type of community water system is regulated by a different body of state law. Generally speaking, five bodies of state law regulate the formation and governance of community water systems. California Water Code regulates special districts like irrigation districts, county water districts and county waterworks districts, to name a few. The California Government Code regulates community services districts. California Public Utilities Code regulates public utility districts (Division 7) and private utility districts (governed by Public Utilities Commission). Municipal water systems are often governed by local municipal codes. Finally, mutual water companies are regulated by the California Corporations Code.[5] While water quality regulations and some state water conservation policies cut across all governance types, the lack of strong state intervention on community water system policies and practices may be attributable to the diversity of regulatory authority governing these systems.

Most community water systems in Los Angeles County are private, with the bulk of those systems being Very Small. Many of the private water systems are commercial businesses, like mobile home parks, that provide water as an ancillary benefit to their main commercial business. However, several larger community water systems are owned and operated by private companies. For example Suburban Water Systems, California Water Service Company and Golden State Water Company operate several large and discontinuous drinking water distribution systems in Los Angeles County.

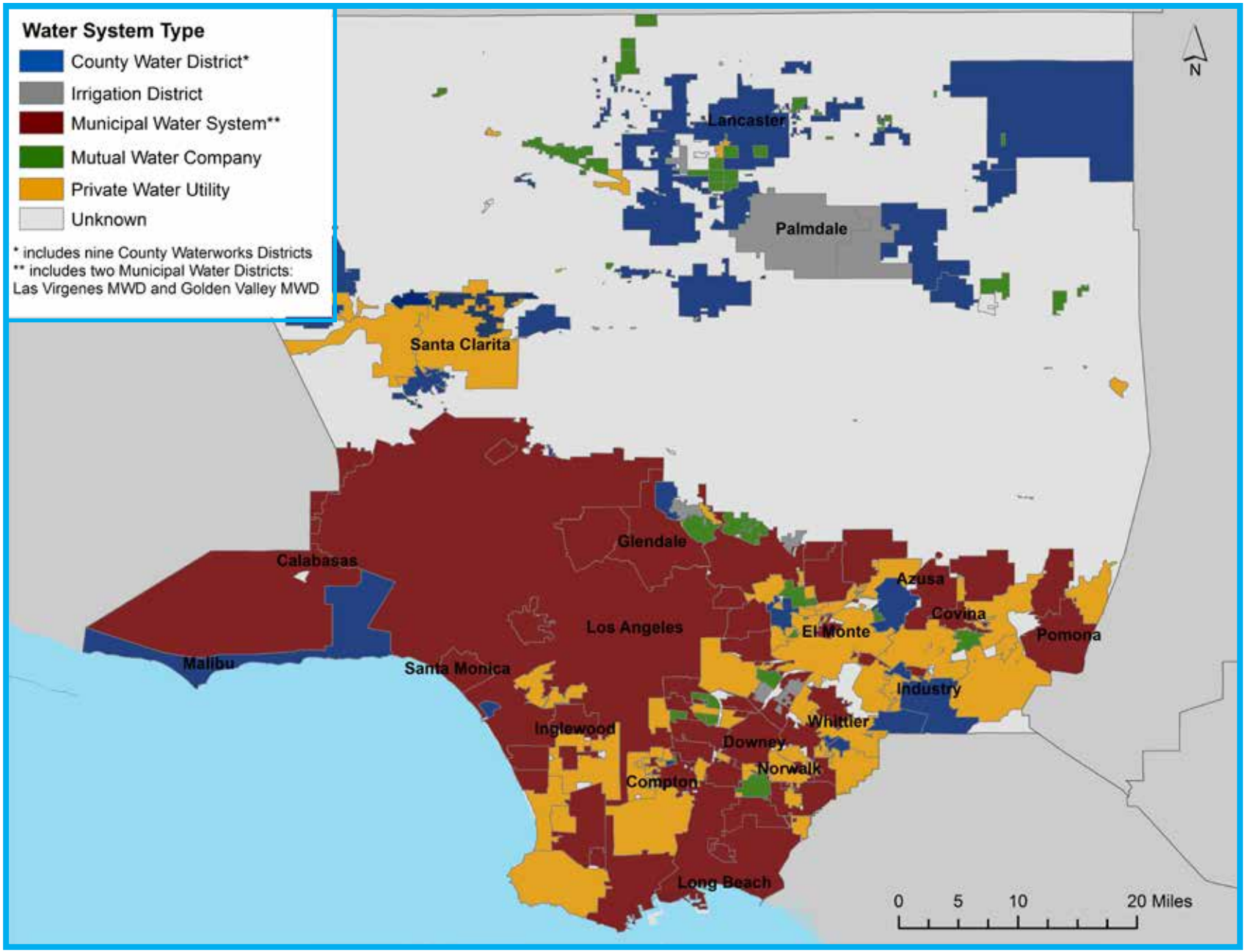
Mutual water systems, also called non-profit mutual water associations, are most prevalent in the form of Very Small and Small water systems. These mutual benefit associations are often formed as cooperatives between neighboring landowners to provide water service in small communities. They encounter few regulatory requirements with respect to public access to information, community participation, and water rate adjustments.[6]

The recent eligibility of regulated private water utilities and mutual water systems for grants through Prop 1 (2014) will require a clear understanding of the distribution of these water systems across the state, the existing and anticipated supply, quality, and capacity challenges faced by these systems, and the likely increase of unfunded demand for addressing these challenges through state grant assistance. The Atlas and Policy Guide will be a crucial resource for developing these analyses with respect to grant eligible community water systems in Los Angeles County.





Community Water System Governance Types



Source: UCLA Luskin Center for Innovation, *see Methodology: "Community Water System Boundaries"*

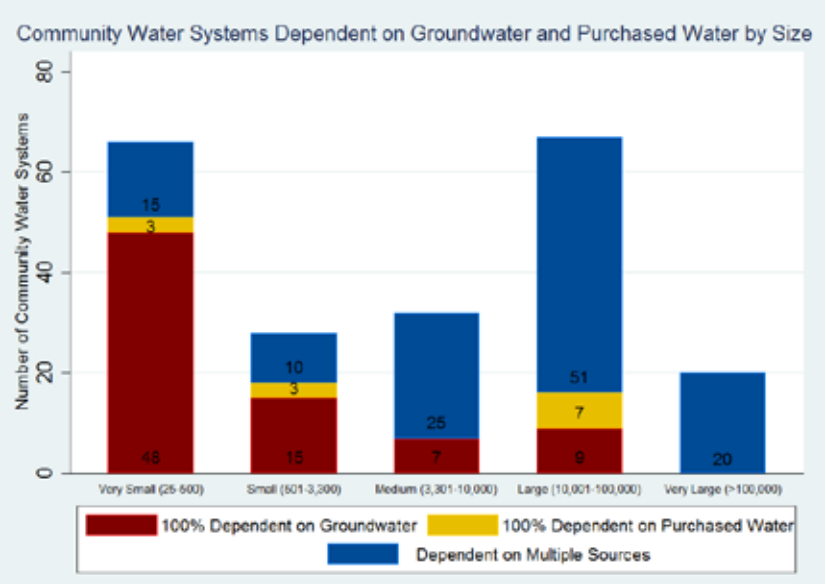
Threats and System Vulnerabilities

Dependence on a Single Type of Drinking Water Source

In the face of increasingly uncertain precipitation patterns and extremes in climate and hydrology, the composition of a community water system's portfolio of sources may indicate likely threats to water supply reliability over time. Water systems with unbalanced water supply portfolios are vulnerable to significant changes in climate and hydrology. In Los Angeles County, community water systems with single source dependency are likely to rely on either groundwater or purchased surface water. Each water source is subject to various conditions and constraints as a function of climate, precipitation, hydrology, and geography. These constraints are especially acute for systems with access to only one well or one wholesale connection, a topic for future research. The following sections describe the threats facing each primary drinking water source type and the likely impacts of climate change on the availability of these water resources.

Groundwater

It is a well-documented fact that during droughts, California increases its dependence on groundwater to replace scarce surface supplies.[7] In general, subsurface groundwater basins are naturally replenished by infiltration of surface runoff from snowmelt and precipitation. During droughts like the current three year critically dry period, water withdrawn from the ground exceeds the volume of water infiltrated by natural or artificial methods. Withdrawals from most of LA County's groundwater basins are monitored and regulated, due to prior adjudication. The Antelope Valley aquifer in northern LA County and southern Kern County, however, is not yet adjudicated. Many of the Very Small and Small water systems in the County that are solely dependent on groundwater are located in the Antelope Valley. The uncertainty of future groundwater supplies in un-adjudicated basins puts these Very Small and Small systems at significant risk for running out of water. State regulators may find this Atlas and Policy Guide valuable in identifying likely recipients of emergency drinking water funding for interim water supplies. In the long run, the mapping of groundwater dependent communities and characterization of their needs also provides a useful baseline resource for regional groundwater management as directed by the recent groundwater legislation AB 1739, SB 1168, and 1319.

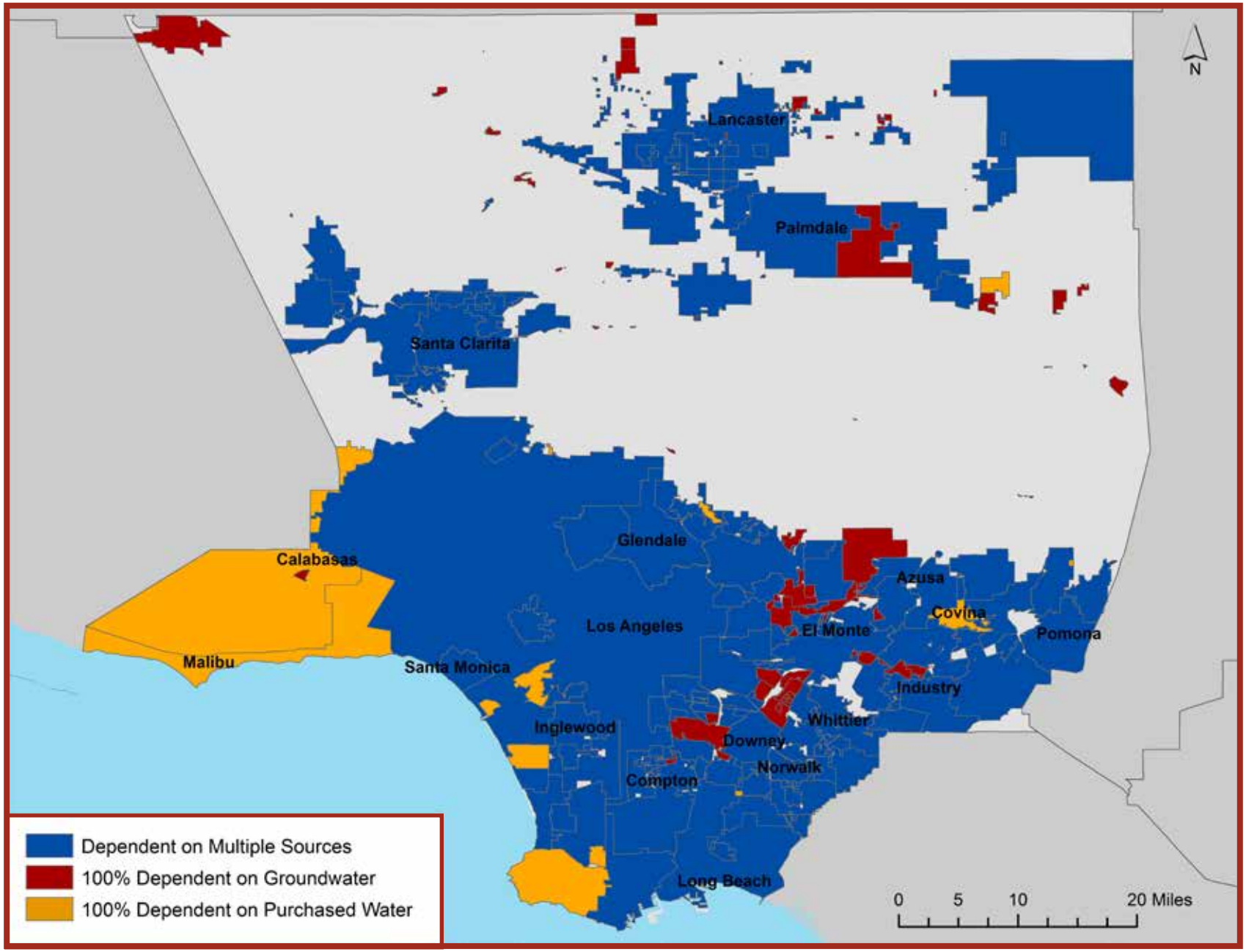


79 Community Water Systems in LA County are 100% dependent on groundwater for drinking water.

Imported Purchased Water

California has one of the most robust systems for the conveyance and delivery of imported water in the world. These supplies however are not immune to drought and the future impacts of climate change. For example, following three consecutive dry years, the State Water Project may supply only 10% of normal water deliveries in 2015.[8] Reduced inflows and the threat of sea level rise places significant pressure on the Bay Delta: a key ecosystem and water source for the state. The cost of mitigating these pressures will likely be borne by water contractors and the community water systems they serve.[9] This Atlas and Policy Guide highlights community water systems that are wholly or partially reliant on purchased surface water. This metric enables evaluation of the impacts from increasing uncertainty in supply and increasing cost of imported water on community water systems.

Water Source Dependency by Community Water System



Source: UCLA Luskin Center for Innovation, *see Methodology: "Community Water System Water Portfolio: Single Source Dependency"*

Reliance on Contaminated Groundwater

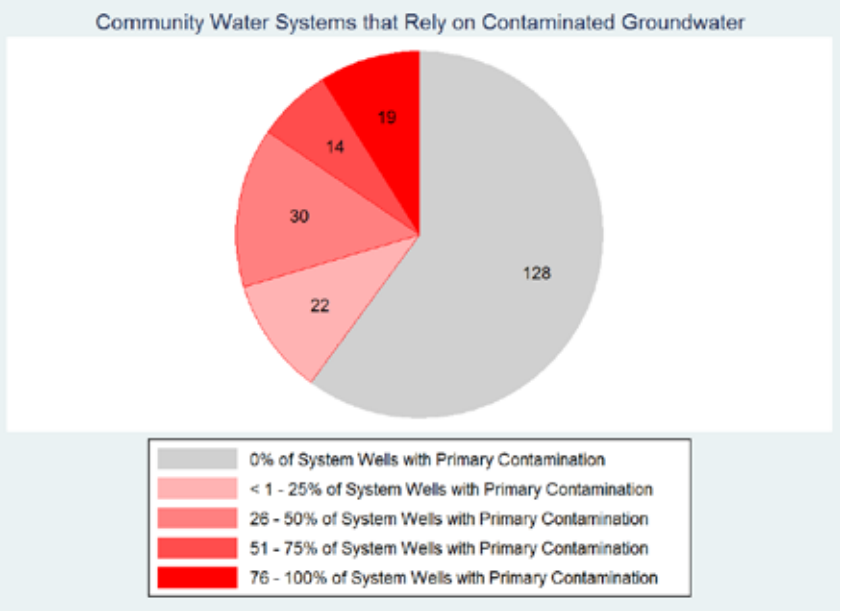
The U.S. Environmental Protection Agency (U.S. EPA) and State of California require community water systems to monitor the quality of the water it serves to customers. California sets thresholds for each contaminant (called Maximum Contaminant Levels) that account for health risk, detectability, treatability, and cost-of-treatment. In the 2002-2010 compliance period, state regulators detected chemical concentrations in raw groundwater sources that exceeded MCLs. Of every county in California, Los Angeles County serves the greatest number of community water systems that rely on contaminated groundwater. Forty percent of community water systems serving Los Angeles County had a principal contaminant detected in an active raw or active untreated drinking-water well at a concentration above an MCL on two or more occasions during the most recent California Department of Public Health compliance cycle (2002-2010).[10]

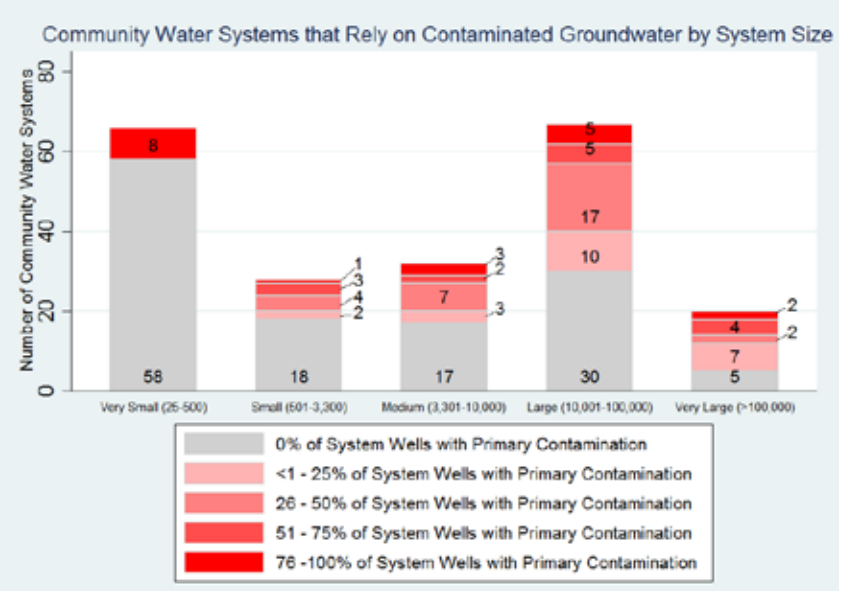
Of every county in California, Los Angeles County has the greatest number of community water systems that rely on contaminated groundwater.

Most Large and Very Large community water systems serving LA County have at least partial reliance on contaminated groundwater sources. Highly urbanized areas like San Fernando Valley and San Gabriel Valley impact their underlying aquifers through a legacy of contaminated runoff and industrial discharges. Despite relying on contaminated groundwater, Large and Very Large systems often have the advantage of multiple source options and access to treatment technologies.

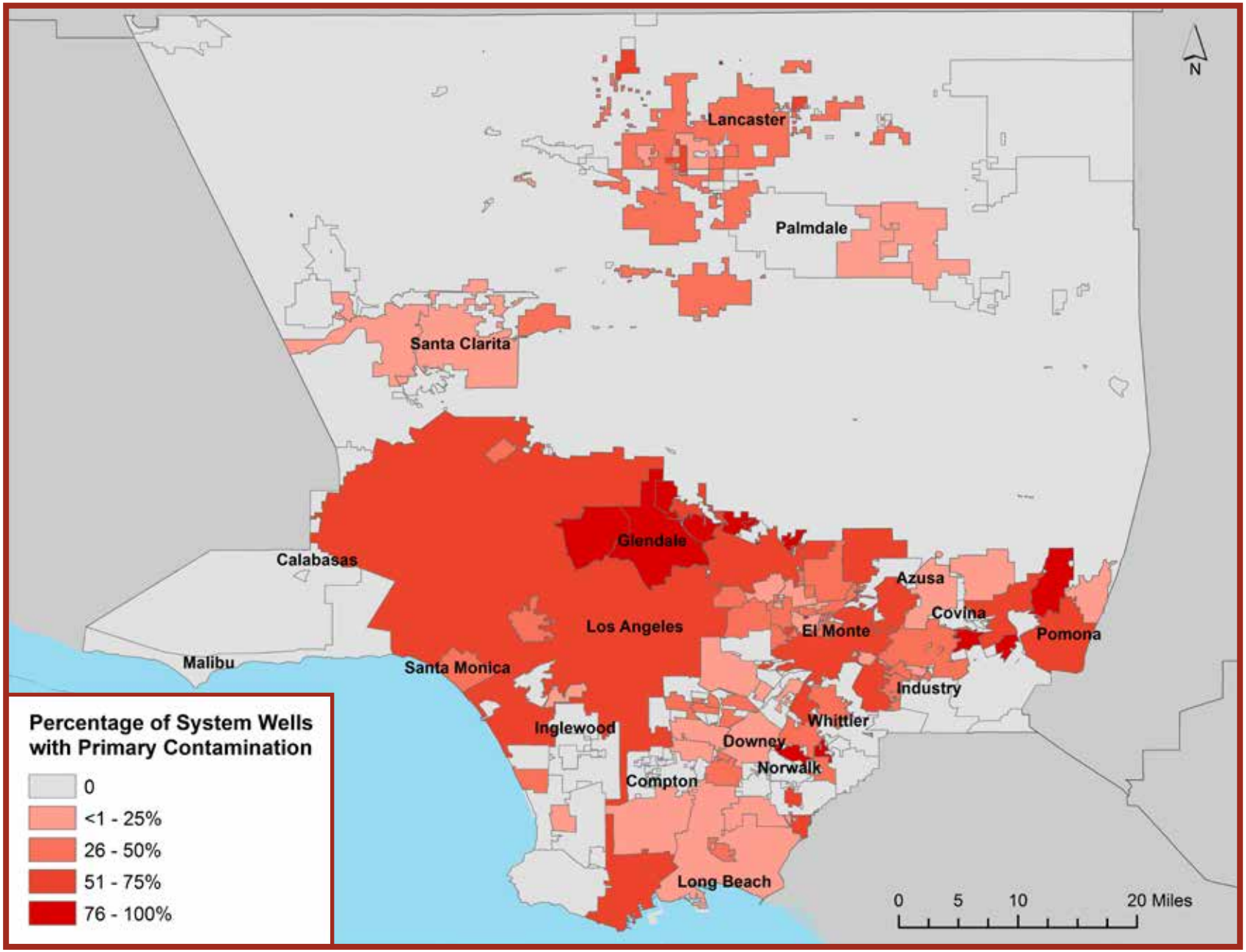
The cost of water treatment and aquifer clean-up will become a financial obstacle for many community water systems and the customers they serve. For example, the San Fernando Valley is a key potential source of groundwater for Los Angeles Department of Water and Power. Due to a legacy of industrial land uses in the Valley, half of the water in the aquifer is contaminated with a toxic plume. Proposals for transforming the Valley's aquifer into a reliable local water source through treatment will require an estimated $600 to $900 million dollars. [11]

This Atlas and Policy Guide highlights community water systems that are heavily dependent on contaminated groundwater, thereby benefitting the most from grants for groundwater cleanup and interim emergency drinking water funds. State and local agencies responsible for dispersing Prop 1 (2014) funds will benefit from this planning resource, which will help them maximize the impact of state financial assistance for groundwater cleanup.





Community Water Systems That Rely On Contaminated Groundwater



Source: UCLA Luskin Center for Innovation, *see Methodology: "Community Water Systems that Rely on Contaminated Groundwater Sources"*

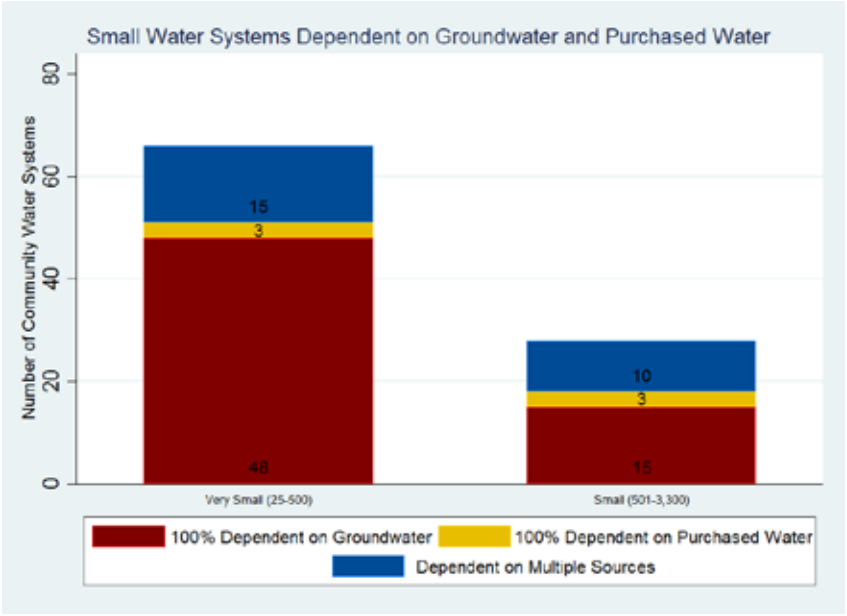
Small Community Water Systems

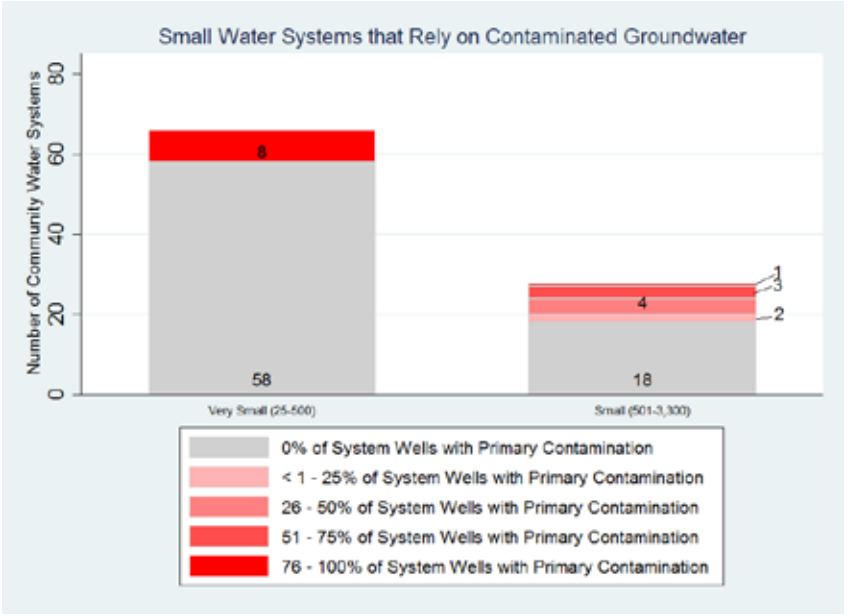
The majority of community water systems in LA County are Very Small and Small systems serving between 25 and 3,300 year-long residents. Very Small and Small community water systems are located in every corner of LA County, with a concentration in the Antelope Valley and the foothills of the San Gabriel Mountains. Seventy-three percent of Very Small and fifty-four percent of Small water systems are solely reliant on groundwater as a source of drinking water. While the bulk of these systems rely on clean groundwater, six Very Small systems are solely dependent on contaminated groundwater. During periods of drought, community water systems are likely to rely more heavily on groundwater, even if it is contaminated.

Researchers and regulators agree that smaller water systems lack the technical, financial, and managerial capacity to build and maintain major improvements to water system infrastructure. [12, 13] Costly capital projects that may be integral to the system's operation, like drilling deeper wells and treating contaminated groundwater, are currently out of reach for many smaller water systems. Without a strong fiscal base to draw on, smaller water systems will struggle to adapt to a changing climate.

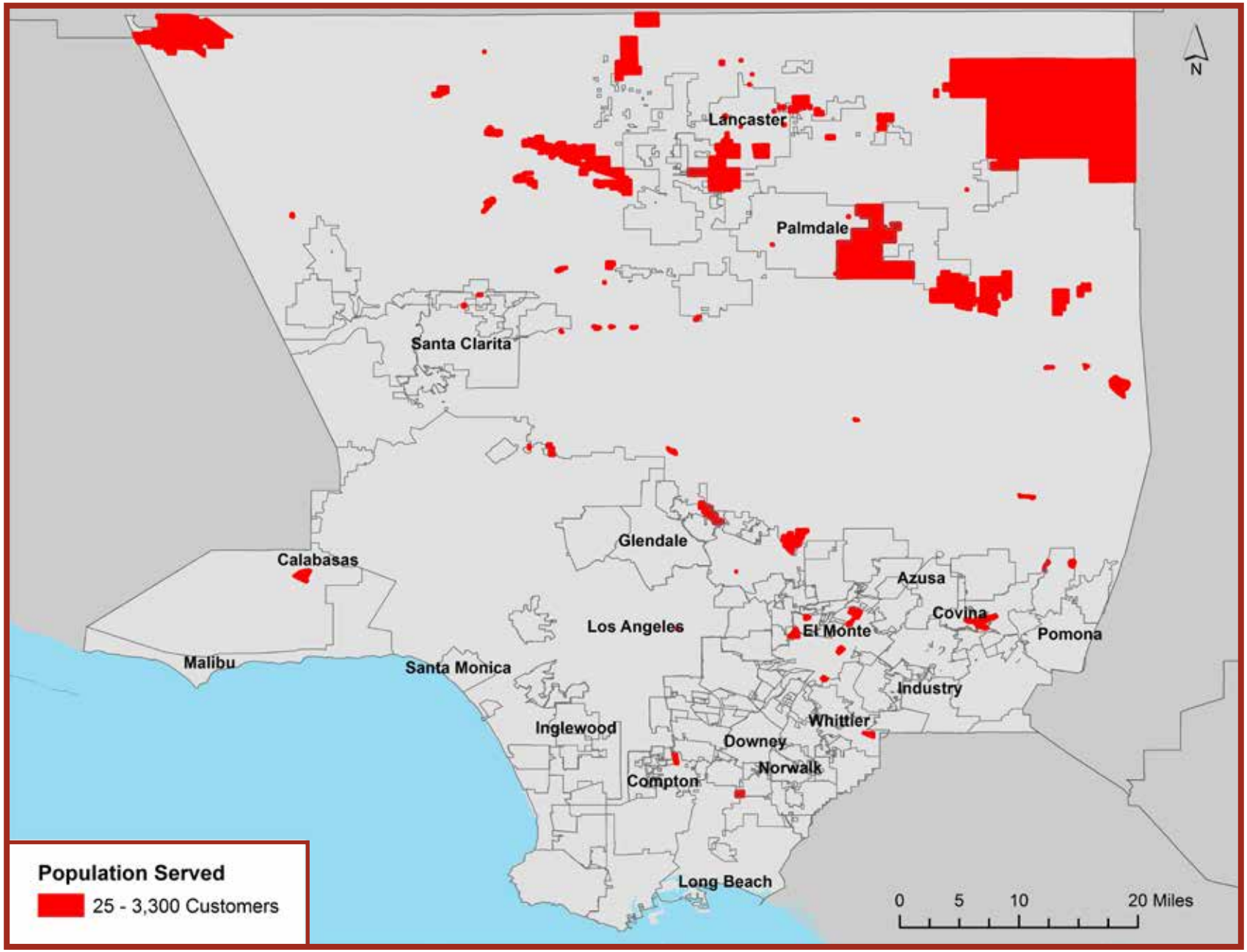
During the most recent drought period, Governor Brown approved an emergency drought relief package, of which $4 million is to be directed to at-risk water systems in need of interim replacement drinking water. The State Water Board could use this spatial resource to identify Very Small and Small water systems that are likely candidates for interim emergency drinking water funding in Los Angeles County.

The State recognizes the critical capacity issues facing smaller water systems, and developed the Small Water System Program Goal to leverage federal, state, and non-profit resources for bringing these water systems back into sustained compliance. Additional state financial resources for Very Small and Small water systems are guaranteed by the passage of Prop 1 (2014). This Atlas and Policy Guide provides insight into the challenges faced by smaller water systems, and offers a useful framework for needs assessment, policy impact evaluation, and grant tracking for the Small Water Systems Program Goal Implementation Plan.





Very Small and Small Community Water Systems



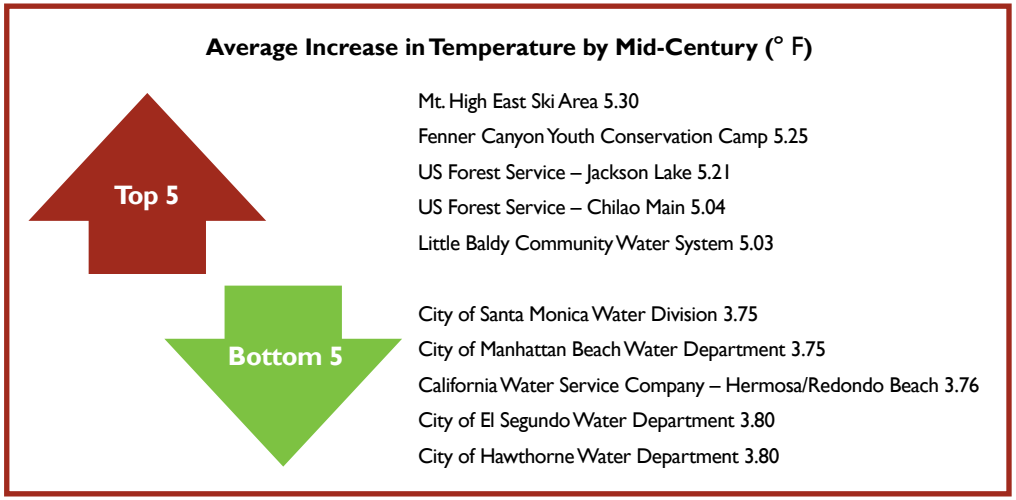
Source: UCLA Luskin Center for Innovation, *see Methodology: "Small Community Water Systems"*

Climate Change: Extreme Heat Days and Increase in Average Temperatures

Increases in extreme heat days and average temperatures are expected statewide by 2050. Climate change will transform California's water resources and the way we consume them. Disruption of the water cycle will ripple through our entire water system, from the vast system of reservoirs and aqueducts of the State Water Project to the many thousand private domestic groundwater wells scattered across the state.[14] The building blocks of our drinking water system, the community water system, will be increasingly challenged to serve clean and affordable drinking water to its customers. This section describes the changing climate in Los Angeles County from downscaled predictions of extreme heat days and average temperature rise.[15]

Extreme heat days

Extreme heat days, when surface air temperatures exceed 95° F, are expected to triple from the coast into the inland valleys by 2050. Areas around the mountains are expected to see six-fold increases in extreme heat days.[16] Extreme heat days will intensify the severity of drought. Residential urban water use studies in California show that around 50% of water is used for landscape irrigation.[17] Extreme heat days will increase landscape evapotranspiration rates, or water needed by vegetation, and therefore drive up demand for residential water. Community water systems that serve golf courses, public parks, and cemeteries may find increasing consumption from these water-intensive accounts due to an increase in extreme heat days.

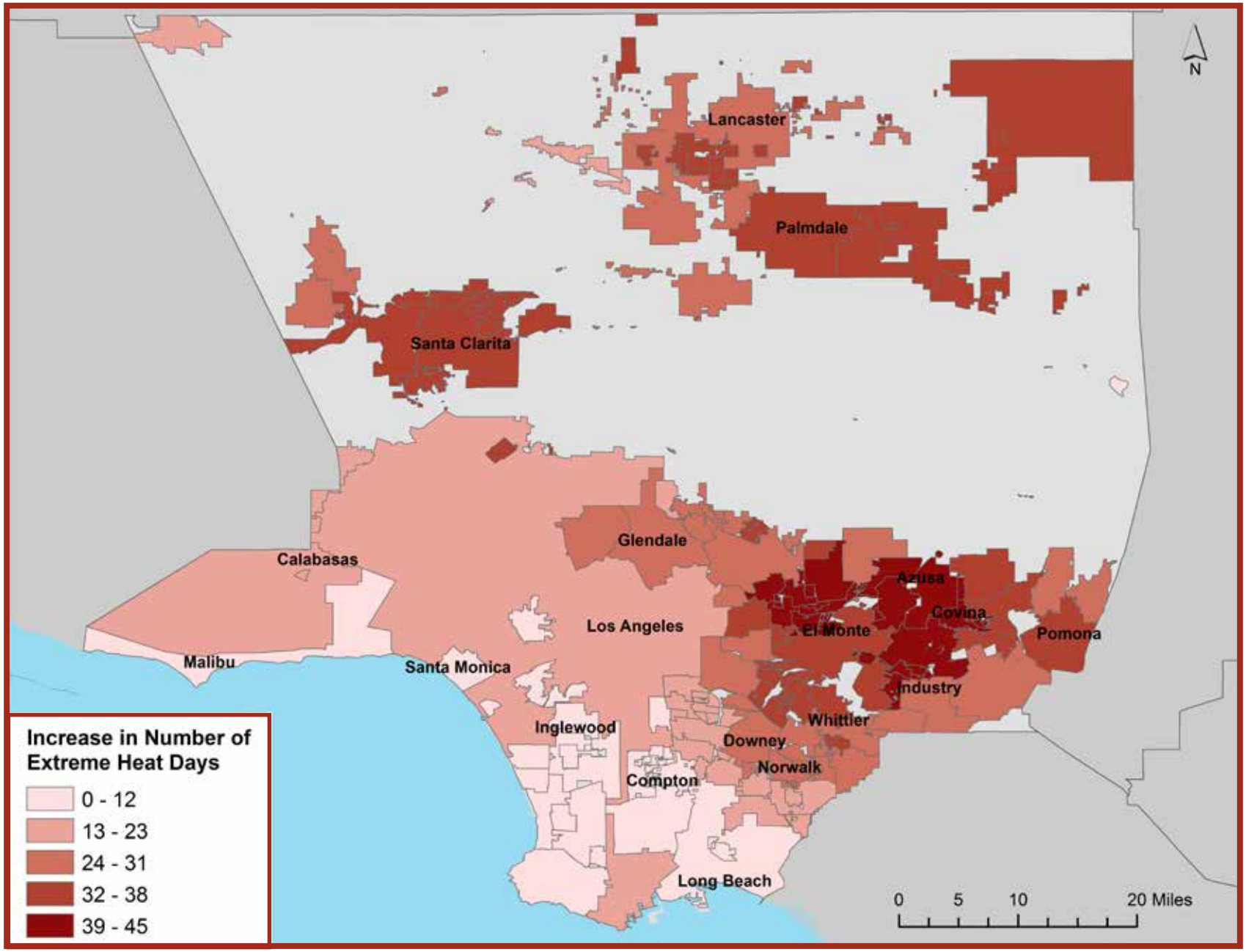


Mid-century temperature rise

In Los Angeles County, climate change projections point to drastic increases in average annual temperatures by 2050. According to these projections, the regional average temperature will rise four to five degrees (Fahrenheit), with the most severe warming in the region's mountains and deserts. As a result of warming, less precipitation may fall as snow and the intensity and irregularity of precipitation may increase, making runoff and stormwater capture more difficult.

By aggregating extreme heat days and temperature rise to the community water system level, this Atlas and Policy Guide describes a future with increases in urban water consumption across all community water systems. Managers of local water systems and state regulators must anticipate the direct and indirect impacts of warming on water resources. This Atlas and Policy Guide points to several of these climate-driven challenges like the increasing cost of imported water supplies and developing high-quality and sustainable groundwater sources. Recognizing the disparities between community water systems in terms of technical, financial, and managerial capacity, it is clear that adapting to climate-driven challenges may be easier for some community water systems than for others.

Increase in Extreme Heat Days by 2050



Source: Sun F, D Walton, and A Hall. 2015. "A hybrid dynamical–statistical downscaling technique, part II: End-of-century warming projections predict a new climate state in the Los Angeles region." Journal of Climate, in press. *See Methodology: "Climate Change"*

Vulnerable Populations Served by Community Water Systems

Vulnerable Populations Served by Community Water Systems
Disadvantaged Communities

The California Office of Environmental Health and Hazard Assessment created a screening tool for identifying communities that face high environmental health risk due to socio-economic status and exposure to air, soil, and water pollution. The California Communities Environmental Health Screening Tool 2.0 evaluated nineteen indicators for every census tract in the state to create a health risk score. Every census tract in the state was ranked by this score to identify communities with the highest environmental health risks. Populations living in census tracts with environmental health risk scores in the top 20% of the state are considered severely disadvantaged communities.

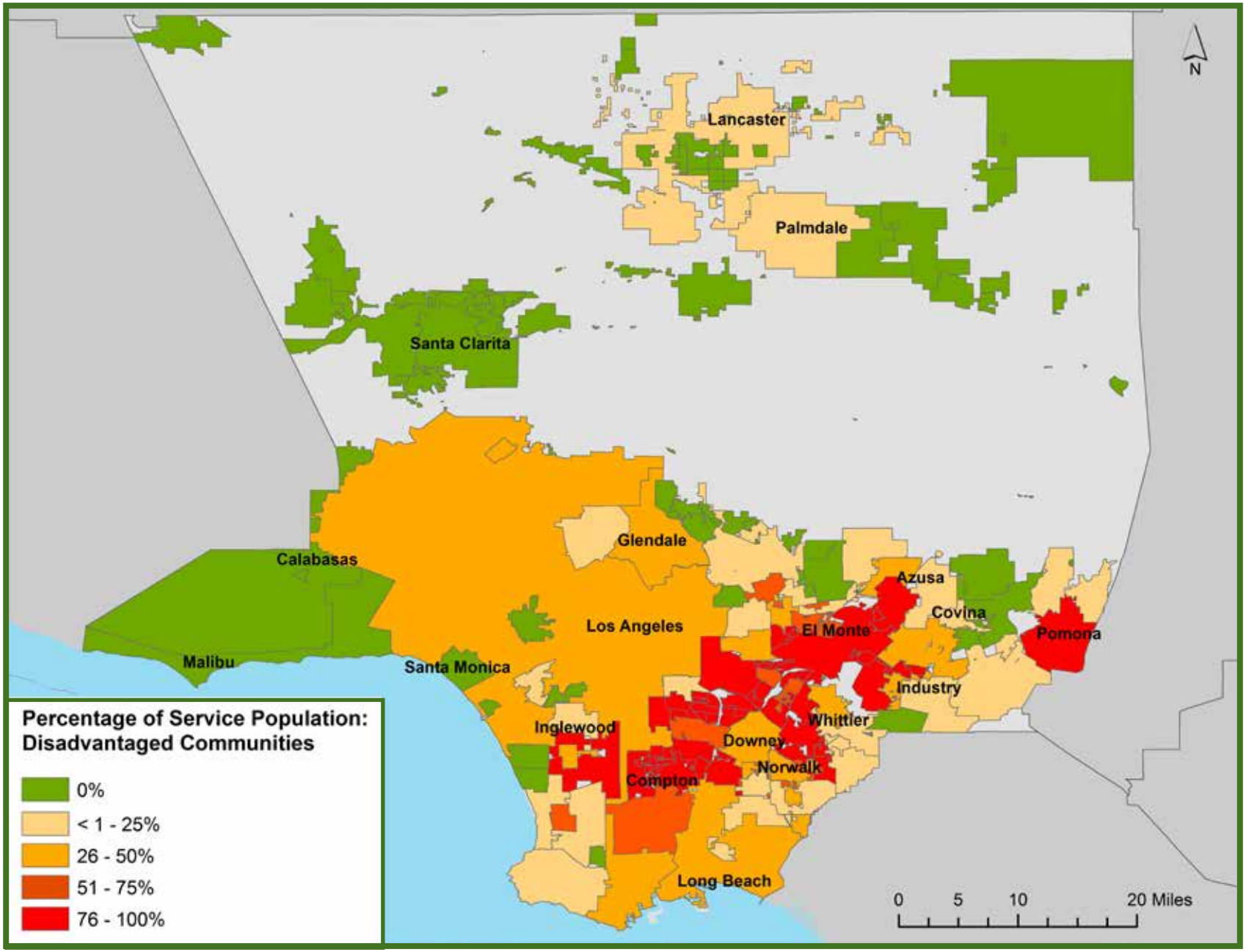
Disadvantaged communities are sensitive populations with low educational attainment, linguistic isolation, poverty, and high unemployment. Curtailment or disruption of potable drinking water supplies requires individuals in households to procure sources of potable water from outside the home. Additional costs are incurred when households must travel to and transport water from a distant location (like a drinking water retail store, water truck, or bottled water from a convenience store). These so-called "replacement" costs represent a significant time and income burden for disadvantaged communities.[18] The population characteristics of disadvantaged communities suggest that they may encounter more obstacles than non-disadvantaged communities when accessing replacement water supplies.

Individuals from disadvantaged communities are more likely to suffer negative health impacts from ingesting quality-impaired drinking water than non-disadvantaged communities. On top of being more susceptible to illness from unhealthy water, disadvantaged communities with low-income, low educational attainment, and high unemployment may also experience difficulty accessing medical care.

More than fifty percent of Californians who live in a disadvantaged community are residents of LA County. Forty-five percent of community water systems in LA County serve disadvantaged communities. Service populations in forty-three community water systems are almost entirely disadvantaged. Most community water systems in LA County with high percentages of disadvantaged communities are Large and Very Large systems, which are concentrated in densely populated areas like South LA, Gateway Cities, and San Gabriel Valley. Because the methodology of the California Environmental Health Screening Tool 2.0 uses census tracts as units of analysis, small rural communities with high environmental health risk are blended into larger population groups, therefore masking their disadvantaged status. The CalEnviroScreen 2.0 dataset may under represent disadvantaged communities in rural areas of Los Angeles County.

Prop 1 (2014) prioritizes disadvantaged communities as recipients of financial assistance for clean, safe, and reliable drinking water. Despite the CalEnviroScreen 2.0 tool, the Department of Water Resources defines disadvantaged communities simply as communities with median household income below 80% of the state's median household income (or approximately less than $49,000). To accurately target communities that are disadvantaged in terms of drinking water access, the state might consider developing additional indicators at the system level. This Atlas and Policy Guide presents indicators for an enhanced definition of disadvantaged communities, like water system size, governance type, and threats and system vulnerabilities faced by community water systems. These indicators may constitute an auxiliary framework for designing a 'water disadvantaged communities' index.

Disadvantaged Communities in Community Water Systems

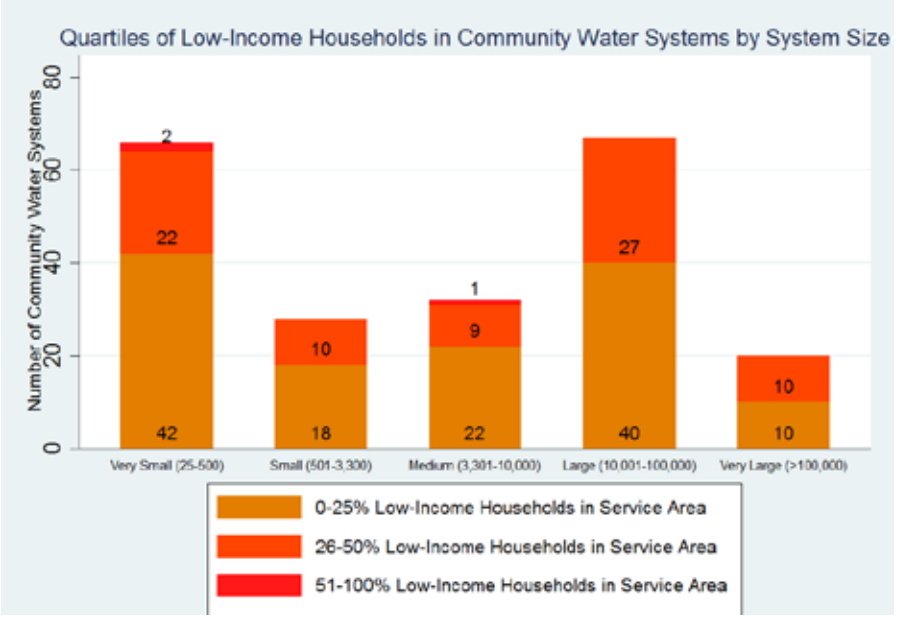


Source: UCLA Luskin Center for Innovation, *see Methodology: "Disadvantaged Communities"*

Vulnerable Populations served by Community Water Systems
Low-Income Households

Community water systems across the country have recently, or are now considering, increasing water rates for residential customers. In the western U.S., this decision is precipitated by several factors including drought, increasing pressure to protect the environment, and increased conservation. Revenue from potable water sales is crucially important to maintaining the essential functions of community water systems and adapting to a changing climate, including developing local water sources to diversify water portfolios, treating contaminated water sources, mitigating environmental impacts, and funding water conservation programs. Managers of community water systems may not know how many of their residential customers are low-income households (defined here as households earning less than $30,000 annually). Low-income households tend to keep annual drinking water charges low by using water primarily for essential indoor uses. Middle and high-income households are likely to spend more on water annually than low-income households, as they tend to use potable water for discretionary purposes like irrigating landscapes.

While increases in water service charges may have little or no impact on water usage in high-income households, the additional cost burden of water charges due to rate increases may constrain even essential uses of water in low-income households.[19] Water rate structures that increase dollar-per-unit costs with the amount of water consumed may keep essential drinking water affordable for low-income households, while discouraging water waste in higher income households. Many Large and Very Large community water systems offer low-income customer assistance programs that reduce the burden of water rates on low-income households. Community water systems are not obligated to provide low-income customer assistance, and these programs are generally administered and funded by local water systems.[20]

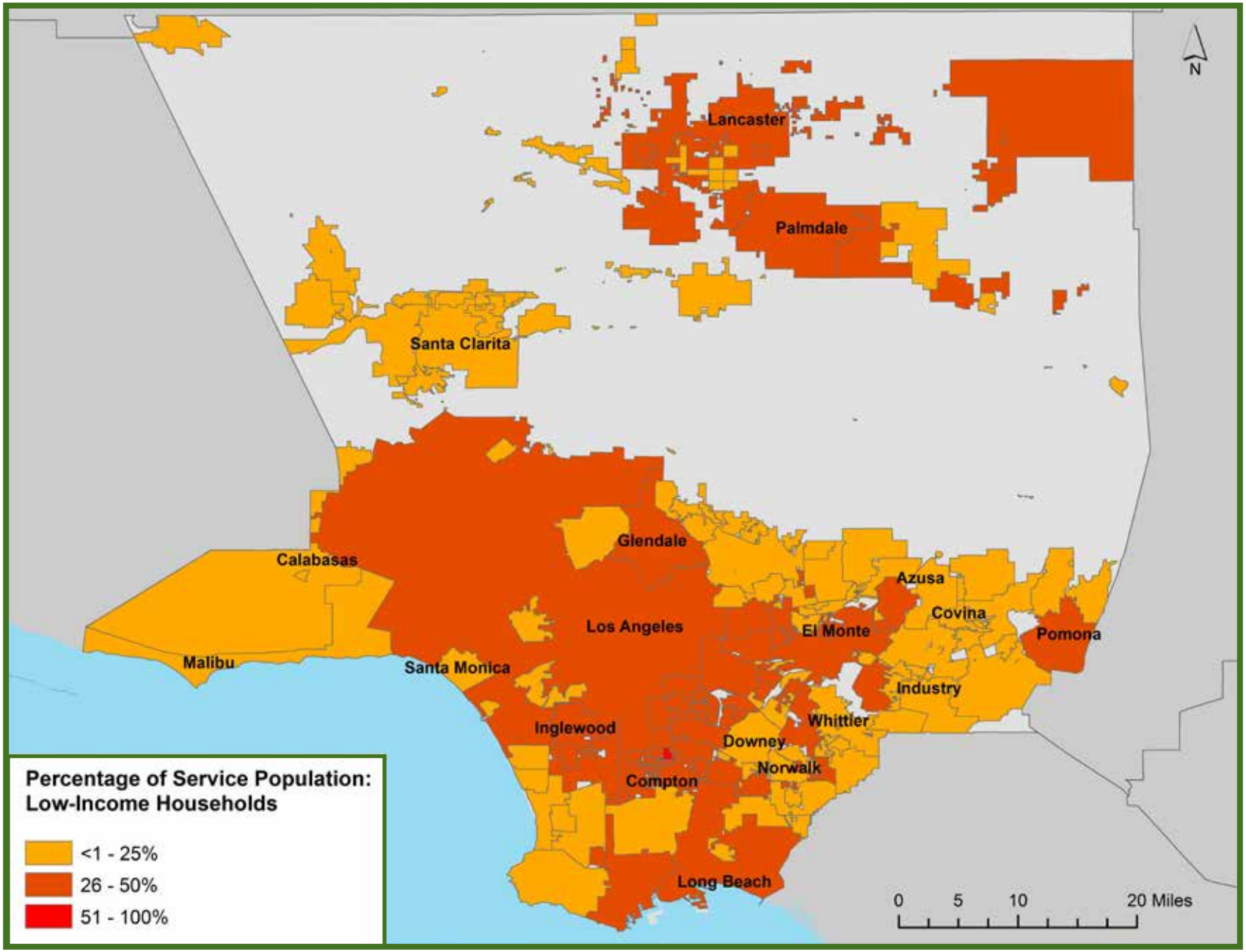


Community Water Systems with Low-Income Households in LA County

This analysis reveals that low-income households are most concentrated in highly urbanized parts of LA County, like the City of Los Angeles, Gateway Cities, and western San Gabriel Valley. Large and Very Large community water systems serve these densely populated areas. This analysis evaluated household income by census block groups. While census block groups have the advantage of being the smallest unit for accurate and timely household income data, they may obscure pockets of low-income households in rural areas served by Very Small and Small water systems. Rural low-income households are blended into larger populations and therefore do not stand out in this analysis.

Community water systems will find that obtaining an accurate understanding of the income levels across residential customer classes is essential for designing sustainable rate structures, conservation strategies, and low-income assistance programs. However, few community water systems have the technical or managerial capacity to perform such analyses at the system level. The spatial overlay methodology applied in this Atlas and Policy Guide has the capacity to generate high-resolution socio-economic characteristics for almost every community water system in the state. At the state level, with the passing of AB 685 in 2012 (the Human Right to Water Bill) regulators will be expected to develop policies and infrastructure projects like the 'Delta Fix' while ensuring that low-income communities have access to affordable water for essential needs. State regulators must understand how large scale water infrastructure investments may indirectly make water more expensive for low-income households. The framework established by this Atlas and Policy Guide series provides a resource for measuring affordability across community water systems.

Low-Income Households Served by Community Water Systems



Source: UCLA Luskin Center for Innovation, *see Methodology: "Low-Income Households"*

Vulnerable Populations served by Community Water Systems
Very Young and Elderly

Children under the age of 10 and adults older than 75 are vulnerable to the adverse health effects from exposure to contaminated drinking water. In young children, early exposure to bacterial or chemically impaired drinking water may adversely impact the development of key functions like immune systems and increase the likelihood of some cancers.[21] Elderly adults may also have compromised immune systems that make them more likely to have existing health conditions that worsen with exposure to contaminated drinking water.

In the event of water curtailments or disruption in service, young children and elderly adults may also face barriers to accessing replacement water. Replacement water is drinking water purchased at a retail vending machine or bottled water purchased from a retail shop, and replaces drinking water that would otherwise come from a household tap. Without assistance from an able-bodied adult, young children and the elderly may not be able to leave the home to acquire replacement water for essential uses like drinking, cleaning, and cooking.

Community Water Systems with Very Young and Elderly populations in LA County

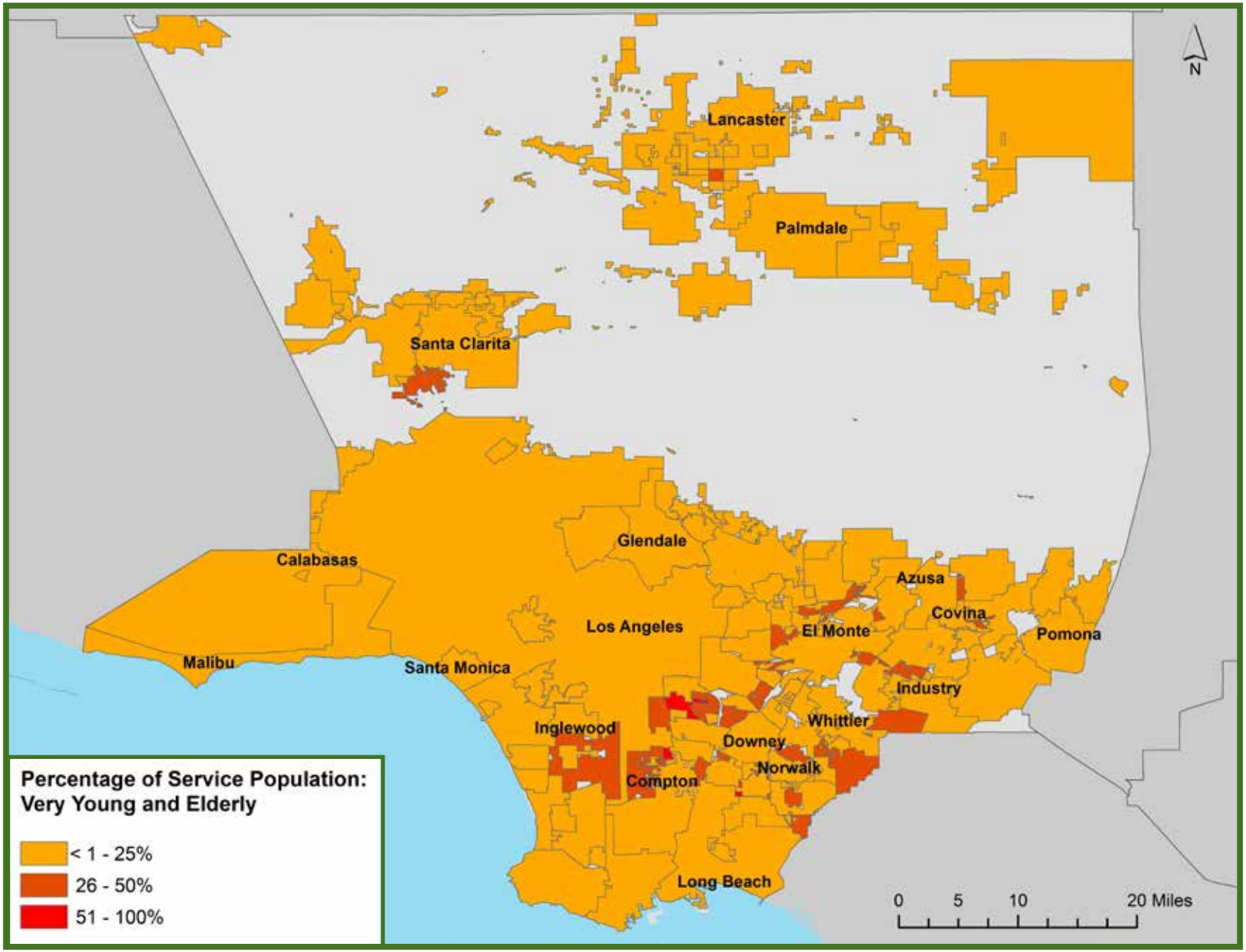
The vast majority of community water systems in LA County have service populations in which up to one in four residents are very young children or elderly. Thirty-one community water systems serve populations in which up to one in two residents are very young children or elderly. The community water systems with above average concentration of young children and elderly residents spans from South LA to Gateway Cities and the San Gabriel Valley.

Drinking water quality standards, developed by federal and state regulators, must take into account the health risk of contaminants on very young and elderly populations. As research related to drinking water quality standards progresses, community water system-level information on young and elderly residents may help guide policymakers in determining the extent of potential public health threats. At the local level, community water system managers may use the methodology applied here to identify portions of their water system that serve many very young and elderly residents. Water managers may then anticipate the need for emergency replacement water and health services in the result of sudden water quality impairment or shortages.

Top 5 Community Water Systems with High Concentrations of Very Young and Elderly Populations

1. Maywood Mutual Water Company No. 1 (68%)
2. Bellflower Home Garden Water Company (65%)
3. City of Huntington Park Water Department (62%)
4. Golden State Water Company Willowbrook (58%)
5. Golden State Water Company Bell, Bell Gardens (50%)

Very Young and Elderly Residents in Community Water Systems



Source: UCLA Luskin Center for Innovation, *see Methodology: "Very Young and Elderly Populations"*

The Built Environment and Water Use

Housing Tenure and Type

Community water systems have several tools for encouraging water conservation and efficiency within their customer base. These tools may consist of price-based incentives, rebates for water efficient landscapes, and assistance for purchasing water-efficient appliances and plumbing fixtures like low-flow faucet heads. The residential tenure (rent vs. own) and type (single-family unit vs. multi-family unit) of water customers may be a key determinant of the effectiveness of conservation and efficiency programs. Price-based incentives, which use the cost of water service to achieve desired conservation outcomes, are increasingly popular in California. The implementation and effectiveness of price-based incentives, however, may be a function of demographic and other household characteristics.

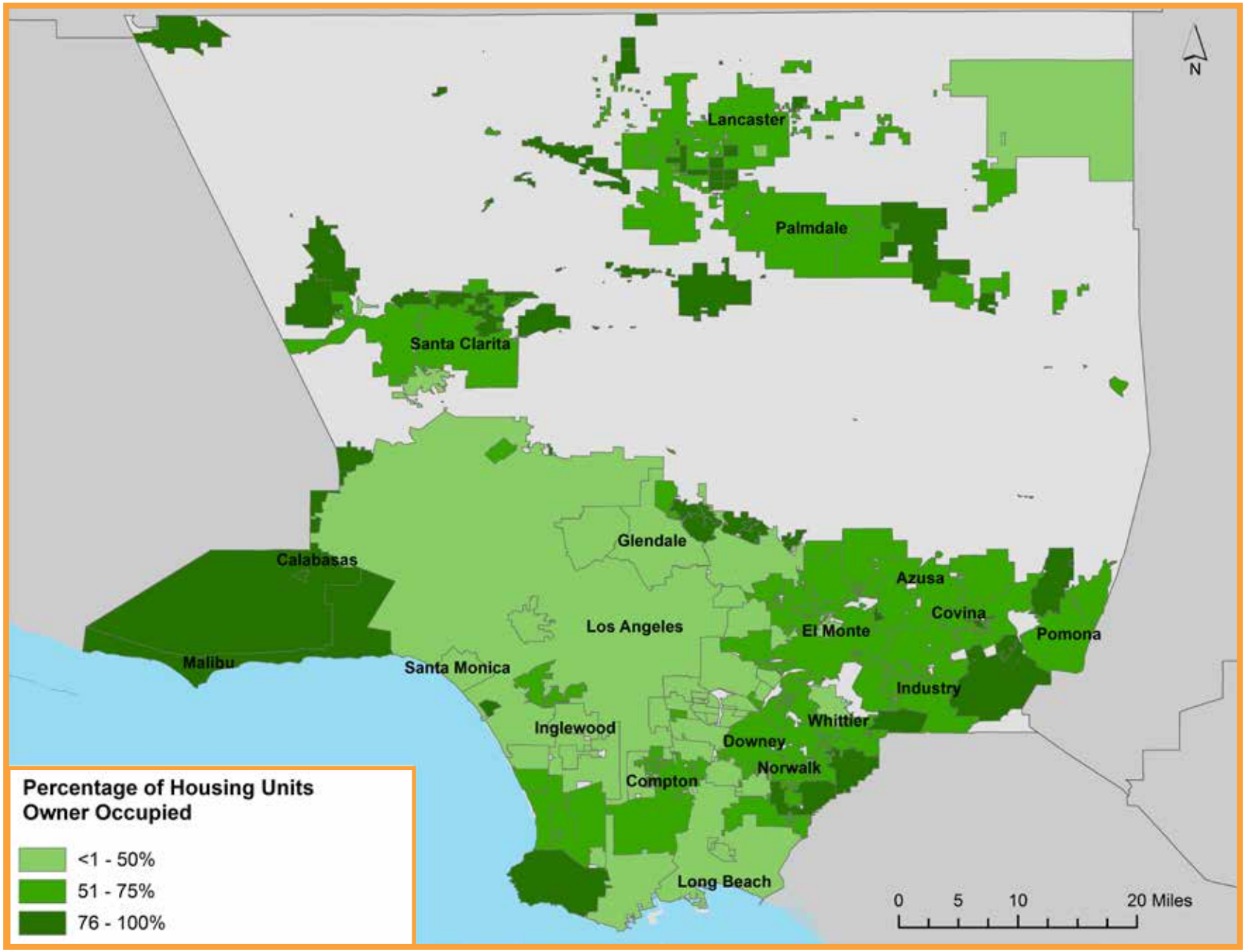
Sensitivity to Water Prices

Conservation pricing is a method for structuring the cost of water service in a way that increases the volumetric price of water as total consumption increases. Depending on the price points used to structure the rates, the increased cost of water service may induce high-use households to reduce consumption. The effectiveness of conservation pricing schemes is heavily contingent on whether or not the water user is responsible for paying the water bill. An owner-occupied single-family household in a Large or Very Large community water system is likely to have metered water service that is paid by the owner of the home. These households may be the most sensitive to changes in water price. Residents that rent units in multi-family housing are less likely to have individual accounts with community water systems, and may not be sensitive to price-based conservation and efficiency strategies.

Household water consumption may also vary by household size, income, race, and lot size. Some innovative community water systems have developed water rates that are adjusted to individual household needs, incorporating lot size and family size into a household water budget. This type of data-driven rate system will be the most effective in both protecting the affordability of essential water use and discouraging water waste. Unfortunately, few community water systems have the resources to develop customer-level data and models needed to implement water-budget based rates.

This analysis provides an example of how U.S. Census data can be used to assess system-level household characteristics that help identify opportunities for price-based conservation strategies. Though this analysis looked only at housing tenure and type, additional variables like household income, household size, and lot size may also provide useful policy dimensions. As we learn more about the effects of housing type, tenure, and other household variables on water use patterns, community water system managers may use the methodology presented in this report to evaluate the potential for conservation pricing strategies in their service areas.

Owner-Occupied Housing Units in Community Water Systems



Source: UCLA Luskin Center for Innovation, *see Methodology: "Housing Tenure"*

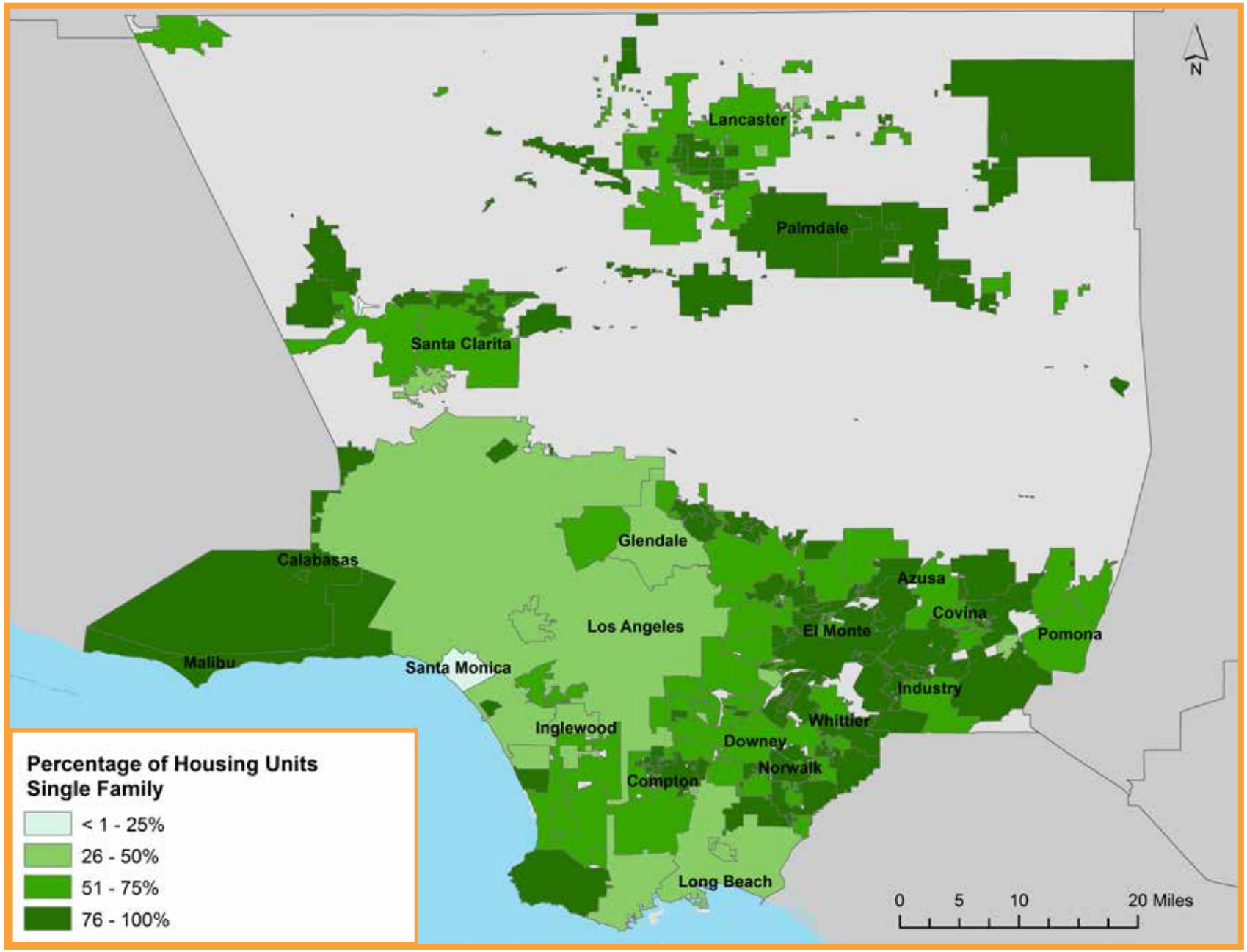
Property management: lawns and landscapes

Over half of residential water consumed in the state is for watering lawns and landscapes. Some community water systems will subsidize the cost of transforming a water-intensive lawn into a drought tolerant landscape, as reducing the water used for irrigating lawns increases the available supply for essential uses like drinking water. This type of conservation program works best when the ratepayer also controls the irrigation of landscaping on the property. Owner-occupied single-family households are likely to both pay a bill for water service and irrigate a landscape on their property, and would be an excellent target for landscape replacement programs. On the other hand, renters in multi-family housing may have no control over the irrigation and maintenance of landscaping, and thus are not the most effective target for lawn replacement incentives. While many multi-family housing complexes are landscaped, residents rarely have a say in landscaping matters. Therefore, local water utility managers might also provide landscape replacement education and outreach to condominium associations and multi-family building managers.

Housing Tenure and Type in Community Water Systems Serving LA County

Among community water systems serving LA County, the highest concentration of single-unit housing and owner-occupied housing is in the eastern edge of the San Gabriel Valley near Orange County, Las Virgenes, and the suburbs around Santa Clarita, Lancaster, and Palmdale in the northern region of the County. As described in the Threats and System Vulnerabilities section of this report, many of these community water systems are also predicted to experience the largest increases in average temperature and extreme heat days of any systems in the County. Community water systems in those regions with high percentages of owner-occupied single-unit housing are strong potential markets for landscape replacement incentives and where these programs may have the highest impact on water efficiency. At a higher resolution, larger municipalities like the City of Los Angeles may have significant clusters of owner-occupied and single-unit housing, which can be evaluated on a block by block basis using tax assessment data.

Single Housing Units in Community Water Systems



Source: UCLA Luskin Center for Innovation, *see Methodology: "Housing Units"*

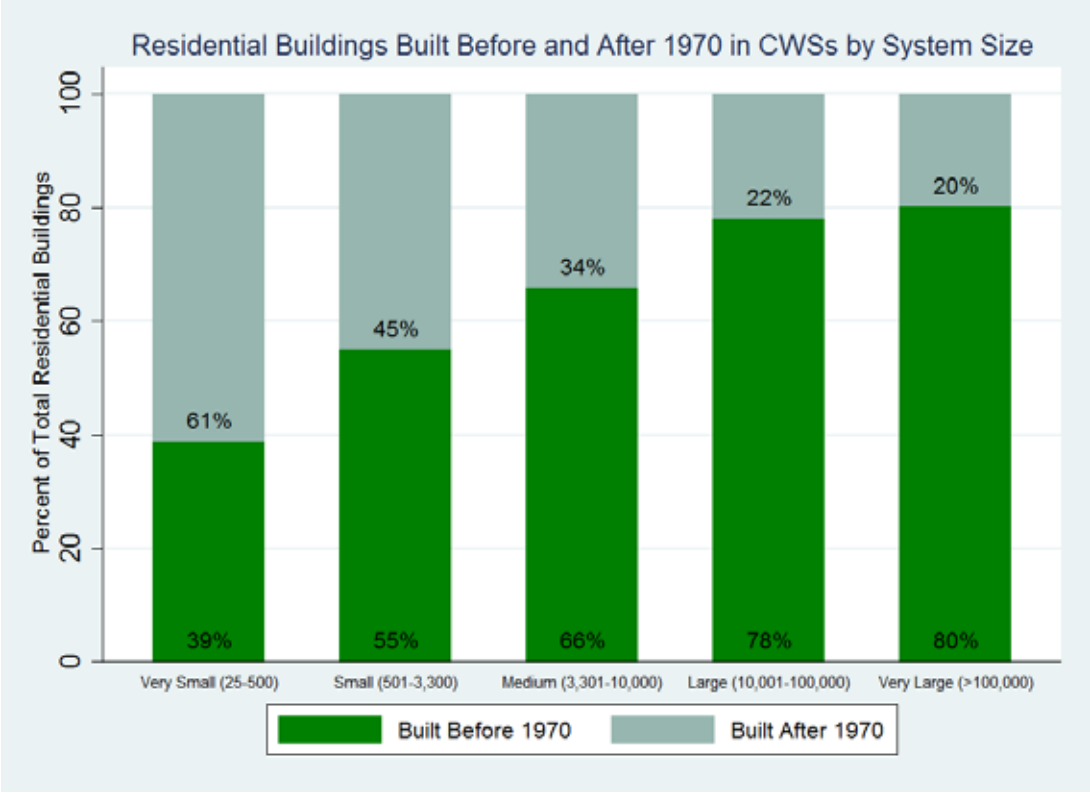
Built Environment Influences on Opportunities for Conservation

State regulations requiring water efficient plumbing fixtures for new development and water-sensitive building codes resulted in sustained improvements to residential water efficiency over the last several decades. Recently built single-family houses and multi-family complexes are likely to use less water than older structures of comparable size. Each year, community water systems in California spend millions of dollars on incentive programs designed to replace inefficient plumbing fixtures and appliances in households. The built environment may serve as an excellent indicator to guide the marketing of these incentives. This Atlas and Policy Guide presents the distribution of building ages for each community water system in LA County. This knowledge may help water managers target older residential buildings with incentives to replace plumbing fixtures with low-flow shower heads and faucets, and purchase water-efficient washing machines. An in-depth study of household water consumption and building age will validate these assumptions, and inform best practices for household water conservation incentives.

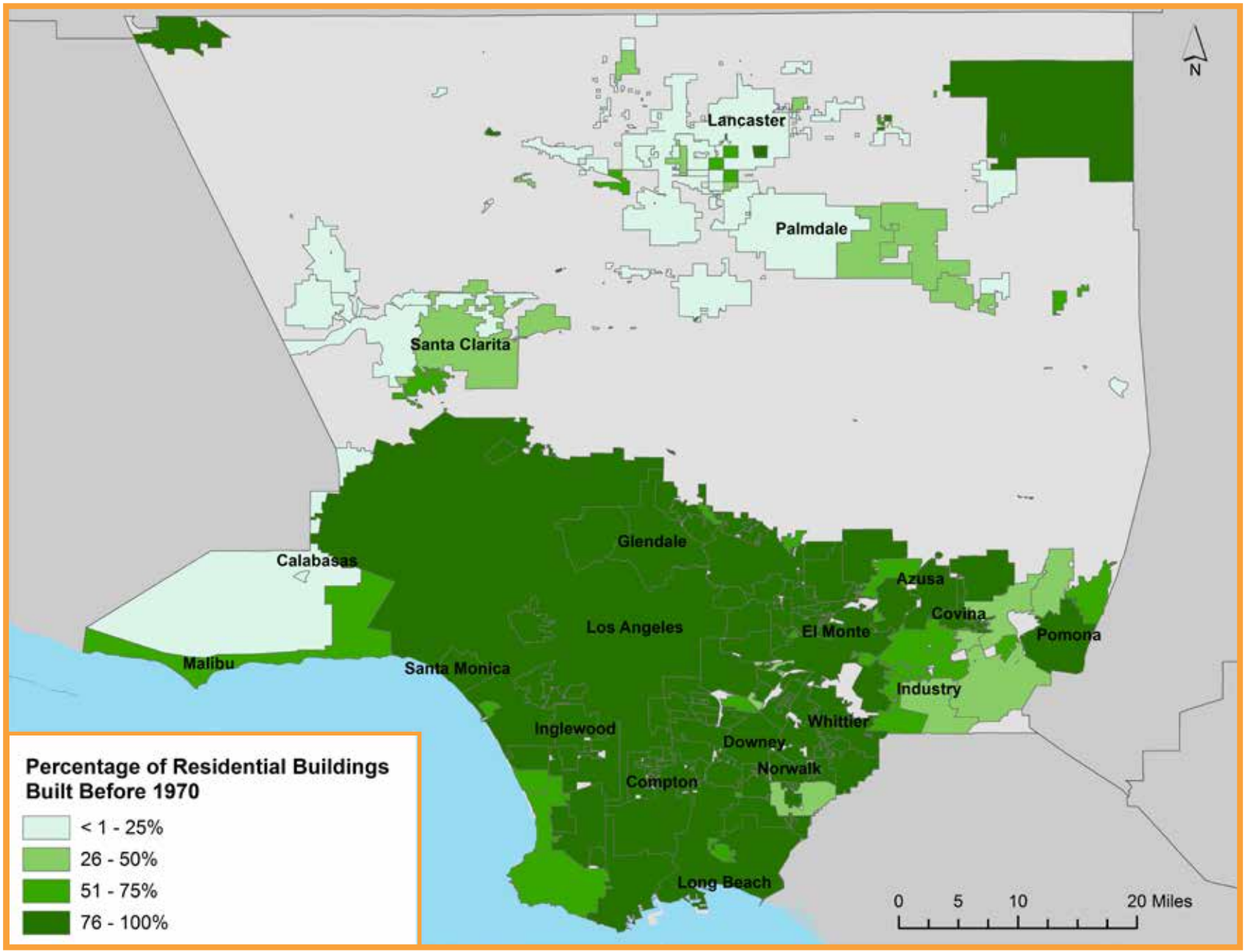
Residential Building Age in Community Water Systems Serving LA County

Some community water systems serving Los Angeles Basin have very high percentages of residential buildings built before 1970. These are some of the older urban settlements in the region, with building stock dating back to the late 19th and early 20th century. Areas of the County that grew rapidly in the 1980s and 1990s, including Santa Clarita, Lancaster, Palmdale, and the eastern edge of San Gabriel Valley, have much higher concentrations of post-1970s housing stock.

California state regulators may also benefit from a more nuanced understanding of building age across community water systems. The state's 1992 toilet retrofit laws, 2010 Model Water Efficient Landscape Ordinance and 2011 Cal Green Building Code are expected to increase urban water efficiency over the long run. The system-level built environment characteristics presented in the Atlas and Policy Guide may be compared to rebate penetration rates to understand whether the areas of highest potential (community water systems with older building stock) are being reached by these programs.



Residential Buildings Constructed Before 1970



Source: UCLA Luskin Center for Innovation, *see Methodology: "Building Age"*

Public Access to System Information

Accessibility to Critical Customer Information

Water systems' provision of information to their customers is an important factor in influencing household water use behavior, providing the necessary information for households to make important consumption decisions, manage their water expenditures, invest in water conservation, and become aware of key changes in state policy.[22] We report on the variation in the quantity and quality of information provided by individual systems. We use the maintenance of a publicly-available website as our key metric for evaluating system performance. We also discuss the type of information provided by system websites, including drought alerts, conservation rebates, pricing and needs-based assistance across systems.

Prevalence of Public Website

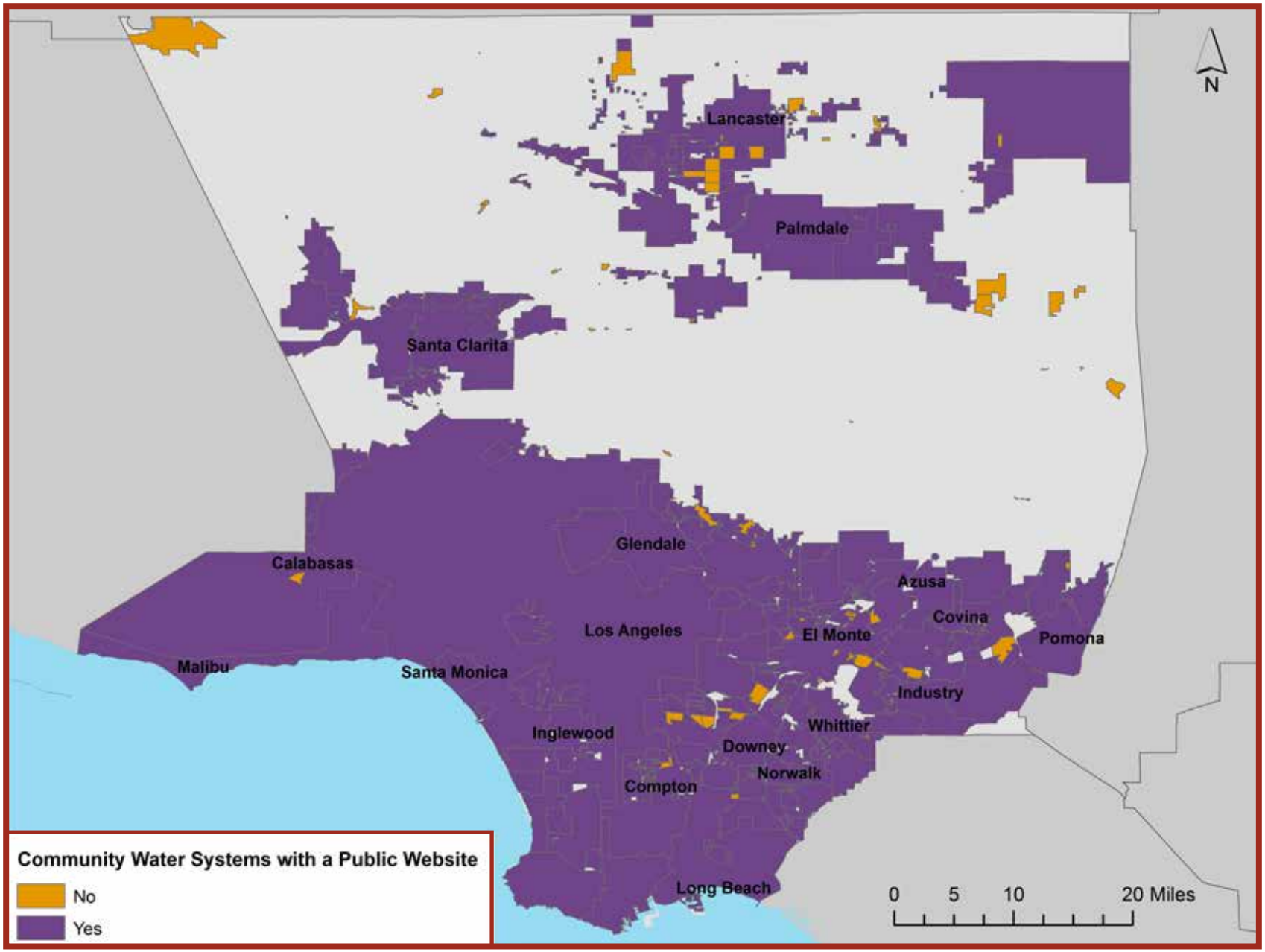
Given the dynamic pace of water policy changes, access to information about water quality, water prices, supply conditions, drought, and governance is most easily distributed to customers using the internet. Community water system websites should serve as comprehensive portals for important water service information. We were able to identify the existence of a publicly-available website maintained by only 128 of the 213 LA County community water systems.[23]

Systems lacking a website, however, were much more likely to serve very small or small populations, which is why the map on Page 6 appears to show LA County being served overwhelmingly by water systems with websites. Systems lacking a website also had a lower-income customer base, and were much more likely to be managed by a private company than systems with a website. Systems without a website were also much less likely to provide conservation rebates and low-income customer assistance.

Information: Pricing, Conservation and Low-Income Assistance

Websites may provide relevant information on pricing and the ability to pay bills, conservation tips and opportunities, and low-income assistance programs. The table below summarizes the proportion of systems in LA County which provide each of these types of information to their customers via a website. System websites could also post up-to-date notices regarding California's rapidly- evolving water laws and policies in the current state of emergency management.[24] Every community water system is nominally required to retain data on each of these components and report on their performance to the state water board, although in practice not all systems do so. Whether systems provide this information on a publicly-available website reflects how organized and accountable systems are to their customers. Providing comprehensive customer information online can also save systems money by reducing the need for expensive mailing and public advertisement campaigns to customers. Maintaining a website will only become more important as the ubiquity of internet use increases among system customers.

Community Water Systems with a Public Website



Source: UCLA Luskin Center for Innovation, see "Methodology: Public Access to System Information"

Types of Information Provided on System Websites

Information/Opportunity Provided on Website	Among Systems that Maintain a Website	Among all Systems
Consumption prices	83%	48%
Ability to pay online	80%	47%
State drought announcement	70%	41%
Water conservation advice	86%	50%
Water conservation rebate program	77%	45%
Low-income customer assistance program	38%	22%

Pricing and Online Payment

Of the LA County systems that maintained websites, eighty percent published the price of water service to consumers. The structure of prices for different levels of water consumption may be complex and not easily communicated over the phone. Viewing pricing information is thus a primary motivation for households to visit a system website, as this data is only otherwise available in a mailed customer bill. 80% of systems also provide customers with the opportunity to directly pay their water bill through the system website. Online payment is easier both for water systems and for customers. The ability to pay online may also incentivize more customers to visit system websites, and consequently view other important messaging such as conservation techniques or opportunities, or low income customer assistance programs.

Drought and Conservation Awareness

Households may become aware of the state-wide drought, and consequently be motivated to conserve water, through sources other than their community water system.[25] Households are in fact more likely to learn about state-wide drought developments through mass media, neighbors or friends. Nevertheless, system websites serve as an important and detailed source of more drought information[26] that affects their individual water access, including the risk of fines for excessive use. 70% of system websites in LA County provided information announcing current statewide drought measures and use restrictions.

Even more systems with a website— nearly 90%— provided tips to households on how to use less water. System websites are likely to play a large role in providing information and influencing the uptake of conservation strategies. Perhaps more importantly, individual water systems are usually the only source of specific information for households to take advantage of rebate opportunities to ease the cost of implementing conservation technologies. Almost 80% of system websites in LA County provide specific information regarding water conservation rebate programs.

Low-Income Customer Assistance

Water systems are also the only entities which provide a direct subsidy for household drinking water consumption. Yet less than 40% of system websites state that they maintain low-income customer assistance programs. This represents less than half the proportion of systems that offer a subsidy for water conservation. While questionable in terms of equity, the greater prevalence of system conservation rather than low-income assistance programs is logical in the current state policy framework. Water systems have traditionally been tasked with prioritizing water resource management, rather than addressing issues of customer affordability, by state regulatory authorities.

Water Conservation Programs

Water Conservation Programs

Systems which maintain publicly-available websites are much more likely to offer conservation rebates.

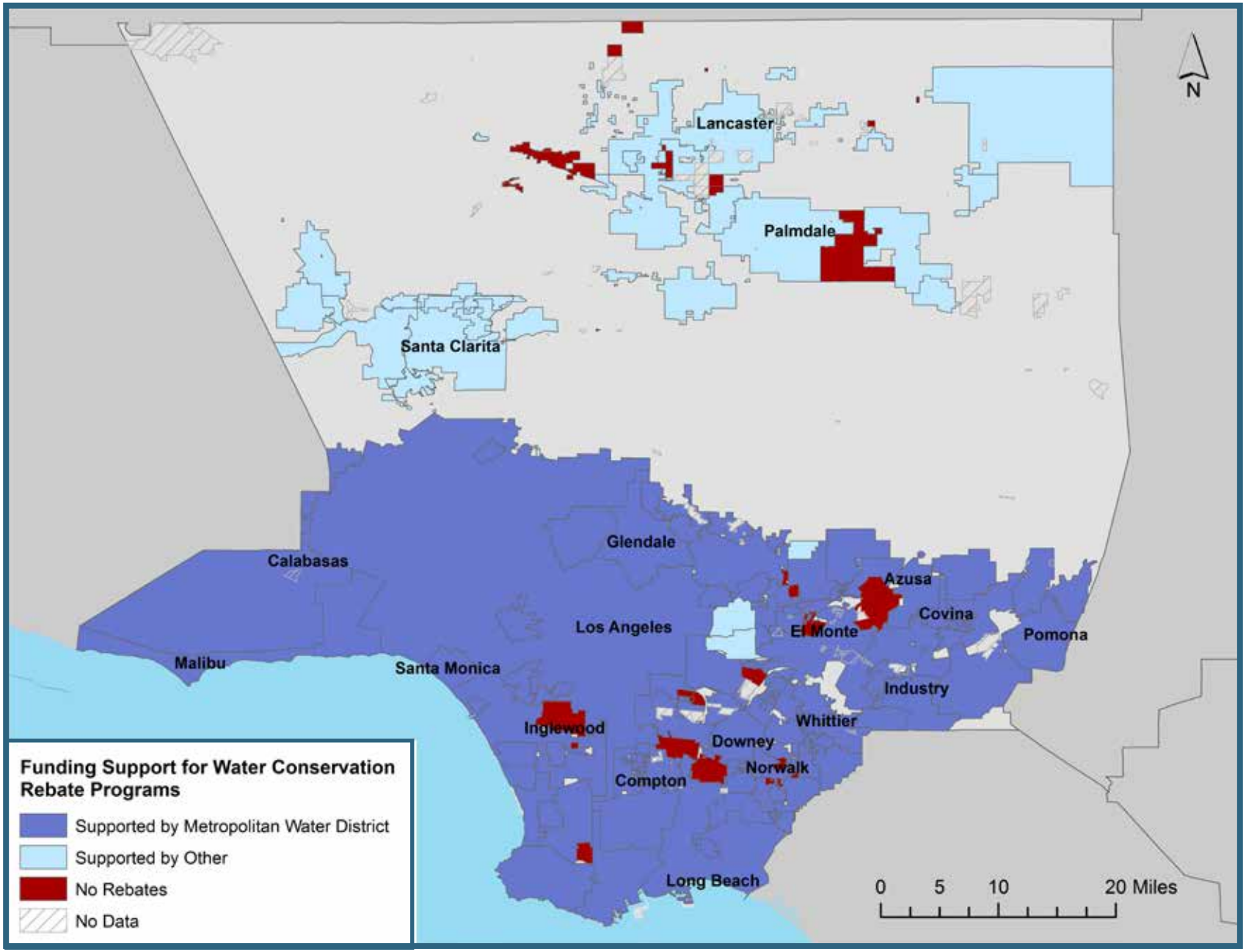
Conservation rebates are financial incentives provided to customers which encourage them to use less water. Community water systems offer rebates to households in exchange for the installation of indoor technological advances such as water efficient appliances or low flow plumbing devices, or outdoor strategies such as efficient, sprinkler systems, soil moisture sensors, drought-resistant landscaping or rain collection barrels. Household adoption of these tools reduces water usage and thus the burden on the water system at large. These rebate programs are funded by individual water systems, or with support from water wholesalers or other public agencies. In Los Angeles County, the Metropolitan Water District of Southern California provides funding support to many larger community water systems— which are its member agencies. Funding may also be available for water systems to support rebate programs for customers through the state's new Water Energy Technology Program, which is jointly run by several state agencies and supported by the Governor's Office of Planning and Research and CalEPA.[27]

Rebate and Incentive Programs Offered

The conservation measures incentivized by water system rebate programs range from small changes to indoor appliances — installing a low-flow showerhead— to overhauling a residence's outdoor space through xeriscaping. Most rebates cover a percentage of the customer's initial cost outlay for a given water-saving device, but also save consumers money in the long-run by reducing their water use. The typical percentage rebate offered to incentivize the adoption of a conservation strategy varies widely, from nearly the entire cost of sprinkler heads to a small fraction of the cost of a new washing machine.

We identified 100 systems that offered rebates within LA County. Systems which maintain publicly-available websites are much more likely to offer conservation rebates. Whereas more than 75% of systems with websites offer rebates, less than 10% of other systems did so. The range of rebates offered does not typically vary by the size of the system; systems tend to offer either a large number of conservation incentives or none.

Funding for Water Conservation Rebate Programs



Source: UCLA Luskin Center for Innovation, see "Methodology: Water Pricing, Cost and Affordability"

The expansive outlay of water-saving options offered by many systems with rebates, however, largely reflects the support of the Metropolitan Water District rather than individual systems' initiative. The district offers a suite of rebates via a program called SoCal WaterSmart. More than 75% of all systems that offer rebates are supported by MWD, including nearly all systems in the southern half of Los Angeles County.

Ease of Enrollment

In addition to providing information on water conservation rebates, the extent to which systems make enrollment in these programs easy is an important factor in uptake. Community water systems in Los Angeles provided two different means to enroll. Households can either download an application from the internet and send it via U.S. mail to the system's billing office, or complete enrollment online. About one fourth of systems only allowed for mail-in enrollment. Some rebates (ie, showerheads) simply required proof of payment whereas others (ie, turf removal) require proof of implementation. In either case, verification of the use of the conservation technology occured once at most.

Rebates and Vulnerable Populations

Across the state, low-income households face several barriers to access conservation rebates. First, they may be more likely to be serviced by systems that do not offer rebates. Second, even if rebates are offered, low-income customers cannot easily take advantage of the more substantial water-saving technologies because they do not have the cash on hand required to make large household investments. Third, they are less likely to learn about rebate opportunities if these opportunities are promoted by systems only in English.

Moreover, in urbanized counties such as Los Angeles, much of the low-income population resides in multi-family housing.[28] While precise data is not available, we know that residents of multi-family housing often do not pay for water service directly. Rather, the cost of water service is included in the price of rent and landlords directly interact with the water system. In this case, multi-family housing occupants are not eligible to enroll for rebates and thus do not have a direct incentive to conserve or reduce their use. Instead, the incentive to apply for and benefit derived from rebates lies with apartment managers or landlords.

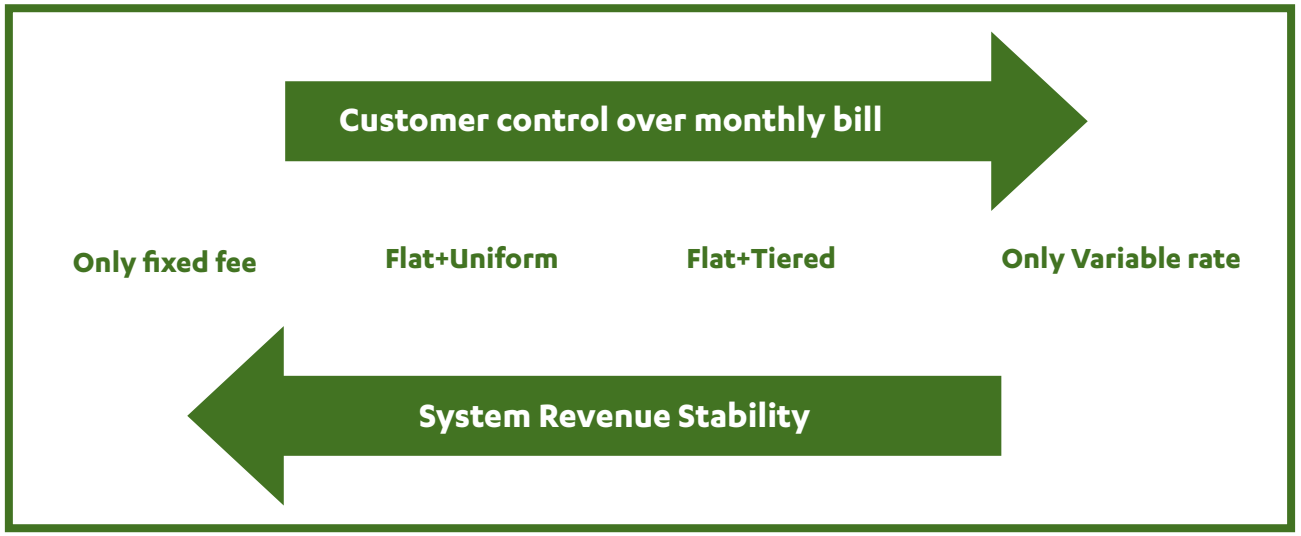
Water Pricing, Cost and Affordability

The cost of water paid by households reflects the quantity of water they use for indoor and outdoor purposes multiplied by the price of water set by their water system. Water's price in turn affects households' incentive to conserve water, interest in conservation rebates and needs-based assistance programs and measures of affordability.[29] Water service is generally defined as affordable if its cost does not exceed a certain percentage of household income, between 1.5% and 3%.

Structure of Water Prices

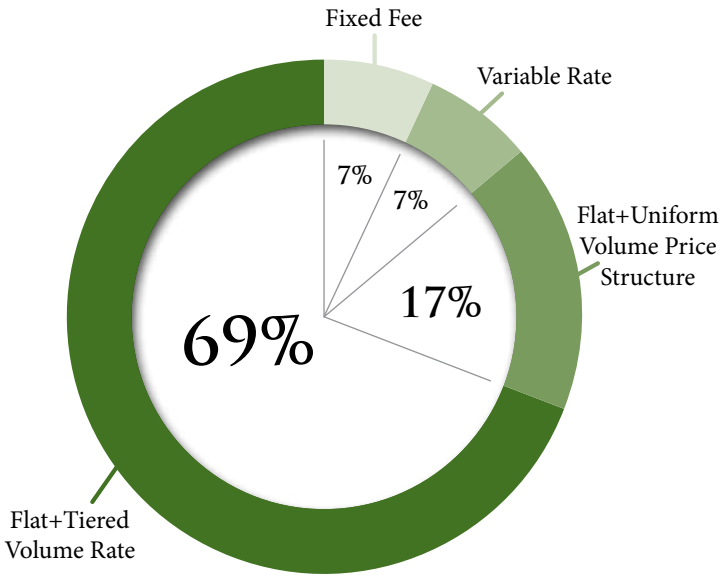
Water system managers and their customers often have different preferences for pricing structures. Water system managers may prefer structures that yield revenue stability in the face of drought or consumption shocks. Customers may prefer a price structure that enables them to decrease their water expenditure by reducing their water consumption.

There are four general types of water price schemes: only fixed fees, fixed fee + uniform quantity rates, fixed fee+ tiered quantity rates, and only variable rates (which may be either uniform or tiered based on quantity thresholds). An exclusive fixed fee charges customers the same amount regardless of how much water they use. Such a fixed fee presents the most revenue stability for water systems but does not incentivize conservation and does not enable customers to adjust expenditures by altering water consumption. On the other hand, an exclusively variable rate charges customers exactly in proportion to how much water they use. While such a variable rate offers customers the largest opportunity to reduce their water cost by as much as they can reduce consumption, it also introduces greater revenue uncertainty for water systems.



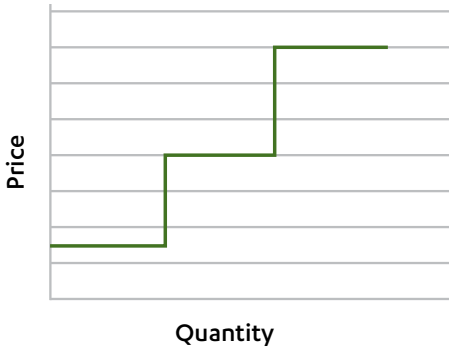
Most water systems in LA County compromise between these two extremes. They charge customers a fixed fee untied to consumption to ensure some revenue stability, and an additional variable rate to give customers the opportunity and incentive to conserve water. The variable rate may be uniform or tiered, with best practice dictating that tiers increase the unit rate as customers pass certain consumption thresholds. This is commonly called an increasing block tariff structure. Most systems also design different tier thresholds for different classes of customers, such as single family residential, multi-family residential, commercial and industrial, to reflect their different expected reasonable use levels. Fixed costs represent 33% of the average water bill for customers across systems in LA County, and overall cost is fairly consistent regardless of whether systems employ flat+uniform or flat+tiered volume structures.

Water Systems Pricing Models



Of the 115 systems for which we have pricing data, 7% only apply a fixed fee. Another 7% of systems take the opposite approach; they only employ a variable rate, with no fixed fee. More commonly, 17% of systems employ a flat +uniform volume price structure, and 69% of systems employ a flat + tiered volume rate. While uniform and tiered variable rates impose a similar cost burden on the average customer, this similarity masks the vastly different incentives that these structures offer to customers, and the welfare implications of imposing such price structures on the majority of households which deviate from the average consumption level in California.[30] There is a growing consensus that the best practice for water system pricing is a carefully-designed increasing block tariff structure that also ensures affordability for low-income customers.[31] The use of this pricing structure by water systems, however, is actually under threat across the state due to a recent court ruling on Proposition 218.[32]

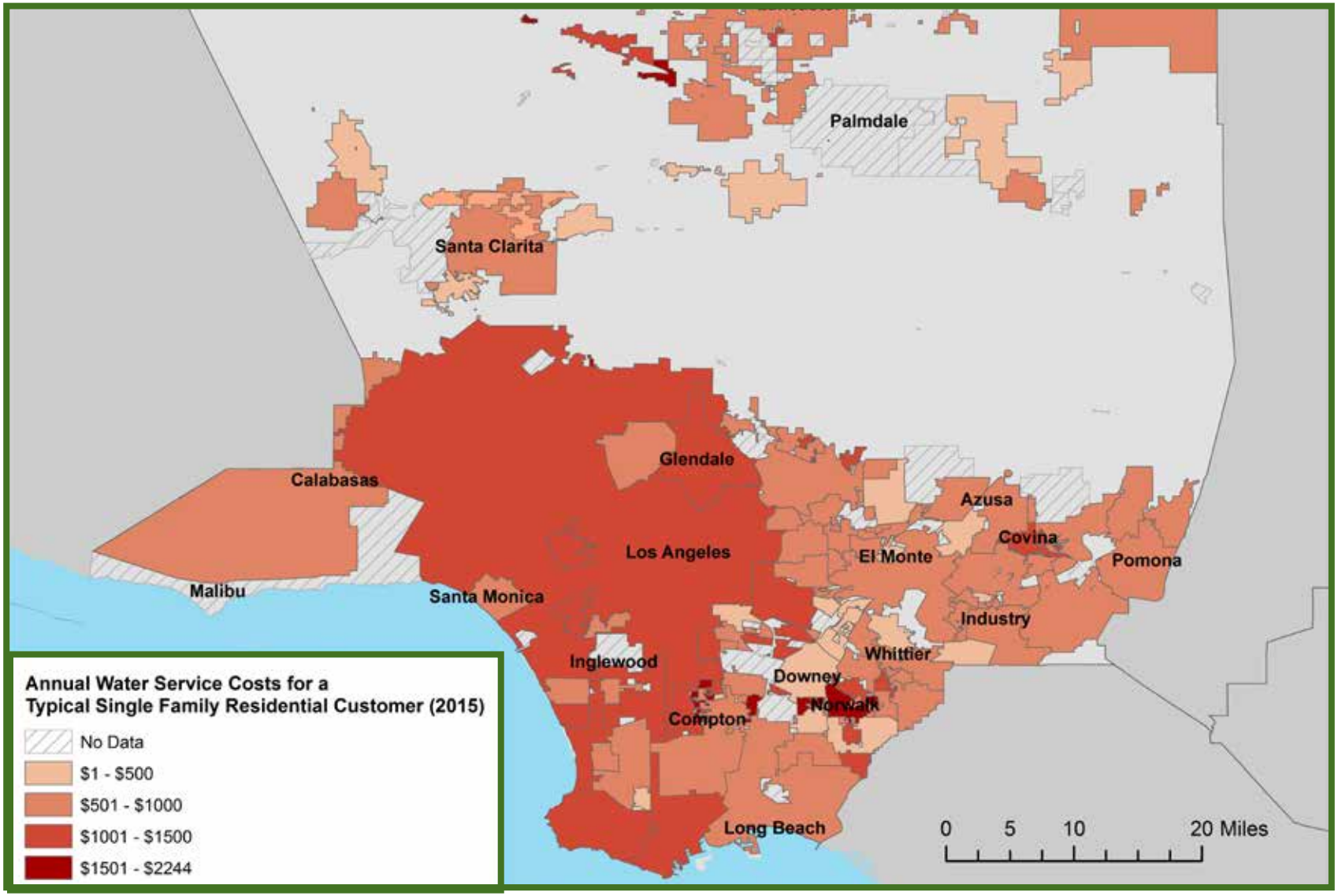
Increasing Block Tariff Structure



Average Cost of Water Service

As more fully detailed in the Methodology section of this report, we calculate the average cost of water service for customers in each water system for which we have data in Los Angeles County by using an average consumption estimate for single-family residences and applying the different price structures employed by each system.[33] The average annual cost to single-family residential customers at the system level was $814. The cost for the same quantity of water across systems varied widely, however, from $145 charged by the Maywood Mutual Water Company to $2214 charged by the California Water Service Company in Lake Hughes.

Annual Water Service Cost for a Typical Single Family Residential Customer (2015)



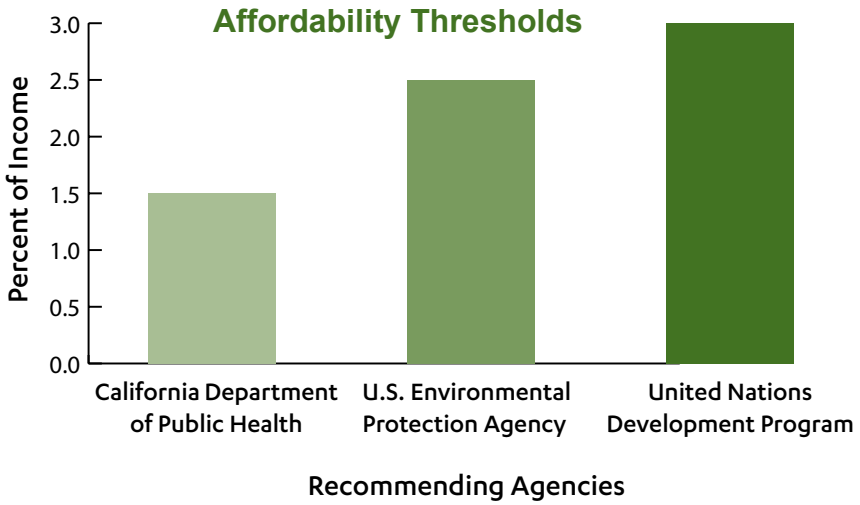
Source: UCLA Luskin Center for Innovation, see "Methodology: Water Pricing, Cost and Affordability"

Income, Disadvantage and Water Service Affordability

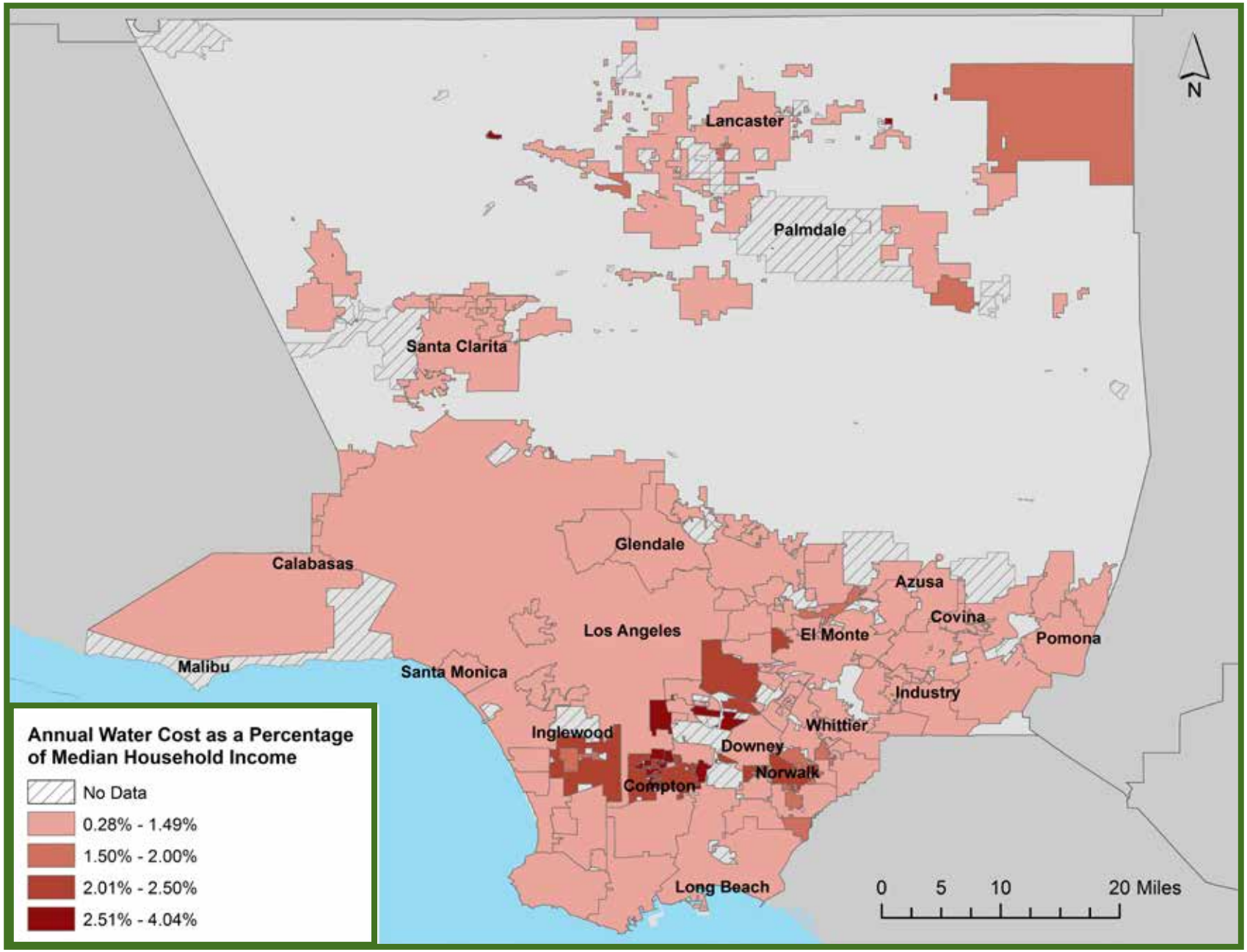
The California Department of Water Resources and the State Water Resources Control Board define a disadvantaged community as a community with median household income equal to or less than 80% of statewide median household income (approximately $48,706).[34] Nearly 50% of all water systems in Los Angeles County, serve at least one disadvantaged community within their boundaries, and nearly 25% of entire system populations have a median income below the threshold for defining a disadvantaged community.

Water cost is a function of the price of water and the amount of water consumed. Affordability is universally determined by whether water cost exceeds a certain percentage of income, but there is not agreement over the affordability threshold.[35] While the California Department of Public Health recommends 1.5% of annual household income as a maximum affordability threshold, the U.S. Environmental Protection Agency EPA suggests a threshold of 2%-2.5% of income, and the United Nations Development Program recommends a maximum of 3%.[36] The determination of an affordability threshold is not just an academic exercise; thresholds are used by systems to determine customer eligibility for needs-based assistance programs.

Across Los Angeles County systems, the average cost of water was 1.23% of annual household income, which suggests that water was indeed affordable for the average household in the county. More than 75% of systems, however, had an average cost of service above 1.5%, the most stringent affordability threshold recommended by a public agency. Of the systems above this threshold, more than half were served by branches of the Golden State Water Company and the California Water Service Company, which are investor owned utilities regulated by the California Public Utilities Commission. Community water systems for which we could not collect pricing data in Los Angeles County tended to be much smaller and serve populations with lower median incomes than those that did report pricing data. Affordability may be more of a concern among customers of these systems due both to the higher average cost of service provided by small water systems and the lower income levels among customers of these systems.



Annual Water Cost as a Percentage of Median Household Income



Source: UCLA Luskin Center for Innovation, see "Methodology: Water Pricing, Cost and Affordability"

Needs-Based Customer Assistance Programs

Needs-Based Customer Assistance Programs

Needs-based assistance programs offer relief for low-income or otherwise vulnerable residential water customers who have difficulty affording the cost of water service to meet household needs. Assistance can take the form of reduced prices, fixed credits, utility tax exemptions, or percentage discounts. While state agencies operate assistance programs for underperforming water systems, needs-based assistance programs for households are generally, if not exclusively, funded by individual community water systems.[16] The type and amount of assistance are thus not standardized across community water systems in Los Angeles, much less the entire state. In our survey, less than 25% of the community water systems in Los Angeles County reported offering any sort of needs-based assistance program, with CPUC-regulated systems and large municipal systems being much more likely to do so. The capacity to offer needs-based assistance thus appears correlated to the type and size of system. More than 90% of these systems offered assistance exclusively on the basis of low household income.

Assistance Packages Offered

Type of benefit

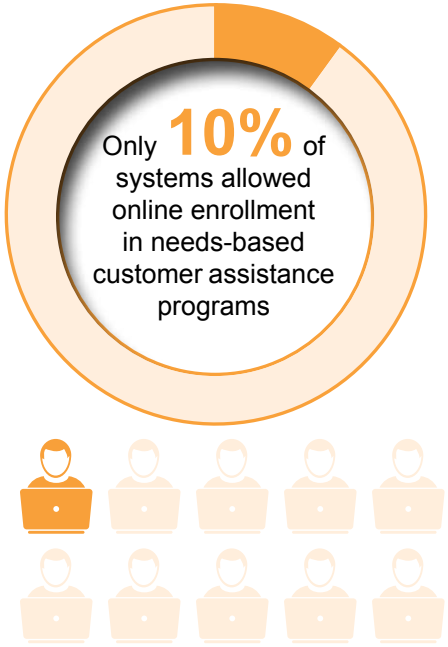
Low-income customer assistance programs vary substantially in content. Nearly 50% of programs offer a fixed credit to ratepayers, while 25% offered a percentage discount (up to a certain percent). The range of other benefits offered to low-income customers included utility tax exemptions and flat fee exemptions which are similar to fixed credits. A few systems offered assistance packages that charged an entirely different and lower set of fixed and variable rates to enrolled low-income customers, and a few other systems offered a rate stability guarantee.

Eligibility requirements

The need for assistance is also defined by each system. Many systems rely on the same income standards employed by utilities regulated by the California Public Utility Commission to determine eligibility for the California Alternative Rates for Energy (CARE) program. For instance, Suburban Water Systems of Glendora allows customers to prove their eligibility for assistance either by showing current enrollment in other energy utility's low-income assistance programs or on the basis of income thresholds, adjusted to household size, which are provided by CARE. Under the CARE scheme, a family of four with income below $47,700 would be eligible to enroll in a participating water system's assistance program as well.

By contrast, non-income related means of eligibility for assistance programs included senior or disabled status. These conditions were usually imposed in addition to low-income criteria. For example, Santa Fe Springs' water system only provides discounts to customers that are elderly (above 60 years of age) and who meet low-income thresholds which are slightly more stringent than CARE's standards. Some systems also only grant enrollment in some needs-based assistance program for a limited time, placing a fairly high burden on eligible households to remain enrolled.

Ease of Enrollment



The ease of enrollment in needs-based customer assistance programs influences uptake. Water systems provided two different means to enroll:

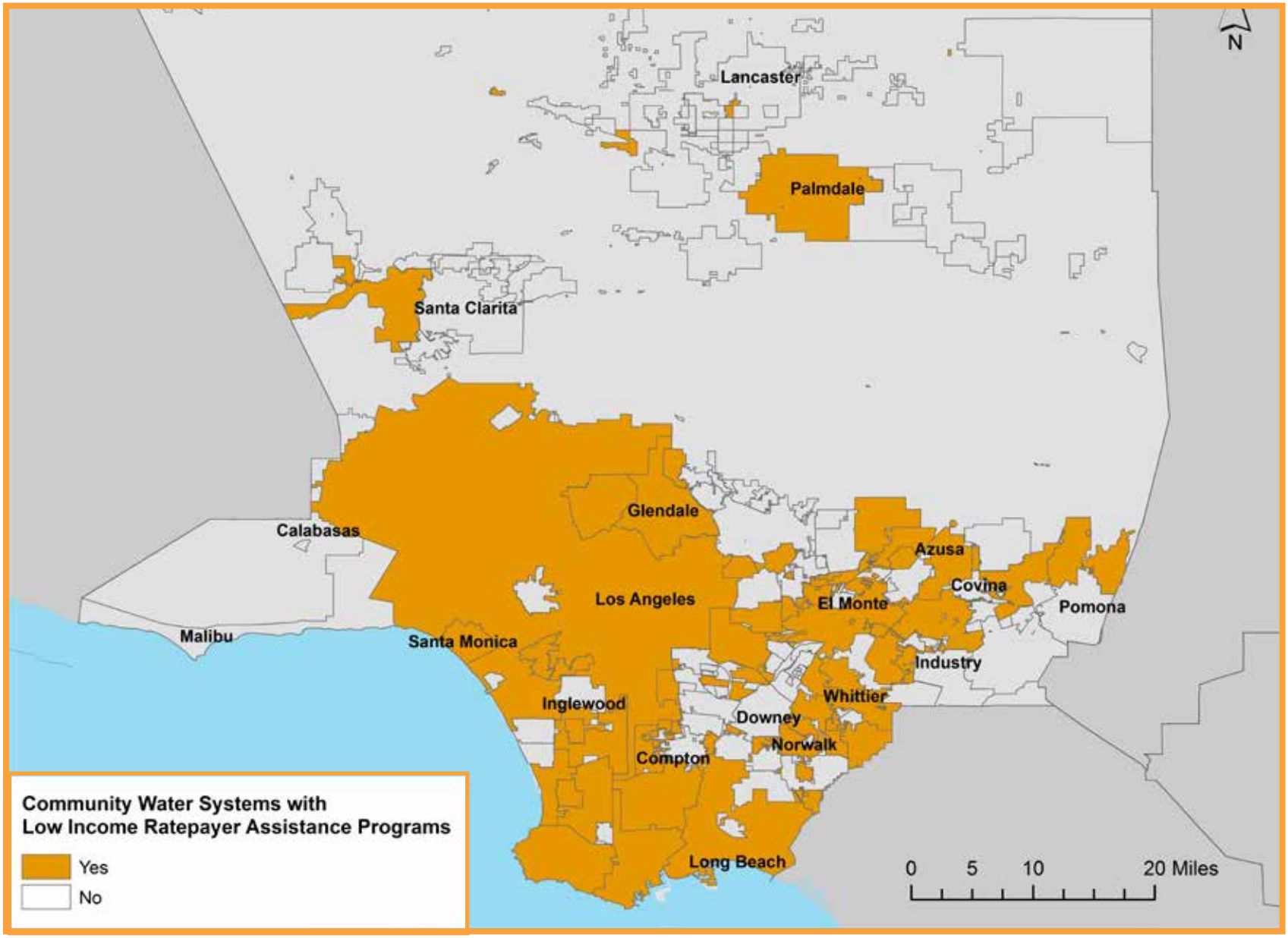
1) households could either download an application from the internet and send it via U.S. mail to the system's billing office, or

2) complete enrollment online.

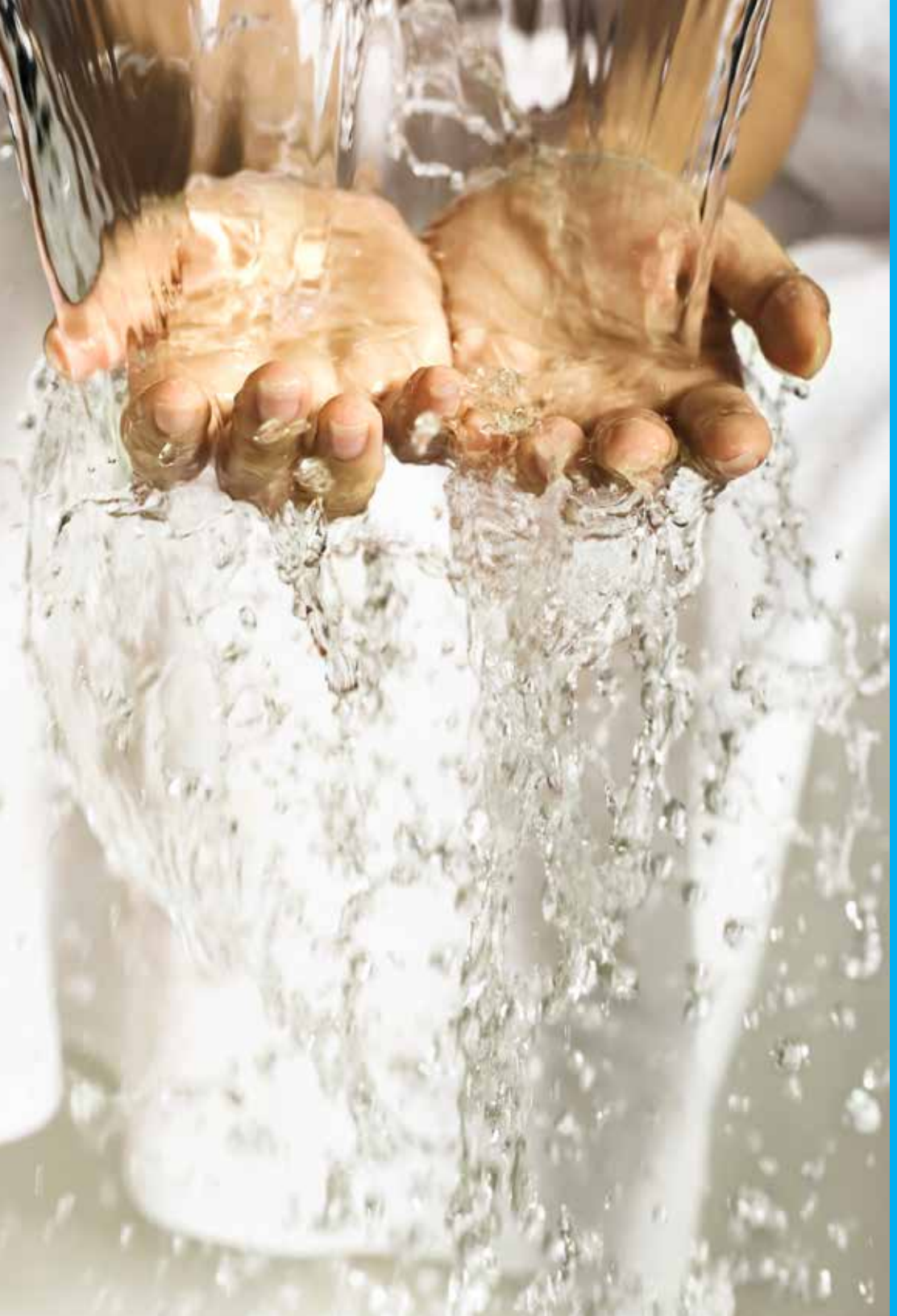
However, only 10% of systems allowed for enrollment solely online whereas the rest required that customers download an application and return it to the system's office. In some cases, enrollment also required that households prove their low income status by sending copies of their official tax return forms or demonstrating participation in other low-income assistance programs. Assistance programs are thus practically inaccessible to residents who do not receive their income from a government-registered employer. On the other hand, programs are also more accessible to households already receiving benefits from other government assistance programs.

Another important dimension of accessibility to low-income assistance programs is the language in which enrollment materials are offered, as affordability is likely lower among foreign-born or non-native English speaking households. Seventy five percent of water systems in Los Angeles County which offered needs-based assistance programs also made enrollment materials available in Spanish as well as English. Additionally, vu housing who do not directly pay for water service are typically not eligible for low-income customer assistance, even if they meet low income or other need thresholds. Multi-family unit managers or landlords are also not able to apply for assistance on eligible residents' behalf, and the benefits from needs-based programs are thus under-utilized to ease the affordability burden. The development of community water system programs which allow multi-family housing tenants to take advantage of water-related rebates for which they are eligible is much needed, especially in urbanized counties such as Los Angeles.

Community Water Systems with Low Income ratepayer Assistance Programs



Source: UCLA Luskin Center for Innovation, see "Methodology: Needs-Based Customer Assistance"



Appendix

Methodology

Community Water System Boundaries

UCLA researchers developed a methodology for drawing a polygon to represent the approximate boundary of a community water system service area. Community water systems are represented in terms of the extent of their drinking water distribution system, the network of underground pipes that distribute drinking water to residential communities. Community water systems with several discontinuous service areas were represented as multi-part polygons.

Data Sources

- U.S. EPA Safe Drinking Water Information System: http://oaspub.epa.gov/enviro/sdw_query_v2.get_list?wsys_name=&fac_search=fac_beginning&fac_county=LOS+ANGELES&pop_serv=500&pop_serv=3300&pop_serv=10000&pop_serv=100000&pop_serv=100001&sys_status=active&pop_serv=&wsys_id=&fac_state=CA&last_fac_name=&page=1&query_results=&total_rows_found= (2014).
- California Department of Public Heath, Water Boundary Tool: http://www.ehib.org/page.jsp?page_key=762 (updated continuously, captured July 2014).
- LA County GIS Portal: Water Purveyor Service Areas, http://egis3.lacounty.gov/dataportal/2011/01/27/water-purveyor-service-areas/ (2009).
- California-Atlas Geospatial Clearing House, http://www.atlas.ca.gov/download.html#/casil/boundaries (2004).
- Urban Water Management Plans, http://www.water.ca.gov/urbanwatermanagement/2010uwmps/ (2010).
- Water system self description of service areas.

Method

- A table of active community water systems serving Los Angeles County, California was downloaded from the U.S. EPA Safe Drinking Water Information System. Water wholesalers were excluded from this base-table.
- The community water systems on the U.S. EPA base-table were cross-checked with three geospatial layers to determine how many community water systems had been previously mapped. Existing geospatial information was aggregated into a new LA County Community Water System basemap.
- The boundaries of community water systems with existing geospatial data were ground-truthed using Urban Water Management Plans, water system self descriptions accessible by internet, historical maps and Google Maps.
- The boundaries of community water systems without existing geospatial data were developed by GIS analysts using Urban Water Management Plans, water system self descriptions accessible by internet, historical maps and Google Maps.

Community Water System Governance Types

Metric: Governance type for each community water system.

Every community water system in the United States falls into one of several governance types. Identifying the type of governance structure for each system may be as simple as looking at the system's name (ex. Los Angeles County Water Works District or Maywood Mutual Water Company). However, some system names were misleading. For example, Palmdale Water District was originally formed as an irrigation district and subsequently removed "irrigation" from its name. Researchers also identified many governance types by self descriptions where accessible by web and checked state business license databases. Researchers could not confirm the governance structures for seven systems, despite several attempts to directly contact water managers in these systems.

Data Sources

- System self-description via public website
- Wysk.com Business to Business data hub
- Direct communication with water managers

Method

- Water system names were evaluated for indicators of governance type
- Public information sources were evaluated for systems with no clear indicator of governance type (water system websites)
- Direct calls were made to water system managers to identify water system governance type

Community Water System Water Portfolio: Single Source Dependency

Metric: Community water systems that depend 100% on groundwater or purchased surface water sources.

Every community water system has a water supply portfolio, the collection of water sources that constitute the system's total available supply of water. Generally this is measured by calculating the percentage of the system's total water supply produced by individual sources like groundwater wells, imported purchased water, recycled water, and surface water over a period of time. The state collects data on water portfolios for urban water systems, which serve more than 3,000 connections or more than 3,000 acre-feet of water annually. For Very Small and Small water systems (serving under 3,300 people), the State Water Resources Control Board published information on all community water systems that are 100% dependent on groundwater. Finally the state's Drinking Water Watch database provides information for each water system on their water sources, providing a clear indicator for community water systems that are reliant on a single source of water like groundwater or imported purchased water.

Data Sources

- State Water Resources Control Board. "Communities that Rely on a Contaminated Groundwater Source for Drinking Water," Appendix 8: List of Community Water Systems that Rely on a Contaminated Groundwater Source for Drinking (2002-2010).
- Department of Water Resources: DOST Table 16 Water Supplies- Current and Projected http://www.water.ca.gov/urbanwatermanagement/2010_Urban_Water_Management_Plan_Data.cfm, 2010.
- California Drinking Water Watch Database: http://drinc.ca.gov/DWW/index.jsp (data updated on a continuous basis).

Method

- Using Appendix 8 from the SWRCB report "Communities that Rely on a Contaminated Groundwater Source for Drinking Water," identified the community water systems in LA County that relied 100% on groundwater in the 2002-2010 drinking water quality compliance period.
- Evaluated Department of Water Resources water supplies dataset for community water systems in LA County that relied 100% on purchased surface water supplies.
- For community water systems not identified in either datasets, researchers looked-up individual systems using the California Drinking Water Watch Database. Single-source dependency was determined by the "Source of Water" and "Water Purchases" web-parts.

Community Water Systems that Rely on Contaminated Groundwater Sources

Metric: Percent of system groundwater wells with primary contamination.

A groundwater reliant community is a community water system that gets at least part of its drinking water from a groundwater source. Using California Department of Public Health water quality data, the State Water Resources Control Board evaluated the prevalence of groundwater reliant communities with raw groundwater sources that exceed state drinking water quality regulations (called Maximum Levels of Contaminants). The state's dataset contains the total number of groundwater wells in each community water system and the number of system wells in which primary contamination was detected. By dividing the number of contaminated wells by the total number of system wells for each community water system, researchers developed a metric indicating the magnitude of contamination issues from groundwater for every community water system in the county. The 2002-2010 period was the last full nine-year compliance cycle, in which every community water system well in the state has complete bacterial and chemical testing results.

Data Sources

- State Water Resources Control Board. "Communities that Rely on a Contaminated Groundwater Source for Drinking Water," Appendix 8: List of Community Water Systems that Rely on a Contaminated Groundwater Source for Drinking (2002-2010).

Method

- Developed Appendix 8: List of Community Water Systems that Rely on a Contaminated Groundwater Source for Drinking (2002-2010) into a table format, and calculated the percentage of groundwater wells in each systems with detected principal contamination.
- Joined tabular database of contaminated groundwater sources of drinking water to geospatial basemap of community water system boundaries via public water system identification number, a unique ID code for every public water system in the state (PWSID).

Small Community Water Systems

Metric: Population served by community water system.

As part of the permitting and compliance regulations for community water systems in the United States, system managers must count the number of connections served and estimate the number of people served by the community water system. By definition, community water systems serve water for human consumption to at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. Very Small water systems serve 25 to 500 residents, while Small water systems serve 501 to 3,300 residents.

Data Sources

- U.S. EPA Safe Drinking Water Information System: http://oaspub.epa.gov/enviro/sdw_query_v2.get_list?wsys_name=&fac_search=fac_beginning&fac_county=LOS+ANGELES&pop_serv=500&pop_serv=3300&pop_serv=10000&pop_serv=100000&pop_serv=100001&sys_status=active&pop_serv=&wsys_id=&fac_state=CA&last_fac_name=&page=1&query_results=&total_rows_found= (extracted June 2014).

Method

- Downloaded table of Los Angeles County community water systems with service population attributes from U.S. EPA Safe Drinking Water Information System website.
- Mapped out community water systems serving between 25 and 3,300 residents.

Climate Change: Increase in Average Temperature and Extreme Heat Days by Mid-Century

Given available downscaled predictions of warming in the greater Los Angeles area, this Atlas and Policy Guide aims to create a vivid picture of what warming will mean for community water systems. The predictions for increases in average temperature and extreme heat days are projecting to 2050, only 35 years into the future. This report uses warming estimates based on the "business as usual" emission scenario, referred to as Representative Concentration Pathways (RCP) 8.5. It is essential that local, regional, and state regulators are able to visualize and internalize the near term consequences of the worst case emission scenario.

Metric: Average Temperature Increase by Mid-Century (RCP 8.5).

Data Sources

- Sun F, D Walton, and A Hall. 2015. "A hybrid dynamical–statistical downscaling technique, part II: End-of-century warming projections predict a new climate state in the Los Angeles region." Journal of Climate, in press.

Method

- Procured gridded raster layer for projected increase in average temperature by mid-century using RCP 8.5 scenario.
- Divided gridded raster layer into equal size smaller pieces and converted raster centroids to points.
- Executed spatial join processing using ArcGIS 10.2, in which all points within each community water system boundary were aggregated and mean average temperature increase was calculated for each community water system.

Metric: Increase in Extreme Heat Days by Mid-Century (RCP 8.5).

Data Sources

- Sun F, D Walton, and A Hall. 2015. "A hybrid dynamical–statistical downscaling technique, part II: End-of-century warming projections predict a new climate state in the Los Angeles region." Journal of Climate, in press.

Method

- Data requested from Fengpeng Sun, UCLA Oceanic and Atmospheric Sciences, in ASCII format.
- Mapped gridded latitude/longitude points using ESRI ArcGIS 10.2.
- Executed spatial join function, joining all gridded points within 2 km of each community water system boundary. Calculate mean, minimum and maximum values for baseline extreme heat days and mid-century extreme heat days for each system.
- Calculated difference between system-level aggregated mean baseline heat days and system-level aggregated mid-century extreme heat days.

Disadvantaged Communities

Metric: Percentage of service population made up of disadvantaged communities.

Disadvantaged communities suffer significant environmental health risks due to socio-economic and demographic factors as well as exposure to environmental hazards like air, soil, and water pollution. The Office of Environmental Health Hazard Assessment developed an index for identifying disadvantaged communities around the state. The index balances the sensitivity of populations (young and elderly, impoverished, underemployed) against exposure to air, soil and water pollution.

Data Sources

- California Office of Environmental Health Hazard Assessment, California Health Screening Assessment Tool 2.0: CES Index Score for California Census Tracts http://oehha.ca.gov/ej/ces2.html (2014).
- Community water system boundaries geospatial layer.

Method

- Downloaded table of all census tracts in California with CES Index Scores assigned to each tract.
- Identified census tracts in Los Angeles County with Index Scores in the top 20% of scores in California.
- Used ArcGIS 10.2 geoprocessing spatial overlay tools to calculate an estimate of disadvantaged community populations living in each community water system. Where necessary, census tracts were divided along community water system boundaries, assigning population estimates based on split census-tract areas.

Low-Income Households

Metric: Percentage of service population made up of low-income households.

Low-income customers are vulnerable to increases in water rates that may result from conservation policies, water supply projects, or other climate change adaptation measures. Understanding the breakdown of household income at the system level will help water managers design water rates and conservation incentives that support sustainable water management.

Data Sources

- American Community Survey (ACS) 5-Year Estimates 2008-2012, accessed through Social Explorer http://www.socialexplorer.com/data/ACS2012_5yr/metadata/
    - Variable: T056A006 Household Income (In 2012 Inflation Adjusted Dollars)- Cumulative- Number of Households Earning Less than $30,000
    - Variable: T056_001 Number of Households
- U.S. Census Bureau: 2013 TIGER/Line Block Group Shapefile https://www.census.gov/geo/maps-data/data/tiger-line.html
- Los Angeles County Land Parcels: Modified data from the Los Angeles County Chief Information Office, the Los Angeles County Solar Map, http://solarmap.lacounty.gov (2009)

Method

- Downloaded variables T056A006 Household Income (In 2012 Inflation Adjusted Dollars)- Cumulative- Less than $30,000 and T056_001 Number of Households from the American Community Survey 5-Year Estimates 2008-2012, accessed through Social Explorer.
- Joined data tables to geospatial layer for U.S. census block groups in Los Angeles County.
- Using ArcGIS 10.2 geoprocessing toolkit, intersect tool, assigned census block group attributes to the residential property parcels located within each census block group. We then merged groups of residential parcels sharing unique census block group IDs into multipart polygons. Instead of assuming that households are evenly distributed across census block groups, we attributed household characteristics to parcels with residential structures. Assigning census block group attributes to their corresponding residential tracts reduced the error in the final stage when the attributes are summed to the community water system level.
- Using ArcGIS 10.2 geoprocessing toolkit, spatial join tool, overlaid community water system boundaries on top of residential parcel groups. This geoprocessing tool aggregates ACS field values from residential parcel groups on an area-weighted basis for each community water system boundary.

- While this method produced strongest results for Medium, Large and Very Large community water systems, the aggregate estimates for small and rural systems were less accurate. For community water systems containing less than three residential parcels (78 community water systems), for example a mobile home park, individual estimates were calculated using an area-weighted average of estimates for each census block group intersecting each community water system.
- For each community water system, the sum of variable T056A006 was divided by variable T056_001 to determine the percentage households in each community water system earning less than $30,000 annually.

Very Young and Elderly Populations

Metric: Percentage of service population made up of very young and elderly residents.

Very young and elderly populations are highly susceptible to the adverse health effects from drinking poor quality water. In the event of supply curtailment, these populations will also face obstacles accessing replacement water supplies. Water managers with an understanding of vulnerable customers will more effectively provide relief in case of water quality or supply emergencies.

Data Sources

- American Community Survey (ACS) 5-Year Estimates 2008-2012, accessed through Social Explorer http://www.socialexplorer.com/data/ACS2012_5yr/metadata/
    - Variable: T007A003 Age – Cumulative – Less than 10 Years
    - Variable: T007B011 Age – Cumulative – More than 75 years
- U.S. Census Bureau: 2013 TIGER/Line Block Group Shapefile https://www.census.gov/geo/maps-data/data/tiger-line.html
- Los Angeles County Land Parcels: Modified data from the Los Angeles County Chief Information Office, the Los Angeles County Solar Map, http://solarmap.lacounty.gov (2009)

Method

- Downloaded variables T007A003 Age – Cumulative – Less than 10 Years and T007B011 Age- Cumulative – More than 75 years from the American Community Survey 5-Year Estimates 2008-2012, accessed through Social Explorer.
- Joined data tables to geospatial layer for U.S. census block groups in Los Angeles County.
- Using ArcGIS 10.2 geoprocessing toolkit, intersect tool, assigned census block group attributes to the residential property parcels located within each census block group. We then merged groups of residential parcels sharing unique census block group IDs into multipart polygons. Instead of assuming that households are evenly distributed across census block groups, we attributed household characteristics to parcels with residential structures. Assigning census block group attributes to their corresponding residential tracts reduced the error in the final stage when the attributes are summed to the community water system level.
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- While this method produced strongest results for Medium, Large and Very Large community water systems, the aggregate estimates for small and rural systems were less accurate. For community water systems containing less than three residential parcels (78 community water systems), for example a mobile home park, individual estimates were calculated using an area-weighted average of estimates for each census block group intersecting the community water system.
- For each community water system, the sum of variable T007A003 and T007B011 was divided by service population estimates to determine the percentage of service population made up of very young and elderly populations in each community water system.

Housing Tenure

Metric: Percentage of housing units by tenure status (owner-occupied, renter-occupied).

Household tenure may be a crucial determinate in the effectiveness of indoor and outdoor household conservation incentives. Owner-occupied households are more likely to have an account with water utilities than renter-occupied households. As we learn more about the relationship between household characteristics and water use, this system-level analysis of household tenure will be crucial for efficiently marketing household conservation incentives.

Data Sources

- American Community Survey (ACS) 5-Year Estimates 2008-2012, accessed through Social Explorer http://www.socialexplorer.com/data/ACS2012_5yr/metadata/
    - Variable: T094_002 Owner-Occupied Housing Units
    - Variable: T094_003 Renter-Occupied Housing Units
    - Variable: T097_001 Total Housing Units
- U.S. Census Bureau: 2013 TIGER/Line Block Group Shapefile https://www.census.gov/geo/maps-data/data/tiger-line.html
- Los Angeles County Land Parcels: Modified data from the Los Angeles County Chief Information Office, the Los Angeles County Solar Map, http://solarmap.lacounty.gov (2009)

Method

- Downloaded variables T094_002 Owner-Occupied Housing Units, T094_003 Renter-Occupied Housing Units and T097_001 Total Housing Units from the American Community Survey 5-Year Estimates 2008-2012, accessed through Social Explorer.
- Joined data tables to geospatial layer for U.S. census block groups in Los Angeles County.
- Using ArcGIS 10.2 geoprocessing toolkit, intersect tool, assigned census block group attributes to the residential property parcels located within each census block group. We then merged groups of residential parcels sharing unique census block group IDs into multipart polygons. Instead of assuming that households are evenly distributed across census block groups, we attributed household characteristics to parcels with residential structures. Assigning census block group attributes to their corresponding residential tracts reduced the error in the final stage when the attributes are summed to the community water system level.
- Using ArcGIS 10.2 geoprocessing toolkit, spatial join tool, overlaid community water system boundaries on top of residential parcel groups. This geoprocessing tool aggregates ACS field values from residential parcel groups on an area-weighted basis for each community water system boundary.
- While this method produced strongest results for Medium, Large and Very Large community water systems, the aggregate estimates for small and rural systems were less accurate. For community water systems containing less than three residential parcels (78 community water systems), for example a mobile home park, individual estimates were calculated using an area-weighted average of estimates for each census block group intersecting the community water system.
- For each community water system, the sum of variable T094_002 was divided by variable T097_001 to determine the percentage housing units in each community water system that are owner-occupied. The sum of variable T094_003 was divided by variable T097_001 to determine the percentage housing units in each community water system that are renter-occupied.

Housing Units

Metric: Percentage of housing units by type (single-unit, multi-unit).

In addition to household tenure, household type may be another factor that water managers should consider when designing water conservation incentive programs, especially outdoor water conservation programs. Single-unit households are more likely than multi-unit households to control residential landscaping and watering. Conservation incentives that encourage lawn replacement will be most effective in areas with high concentrations of single-unit households.

Data Sources

- American Community Survey (ACS) 5-Year Estimates 2008-2012, accessed through Social Explorer http://www.socialexplorer.com/data/ACS2012_5yr/metadata/
    - Variable: T097_001 Total Housing Units
    - Variable: T097_002 Single Housing Units
    - Variable T097_005 2 Housing Units
    - Variable: T097_006 3 or 4 Housing Units
    - Variable: T097_007 5 to 9 Housing Units
    - Variable: T097_008 10 to 19 Housing Units
    - Variable: T097_009 20 to 49 Housing Units
    - Variable: T097_010 50 or more
- U.S. Census Bureau: 2013 TIGER/Line Block Group Shapefile https://www.census.gov/geo/maps-data/data/tiger-line.html
- Los Angeles County Land Parcels: Modified data from the Los Angeles County Chief Information Office, the Los Angeles County Solar Map, http://solarmap.lacounty.gov (2009)

Method

- Downloaded variables T097_001 Total Housing Units, T097_002 Single Housing Units, T097_005 2 Housing Units, T097_006 3 or 4 Housing Units, T097_007 5 to 9 Housing Units, T097_008 10 to 19 Housing Units, T097_009 20 to 49 Housing Units, and T097_010 50 or more Housing Units from the American Community Survey 5-Year Estimates 2008-2012, accessed through Social Explorer.
- Joined data tables to geospatial layer for U.S. census block groups in Los Angeles County.
- Using ArcGIS 10.2 geoprocessing toolkit, intersect tool, assigned census block group attributes to the residential property parcels located within each census block group. We then merged groups of residential parcels sharing unique census block group IDs into multipart polygons. Instead of assuming that households are evenly distributed across census block groups, we attributed household characteristics to parcels with residential structures. Assigning census block group attributes to their corresponding residential tracts reduced the error in the final stage when the attributes are summed to the community water system level.
- Using ArcGIS 10.2 geoprocessing toolkit, spatial join tool, overlaid community water system boundaries on top of residential parcel groups. This geoprocessing tool aggregates ACS field values from residential parcel groups on an area-weighted basis for each community water system boundary.
- While this method produced strongest results for Medium, Large and Very Large community water systems, the aggregate estimates for small and rural systems were less accurate. For community water systems containing less than three residential parcels (78 community water systems), for example a mobile home park, individual estimates were calculated using an area-weighted average of estimates for each census block groups intersecting the community water system.
- For each community water system, the sum of variable T097_002 was divided by variable T097_001 to determine the percentage housing units in each community water system that are single units. The sum of variables T097_005 through T097_010 was divided by variable T097_001 to determine the percentage housing units in each community water system that are multiple units.

Building Age

Metric: Percentage of residential structures constructed before or after 1970.

Older single-family and multi-family dwellings may use more water than recently built structures of the same size. Many water systems provide rebates and incentives for replacing water intensive faucet heads and appliances with more water-efficient models. Older residential structures have the highest potential for indoor water-efficiency improvements, and thus should be the primary target of these water-efficiency incentives. Water managers with an understanding of residential building age in their customer base have the advantaged of geographically targeting households with the most to gain from water-efficiency rebate programs.

Data Sources

- Los Angeles County Land Parcels: Modified data from the Los Angeles County Chief Information Office, the Los Angeles County Solar Map, http://solarmap.lacounty.gov (2009)

Method

- The "year built" of residential parcels is included as an attribute in the Los Angeles County Land Parcels geospatial layer.
- Using ArcGIS 10.2 geoprocessing tool, identity, we assigned the attributes of each community water system (system name and public water system identification number) to each residential parcel.
- Using the "summarize" function of ArcGIS 10.2, we calculated the number of residential units built before 1970 and the number of residential units built after 1970 for each community water system.

Public Access to System Information

Metric: Presence of system website and information provided on website.

We identified whether a given water system maintained a publicly-available website. If a website existed, we identified whether the website contained information regarding water rates, the state-wide drought, conservation rebates and low-income customer assistance.

Data Sources

- Original dataset created by UCLA researchers
- Public websites

Method

- UCLA research assistants used internet browsers and standard web search engines like Google and Yahoo to locate publicly accessible websites dedicated to the provision of water service information about specific community water systems. Public websites dedicated to the provision of water service information for a specific utility were cataloged by UCLA researchers.

Water Conservation Programs

Metric: Presence, range and ease of enrollment in systems' conservation rebate programs

We identified whether a given water system offered rebates for water conservation to customers, collected data on the range of rebates offered by each system, and the means to enroll in rebate programs.

Data Sources

- Original dataset created by UCLA researchers
- Community water system public websites
- Phone interviews with community water system representatives

Method

- If a community water system had a publically accessible website for the provision of water service information, UCLA researchers searched website for information on water conservation rebates for customers.
- Community water systems without publically accessible websites were contacted directly by phone. UCLA researchers conducted a short survey by phone that included questions about the provision of water conservation rebates for customers. Unresponsive systems were contacted by phone up to three times, during normal business hours on a Tuesday, Wednesday or Thursday, to maximize the potential response rate.
- Many community water systems providing rebates for residential water conservation directed customers to the rebate enrollment web-page through Metropolitan Water District of Southern California. UCLA researchers took note of rebate programs supported by Metropolitan Water District and other external entities. In this way, our dataset differentiates between rebate programs supported by Metropolitan versus other entities.
- Researchers made a critical assumption about determining whether or not a community water system provided rebates to encourage water conservation. If a community water system had a public website, and water conservation rebates were not advertised on this public website, then we assumed the community water system did not offer customers water conservation rebates.

Water Pricing, Cost and Affordability

Metric: Median Household Income

Median household income is the 50th percentile of household income in a given geography. For the purposes of this report, UCLA researchers created a spatial method of aggregating U.S. Census block group estimates of median household income to the community water system level.

Data Sources

- American Community Survey 2013 (ACS) 5-Year Estimates 2009-2013, accessed through Social Explorer http://www.socialexplorer.com/data/ACS2013_5yr

  Variable: T057_001 Median Household Income (In 2013 Inflation Adjusted Dollars)
- U.S. Census Bureau: 2013 TIGER/Line Block Group Shapefile https://www.census.gov/geo/maps-data/data/tiger-line.html
- Los Angeles County Land Parcels: Modified data from the Los Angeles County Chief Information Office, the Los Angeles County Solar Map, http://solarmap.lacounty.gov (2009)

Method

- Downloaded variable T057_001 Median Household Income for Block Groups in Los Angeles County from the American Community Survey 5-Year Estimates 2009-2013, accessed through Social Explorer.
- Instead of assuming that households are evenly distributed across census block groups, we attributed household characteristics to tax parcels with residential structures. Assigning census block group attributes to their corresponding residential tracts reduced the error in the final stage when the attributes are aggregated to the community water system level. Using ArcGIS 10.2 geoprocessing toolkit, we intersected census block group boundaries with residential property parcels located within each census block group. We then merged groups of residential parcels sharing census block group IDs (GEOIDs) into multipart polygons.

- Using ArcGIS 10.2 geoprocessing toolkit, intersect tool, split residential tract polygons into groups based on an overlay with community water system boundaries. This process split residential polygons by community water system boundary and 'tagged' residential tract polygons with community water system identities (system name and water system identification numbers).
- Calculated the area of multipart residential polygons.
- Joined the T057_001, Median Household Income, data table to the multipart residential polygon layer by GEOID.
- Calculated new field: [Median Household Income] x [Area].
- Exported attribute table to Microsoft Excel, and created a Pivot table. In Pivot table, summed the area-weighted median household income values by community water system name. The resulting output table is the area-weighted average median household income for community water system boundaries.
- While this method produced strongest results for Medium, Large and Very Large community water systems, the aggregate estimates for small and rural systems were less accurate. For community water systems containing less than three residential parcels (78 community water systems), for example a mobile home park, individual estimates were calculated using an area-weighted average of median household income for each census block group intersecting the community water system.

Metric: Annualized Water Cost for Typical Single-Family Residential Customer

The annualized cost of single-family residential water service varies considerably across Los Angeles County, including the timing, structure and value of water service costs. Using a document investigation and survey approach, UCLA researchers gathered water service cost information and calculated typical single-family service costs for a residential customer. Researchers made two major assumptions: 1) single-family residential customers are connected to the drinking water distribution system by the smallest available connection size (5/8" connection, or ¾" if 5/8" was not offered); 2) single-family residential customers consume an average of 18 hundred cubic feet (CCF) of potable water over one month. The assumption of 18 CCF per month per household is based on dissertation research by Caroline Mini (2013) who calculated average single family residential water use in City of Los Angeles between 2000 and 2010 as 102 m3/household per bimonthly billing period, or 36 CCF per household per bimonthly billing period.

Data Sources

- Original dataset created by UCLA researchers
- Community water system public websites
- Phone interviews with community water system representatives
- Mini, Caroline. 2013. Residential Water Use and Landscape Vegetation Dynamics in Los Angeles. University of California Los Angeles.

Method

- UCLA researchers gathered water service cost information from each community water system, either through website searches or via phone
- Using assumptions made by Mini, typical single-family service costs for a residential customer in each ssytem were calculated.

Metric: Annual Water Cost as a Percentage of Median Household Income

The affordability of water service can be measured as the percentage of annual household income spent on water service costs at the water system scale.

Data Sources

- Median household income by community water systems, original dataset created by UCLA researchers
- Annualized water service costs for typical single-family residential customers by community water system, original dataset created by UCLA researchers

Method

- UCLA researchers calculated the percentage of median household income for community water systems spent on annualized water costs using Microsoft Excel. Researchers created a table with community water systems, estimated median household income (original dataset) by water system, and annualized water service costs for single-family residential customers (original dataset). Researchers created a simple formula that divides annualized water service costs by median household income, and multiplies that result by 100.
- The resulting table was joined to the community water system basemap layer, and visualized as a map in ArcGIS 10.2.

Needs-Based Customer Assistance

Metric: Presence, range and ease of enrollment in systems' needs-based customer assistance programs

We identified whether a given water system offered financial assistance to customers on the basis of need and the definition of need used by each system. We also collected data on the range of assistance offered by each system, and the means to enroll in assistance programs.

Data Sources

- Original dataset created by UCLA researchers
- Community water system public websites
- Phone interviews with community water system representatives

Method

- If a community water system had a publically accessible website for the provision of water service information, UCLA researchers searched website for information on needs-based ratepayer assistance programs.
- Community water systems without publically accessible websites were contacted directly by phone. UCLA researchers conducted a short survey by phone that included questions about the provision of needs-based ratepayer assistance programs. Unresponsive systems were contacted by phone up to three times, during normal business hours on a Tuesday, Wednesday or Thursday, to maximize the potential response rate.
- Researchers made a critical assumption about determining whether or not a community water system provided needs-based customer assistance programs. If a community water system had a public website, and needs-based assistance rebates were not advertised on this public website, then we assumed the community water system did not offer needs-based assistance.
- Corresponding residential tracts reduced the error in the final stage when the attributes are summed to the community water system level.
- Using ArcGIS 10.2 geoprocessing toolkit, spatial join tool, overlaid community water system boundaries on top of residential parcel groups. This geoprocessing tool aggregates ACS field values from residential parcel groups on an area-weighted basis for each community water system boundary.
- While this method produced strongest results for Medium, Large and Very Large community water systems, the aggregate estimates for small and rural systems were less accurate. For community water systems containing less than three residential parcels (78 community water systems), for example a mobile home park, individual estimates were calculated using an area-weighted average of estimates for each census block group intersecting the community water system.
- For each community water system, the sum of variable T007A003 and T007B011 was divided by service population estimates to determine the percentage of service population made up of very young and elderly populations in each community water system.

Works Cited

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2. California Department of Water Resources et al. "20x2020 Water Conservation Plan" (2010), 14.

3. "Water Rates: Water Affordability," Pacific Institute, Accessed October 15, 2014, http://pacinst.org/wp-content/uploads/sites/21/2013/01/water-rates-affordability.pdf.

4. There are 228 community water systems in Los Angeles County, as counted by U.S. EPA. Of these 228 systems, seven are considered water wholesalers, and were not included in our analysis. Despite significant investigation by UCLA researchers, service boundaries could not be determined for seven Very Small community water systems due to lack of accessible information. One community water system is currently transitioning ownership to another community water system. Therefore, this report limits the scope of analysis to 213 community water systems.

5. Firestone, Laurel, "Guide to Community Drinking Water Advocacy," Community Water Center, published 2009, accessed October 15, 2014, http://www.communitywatercenter.org/cwc_community_guide, 105.

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8. California Department of Water Resources, "Storms, Droughts and California's Water Situation: Key Points" (December 31, 2014) http://www.water.ca.gov/waterconditions/waterconditions.cfm.

9. "Report of the Blue Ribbon Committee," The Metropolitan Water District of Southern California, (2011).

10. State Water Resources Control Board, "Communities that Rely on a Contaminated Groundwater Source for Drinking Water," (2013). http://www.swrcb.ca.gov/water_issues/programs/gama/ab2222/index.shtml

11. Louis Sahagun, "DWP to Build Groundwater Treatment Plants on Superfund Site," Los Angeles Times, (June 23, 2013).

12. Public Policy Institute of California, "Paying for Water in California," (2014), 35.

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15. Sun F, D Walton, and A Hall. 2015. "A hybrid dynamical–statistical downscaling technique, part II: End-of-century warming projections predict a new climate state in the Los Angeles region." Journal of Climate, in press

16. Ibid.

17. California Department of Water Resources et al. "20x2020 Water Conservation Plan" (2010), 14.

18. Juliet Christian-Smith, Carolina Balazs, Matthew Heberger, Karl Longley, "Assessing Water Affordability: A Pilot Study in Two Regions of California," Pacific Institute, 2013, http://pacinst.org/wp-content/uploads/sites/21/2013/08/assessing-water-affordability.pdf.

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20. "Water Rates: Water Affordability," Pacific Institute, Accessed October 15, 2014, http://pacinst.org/wp-content/uploads/sites/21/2013/01/water-rates-affordability.pdf.

21. "California Communities Health Screening Tool, Version 2.0, Guidance and Screening Tool," (Office of Environmental Health Hazard Assessment, October 2014), 93. http://oehha.ca.gov/ej/pdf/CES20FinalReportUpdateOct2014.pdf

22. "The Human Right to Water Bill in California," International Human Rights Law Clinic, Accessed July 14, 2015, https://www.law.berkeley.edu/files/Water_Report_2013_Interactive_FINAL(1).pdf.

23. There are 228 community water systems in Los Angeles County, as counted by U.S. EPA. Of these 228 systems, seven are considered water wholesalers. Despite significant investigation by UCLA researchers, service boundaries could not be determined for seven very small community water systems due to lack of accessible information. One community water system is currently transitioning ownership to another community water system. Therefore, this report limits analysis to 213 community water systems.

24. Websites could also maintain easy-to-use dashboard applications to allow customers to calculate their water bills based on different levels of use. An example of such a dashboard is provided by researchers at UNC-Chapel Hill for water systems in North Carolina. See "North Carolina Water and Wastewater Rates Dashboard," Environmental Finance Center, Accessed July 13, 2015, http://www.efc.sog.unc.edu/reslib/item/north-carolina-water-and-wastewater-rates-dashboard.

25. Given the current state of water supply availability in California, public agencies have redoubled their efforts to raise awareness of the drought among households. These efforts seem to be making a positive impact. As of October 2014, more than 90% of California households reported following news of the drought closely. More than two-thirds of voters also approved Proposition 1, which provides funding for improving state-wide water supply infrastructure, in November 2014 ("Californians and Their Government," Public Policy Institute of California, Accessed July 1, 2015, http://www.ppic.org/content/pubs/survey/S_1014MBS.pdf). Since that time, public awareness can only have increased due to further state-wide mandated restrictions on water use. While large disparities between environmental awareness and actualized household conservation practices remain, awareness does generally translate into enhanced conservation.

26. Governor Jerry Brown, April 1, 2015, "Executive Order B-29," http://gov.ca.gov/docs/4.1.15_Executive_Order.pdf.

27. The primary agencies operating the program are the California Energy Commission, the Department of Water Resources and the State Water Resources Control Board. See "California's Drought Technology Program: Investing in Innovative Water and Energey Saving Technologies," California Energy Commission, Accessed July 2, 2015, http://www.energy.ca.gov/2015publications/CEC-500-2015-025/CEC-500-2015-025-FS.pdf.

28. According to 2013 American Community Survey data, 44% of Los Angeles County's population lives in multi-family housing.

29. There remains a disparity between household awareness regarding water scarcity and water's value. A 2014 poll of a cross-section of California voters found that while 89% found the state's water shortage to be a crisis, only 16% perceived the shortage to be having a major impact on their lives (See Bettina Boxall, June 6, 2014, "Poll finds little support for drought spending despite broad awareness" Los Angeles Times). Raising prices to reflect the true cost of water delivery is the easiest way to narrow that gap in awareness.

30. Paul Rogers and Nicholas St. Fleur, February 7, 2014, "California Drought: Database shows big difference between water guzzlers and sippers," San Jose Mercury News.

31. For instance, see Kenneth, Baerenklau, Kurt Schabe, and Ariel Dinar, 2014, "The residential water demand effect of increasing block rate water budgets," Land Economics, 90(4), 683-699.

32. Christopher Cadelago, April 21, 2015, "California cities fret over tiered water rates after court decision," Sacramento Bee.

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34. "Resources - Disadvantaged Communities (DAC) Mapping Tool", California Department of Water Resources, Accessed July 6, 2015, http://www.water.ca.gov/irwm/grants/resources_dac.cfm.

35. Juliet Christian-Smith, Carolina Balazs, Matthew Heberger, Karl Longley, 2013, "Assessing Water Affordability: A Pilot Study in Two Regions of California," Pacific Institute.

36. The EPA standard includes guidance for wastewater bills. See "Need to Know: Water Rates: Water Affordability," Pacific Institute, Accessed October 15, 2014, http://pacinst.org/wp-content/uploads/sites/21/2013/01/water-rates-affordability.pdf.

37. The California Public Utilities Commission does provide guidance and support to water systems under its remit to provide low-income assistance programs to households, but there is no state-wide mandate for all systems to provide such assistance. See Seaneen Wilson, 2007, "Assessment of Water Utility Low-Income Assistance Programs," California Public Utilities Commission Division of Water and Audits, http://www.cpuc.ca.gov/NR/rdonlyres/159B7FB3-D717-41C3-9BCE-27FFE7530AD5/0/dwa_lowincome_research_paper_112507.pdf.

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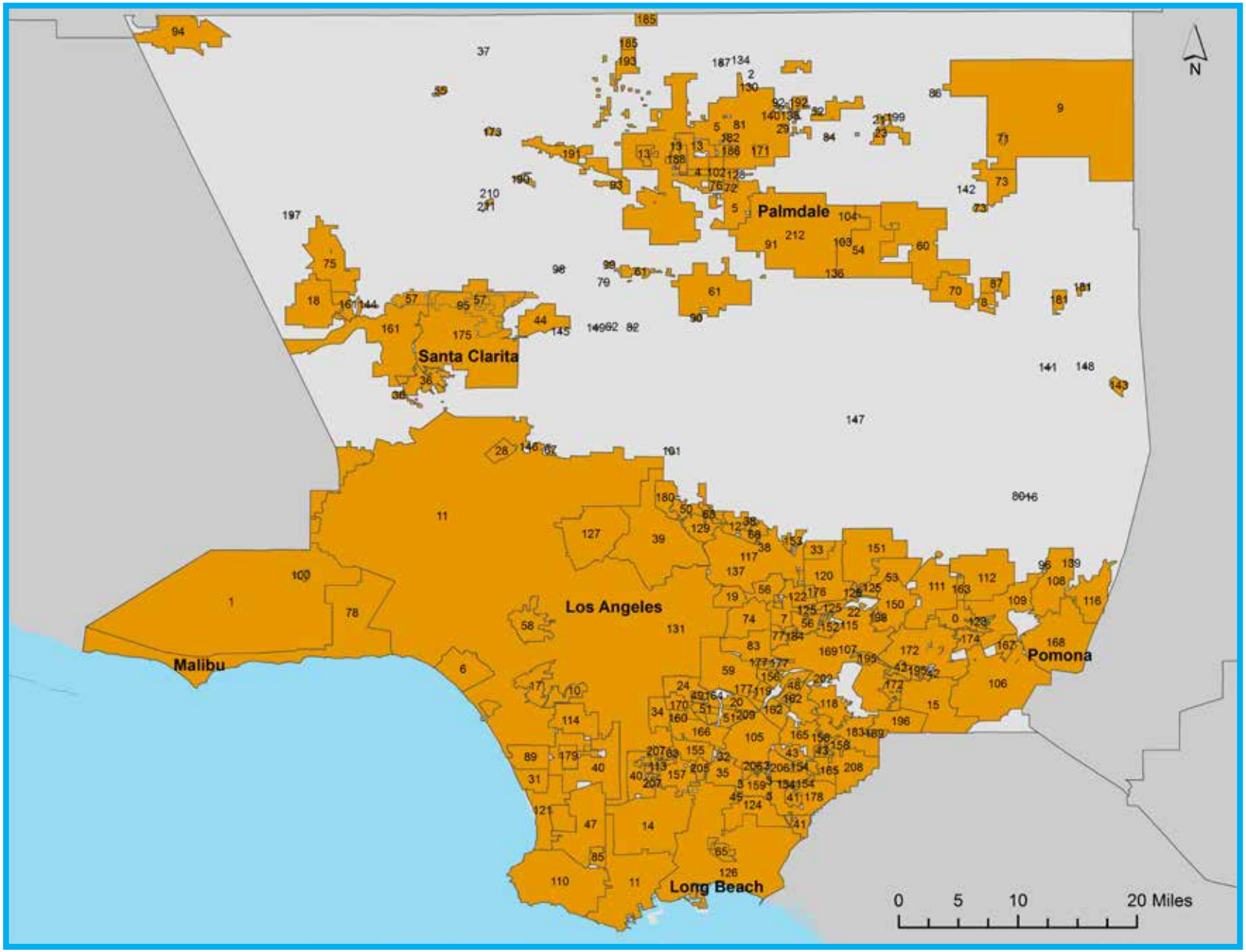

Source: UCLA Luskin Center for Innovation, *see Methodology: "Community Water System Boundaries"*

List of Community Water Systems in Los Angeles County

0 COVINA-CITY, WATER DEPT.
1 LAS VIRGENES MUNICIPAL WATER DISTRICT
2 LANCASTER PARK MOBILE HOME PARK
3 BELLFLOWER MUNICIPAL WATER SYSTEM
4 SUNNYSIDE FARMS MUTUAL WATER COMPANY
5 LA COUNTY WATERWORKS DIST 4 & 34-LANCASTER
6 SANTA MONICA-CITY, WATER DIVISION
7 SAN GABRIEL COUNTY WATER DISTRICT
8 LLANO DEL RIO WATER COMPANY
9 LA COUNTY WATERWORKS DIST 40 REG. 35-N.E. L.A.
10 CAL/AM WATER COMPANY - BALDWIN HILLS
11 LOS ANGELES-CITY, DEPT. OF WATER & POWER
12 LINCOLN AVENUE WATER COMPANY
13 QUARTZ HILL WATER DISTRICT
14 CALIFORNIA WATER SERVICE CO. - DOMINGUEZ
15 ROWLAND WATER DISTRICT
16 CAMP WILLIAMS- RESORT
17 GOLDEN STATE WATER COMPANY - CULVER CITY
18 LA COUNTY WATERWORKS DIST 36-VAL VERDE
19 CITY OF SOUTH PASADENA
20 COMMERCE-CITY, WATER DEPT.
21 REESEDALE MUTUAL WATER COMPANY
22 RURBAN HOMES MUTUAL WATER COMPANY
23 COLORADO MUTUAL WATER COMPANY
24 VERNON-CITY, WATER DEPT.
25 OAK GROVE TRAILER PARK
26 WESTERN SKIES MOBILE HOME PARK
27 TRACT 180 MUTUAL WATER COMPANY
28 SAN FERNANDO-CITY, WATER DEPT.
29 EL RANCHO MOBILE HOME PARK
30 ANTELOPE PARK MUTUAL WATER COMPANY
31 MANHATTAN BEACH-CITY, WATER DEPT.
32 GOLDEN STATE WATER COMPANY - HOLLYDALE
33 SIERRA MADRE-CITY, WATER DEPT.
34 GOLDEN STATE WATER CO. - FLORENCE/GRAHAM
35 PARAMOUNT - CITY, WATER DEPT.
36 NEWHALL COUNTY WATER DISTRICT-NEWHALL
37 WINTERHAVEN MOBILE ESTATES
38 LAS FLORES WATER COMPANY
39 GLENDALE-CITY, WATER DEPT.
40 GOLDEN STATE WATER COMPANY - SOUTHWEST
41 GOLDEN STATE WATER COMPANY - ARTESIA
42 LA PUENTE VALLEY COUNTY WATER DISTRICT
43 GOLDEN STATE WATER COMPANY - NORWALK
44 NEWHALL COUNTY WATER DISTRICT-PINETREE
45 BELLFLOWER HOME GARDENS WATER COMPANY
46 GOLDEN SANDS MOBILE HOME PARK
47 TORRANCE-CITY, WATER DEPT.
48 PICO WATER DISTRICT
49 MAYWOOD MUTUAL WATER CO. #1
50 LA CANADA IRRIGATION DIST.
51 GOLDEN STATE WATER CO - BELL, BELL GARDENS
52 EVERGREEN MUTUAL WATER COMPANY
53 CAL-AM WATER COMPANY - DUARTE
54 LITTLEROCK CREEK IRRIGATION DIST.
55 BLEICH FLATS MUTUAL WATER CO
56 CAL/AM WATER COMPANY - SAN MARINO
57 NEWHALL COUNTY WD-TESORO DEL VALLE
58 BEVERLY HILLS-CITY, WATER DEPT.
59 CALIFORNIA WATER SERVICE CO. – EAST LA
60 LA COUNTY WW DIST 40, R24, 27,33-PEARBLSM
61 LA COUNTY WATERWORKS DISTRICT 37-ACTON
62 OASIS PARK MOBILE HOME PARK
63 GOLDEN STATE WATER CO - WILLOWBROOK
64 HEMLOCK MUTUAL WATER COMPANY
65 SIGNAL HILL - CITY, WATER DEPT.
66 RUBIO CANON LAND & WATER ASSOCIATION
67 LA COUNTY WW DISTRICT 21-KAGEL CANYON
68 TRACT 349 MUTUAL WATER COMPANY
69 CHAMPION WATER MUTUAL
70 LA COUNTY WW DIST 40 REG. 39-ROCK CREEK
71 WILSONA GARDENS MUTUAL
72 WEST SIDE PARK MUTUAL
73 LA COUNTY WW DIST 40 REG 38 LAKE L.A.
74 CITY OF ALHAMBRA
75 NEWHALL COUNTY WATER DISTRICT-CASTAIC
76 SHADOW ACRES MUTUAL WATER COMPANY
77 GOLDEN STATE WATER CO-SOUTH SAN GABRIEL
78 LA COUNTY WATERWORKS DIST 29 & 80-MALIBU
79 CASA DULCE ESTATES
80 FOLLOWS CAMP

List of Community Water Systems in Los Angeles County

81 LANCASTER WATER COMPANY
82 THE ROBIN'S NEST RECREATION RESORT
83 MONTEREY PARK-CITY, WATER DEPT.
84 TIERRA BONITA MUTUAL WATER COMPANY
85 LOMITA-CITY, WATER DEPT.
86 BAXTER MUTUAL WATER COMPANY
87 LLANO MUTUAL WATER COMPANY
88 MESA CREST WATER COMPANY
89 EL SEGUNDO-CITY, WATER DEPT.
90 ACTON REHAB CENTER
91 ALPINE SPRINGS MOBILE HOME PARK
92 BLUE SKIES MOBILE HOME PARK
93 CALIFORNIA WATER SERVICE CO-LEONA VALLEY
94 GOLDEN VALLEY MUNICIPAL WATER DISTRICT
95 LILY OF THE VALLEY MOBILE VILLAGE
96 SAN DIMAS CANYON IMPROVEMENT ASSOCIATION
97 SHERWOOD MOBILE HOME PARK
98 SLEEPY VALLEY WATER COMPANY INC.
99 SPV WATER COMPANY INC
100 THE OAKS
101 VALHALLA WATER ASSOCIATION
102 WHITE FENCE FARMS MUTUAL WC NO.3
103 JOSHUA VIEW MOBILE HOME PARK
104 PALMDALE TRAILER PARK
105 DOWNEY - CITY, WATER DEPT.
106 WALNUT VALLEY WATER DISTRICT
107 DEL RIO MUTUAL
108 LA VERNE, CITY WATER DIVISION
109 GOLDEN STATE WATER COMPANY-SAN DIMAS
110 CALIFORNIA WATER SERVICE CO. - PALOS VERDES
111 AZUSA LIGHT AND WATER
112 GLENDORA-CITY, WATER DEPT.
113 SATIVA-L.A. COUNTY WATER DISTRICT
114 INGLEWOOD- CITY, WATER DEPT.
115 STERLING MUTUAL WATER COMPANY
116 GOLDEN STATE WATER COMPANY - CLAREMONT
117 PASADENA-CITY, WATER DEPT.
118 WHITTIER-CITY, WATER DEPT.
119 SOUTH MONTEBELLO IRRIGATION DIST.
120 CITY OF ARCADIA
121 CALIFORNIA WATER SERVICE CO. - HERM/REDO
122 SUNNY SLOPE WATER COMPANY
123 SUBURBAN WATER SYSTEMS-COVINA KNOLLS
124 LAKEWOOD - CITY, WATER DEPT.
125 GOLDEN STATE WATER CO.-SOUTH ARCADIA
126 LONG BEACH-CITY, WATER DEPT.
127 BURBANK-CITY, WATER DEPT.
128 EL DORADO MUTUAL WATER COMPANY
129 VALLEY WATER COMPANY
130 THE VILLAGE MOBILE HOME PARK
131 YOUNG NAK CHURCH OF LOS ANGELES
132 DESERT PALMS MOBILE HOME PARK
133 L.A RESIDENTIAL COMMUNITY FOUNDATION
134 MITCHELL S AVENUE E MOBILE HOME PARK
135 THE RIVER COMMUNITY
136 BLUE SKIES TRAILER PARK
137 HATHAWAY-SYCAMORES CHILD FAMILY SVCS
138 CALIFORNIAN MOBILE HOME PARK
139 CAMP AFFLERBAUGH-PAIGE
140 CLEAR SKIES MOBILE HOME RANCH
141 FENNER CANYON YOUTH CONSERVATION CAMP
142 HILLCREST MOBILE HOME PARK
143 MT. HIGH EAST SKI AREA
144 PETER PITCHESS HONOR RANCHO. LAFCO. SHER
145 RIVERS END TRAILER PARK
146 SKY TERRACE MOBILE HOME PARK
147 US FOREST SERVICE-CHILAO MAIN (A-9)
148 US FOREST SERVICE-JACKSON LAKE V-4
149 WHITE ROCK LAKE RV PARK
150 VALLEY COUNTY WATER DISTRICT
151 MONROVIA-CITY, WATER DEPT.
152 EL MONTE-CITY, WATER DEPT.
153 KINNELOA IRRIGATION DISTRICT
154 NORWALK - CITY, WATER DEPT.
155 LYNWOOD-CITY, WATER DEPT.
156 MONTEBELLO LAND & WATER CO.
157 COMPTON-CITY, WATER DEPT.
158 ORCHARD DALE WATER DISTRICT
159 BELLFLOWER - SOMERSET MUTUAL WATER CO.
160 WALNUT PARK MUTUAL WATER CO.
161 VALENCIA WATER CO.

List of Community Water Systems in Los Angeles County

162 PICO RIVERA - CITY, WATER DEPT.
163 SUBURBAN WATER SYSTEMS-GLENDORA
164 MAYWOOD MUTUAL WATER CO. #3
165 SANTA FE SPRINGS- CITY, WATER DEPT.
166 SOUTH GATE-CITY, WATER DEPT.
167 CAL POLY POMONA UNIVERSITY
168 POMONA - CITY, WATER DEPT.
169 SAN GABRIEL VALLEY WATER CO-EL MONTE
170 HUNTINGTON PARK-CITY, WATER DEPT.
171 LANDALE MUTUAL WATER COMPANY
172 SUBURBAN WATER SYSTEMS-SAN JOSE
173 CALIFORNIA WATER SERVICE CO-LAKE HUGHES
174 VALENCIA HEIGHTS WATER COMPANY
175 SANTA CLARITA WATER DIVISION
176 EAST PASADENA WATER CO.
177 MONTEBELLO-CITY, WATER DEPT.
178 CERRITOS - CITY, WATER DEPT.
179 HAWTHORNE-CITY WATER DEPT.
180 CRESCENTA VALLEY COUNTY WATER DISTRICT
181 LITTLE BALDY
182 CALIFORNIA WATER SERVICE CO.-LANCASTER
183 SUBURBAN WATER SYSTEMS-WHITTIER
184 AMARILLO MUTUAL WATER COMPANY
185 SUNDALE MUTUAL WATER COMPANY A, B
186 WHITE FENCE FARMS MUTUAL WATER CO.
187 LEISURE LAKE MOBILE ESTATES
188 PALM RANCH IRRIGATION DISTRICT
189 CALIFORNIA DOMESTIC WATER COMPANY
190 GREEN VALLEY COUNTY WATER DISTRICT
191 LAKE ELIZABETH MUTUAL WATER COMPANY
192 AVERYDALE MUTUAL WATER COMPANY
193 LAND PROJECT MUTUAL WATER COMPANY
194 LYNWOOD PARK MUTUAL WATER COMPANY
195 CITY OF INDUSTRY WATERWORKS SYSTEMS
196 LA HABRA HEIGHTS COUNTY WATER DISTRICT
197 PARADISE RANCH MOBILE HOME PARK
198 VALLEY VIEW MUTUAL WATER COMPANY
199 AQUA J MUTUAL WATER COMPANY
200 ADAMS RANCH MUTUAL WATER COMPANY
201 LOWEL TRACT MUTUAL WATER COMPANY
202 BEVERLY ACRES
203 MAYWOOD MUTUAL WATER CO. #2
204 SO. CAL. EDISON CO.-SANTA CATALINA
205 PARK WATER COMPANY -LYNWOOD
206 PARK WATER COMPANY -BELLFLOWER-NORWALK
207 PARK WATER COMPANY - COMPTON
208 SUBURBAN WATER SYSTEMS-LA MIRADA
209 BELL GARDENS-CITY, WATER DEPT.
210 LOS ANGELES, CITY OF - POWER PLANT #2
211 LOS ANGELES, CITY OF - POWER PLANT #1
212 PALMDALE WATER DISTRICT

Community Water Systems Not Pictured:

WEST VALLEY COUNTY WATER DISTRICT
MUTUAL WATER OWNERS OF LOS NIETOS
LOCUST GROVE MOBILE HOME PARK
METTLER VALLEY MUTUAL
NORTH TRAILS MUTUAL WATER COMPANY
PROPERTY OWNERS WATER SYSTEM
SKYLINE MUTUAL

Wholesale Water Agencies:

CASTAIC LAKE WATER AGENCY
ANTELOPE VALLEY-EAST KERN WATER AGENCY
THREE VALLEYS MUNICIPAL WATER DISTRICT
CENTRAL BASIN MUNICIPAL WATER DISTRICT
COVINA IRRIGATING COMPANY
FOOTHILL MUNICIPAL WATER DIST.
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA


WATER

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