# *Demystifying the Role of Water Reclamation in Los Angeles' Water Infrastructure*

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## ABSTRACT

Extreme weather events brought on by climate change are expected to occur more frequently and intensely in the next decade. One such extreme weather event is drought and accordingly increased water scarcity. In high-risk areas such as Los Angeles, where water scarcity has a long-standing and storied history, suggestions for conservation strategies include water reclamation. This paper uncovers the role that water reclamation plays in Los Angeles' water infrastructure through a series of interviews with a spectrum of knowledgeable experts, nonprofit workers, and government workers. This paper discovers that (1) education and communication are necessary for the success of water reclamation projects, (2) Los Angeles is among global leaders of reclamation due to the scale and scope of its operations, (3) cost is the most pressing challenge to the success of reclamation, and (4) it is unclear how the coronavirus disease 2019 (COVID-19) pandemic will impact water reclamation advancements in Los Angeles. These findings encourage a collection of policy solutions, including the deployment of a wide-scale educational campaign, investment in water infrastructure and technology, improvement in communication through an interagency task force, and the implementation of integrated water management.

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## INTRODUCTION

Climate change presents a score of challenges to the planet, including an increase in extreme weather events such as heatwaves and droughts (Bulkeley, 2013). Extreme events are expected to intensify and occur more frequently in many regions throughout the 21st century (Haghighi et al., 2018). Cities must find a way to adapt to these changes, especially areas that are arid and prone to droughts. Arid regions are increasingly forced to consider alternative water sources, as drought and water-overuse deplete natural sources. As the population grows, these issues will be exacerbated as more people will increase the need for water.

This paper examines and analyzes the role that water reclamation plays in Los Angeles' water infrastructure. Water reclamation plants offer a solution to Los Angeles' unsustainable water use, in which water is withdrawn at a rate higher than it is replenished. New legislation, such as Measure W and Los Angeles' Green New Deal, may promote the development and investment of water reclamation, along with other water conservation methods. However, roadblocks such as negative public perception, potential health and safety risks, and the spread of coronavirus disease 2019 (COVID-19) into wastewater supplies may prevent the success of water reclamation. This paper considers relevant policy, public perception, costs, and other perceived and proven benefits and burdens to determine: *What role does water reclamation play in Los Angeles' water infrastructure*?

To ascertain the role that water reclamation plays in Los Angeles' water infrastructure, this paper engages in a review and analysis of relevant research, and conducts a series of interviews with experts in the field. Informed by an analysis of the interviews, this research

determines that education and communication are necessary for the success of reclamation projects, Los Angeles is among global water reclamation leaders by default due to the scale and scope of its operations, cost is the most pressing challenge to the success of water reclamation operations, and it's unclear how COVID-19 will impact water reclamation advancements. This paper reveals that water reclamation has great potential in Los Angeles as a water conservation method, but its level of success is not currently universally accepted. A large part of water reclamation's success hinges on the ability of the city to organize, communicate, educate the public, invest in technology and infrastructure, and pass supportive legislation.

## BACKGROUND

*Water Reclamation History*

Water reclamation is the treatment of wastewater to make it usable by meeting water quality criteria standards (Zaneti et al., 2012). The technology for water reclamation has existed globally in practice for several decades, with the most significant developments having occurred in arid regions where water is scarce (Metcalf et al., 2007). In Southern Africa, Windhoek, Namibia has been recycling wastewater since 1969. Windhoek is unique because it is one of the only cities that use reclaimed water for consumptive purposes. To date, there are no reported negative health impacts due to drinking recycled water (Ghernaout, 2018). In Namibia, recycled water serves as an important solution to the lack of water due to the arid climate.

Cities have also utilized water reclamation for agricultural and irrigation purposes. This includes methods such as groundwater recharge, in which water is artificially added to groundwater basins (Asano & Cotruvo, 2004). In 1977 Tel-Aviv, Israel began using groundwater recharge via basins; in 1984 Tokyo, Japan began using reclaimed water to supply commercial building toilet water; in 1989 Girona, Spain used reclaimed water to irrigate golf courses; in 1999 Adelaide, Australia created the Virginia Pipeline Project which irrigates vegetable crops using reclaimed water (Metcalf et al., 2007). Shende et al. found that wastewater is too valuable to waste in arid regions especially in developing countries (1988), and many farmers in these countries use untreated wastewater out of necessity (Buechler & Mekala, 2005). This is not necessarily the same practice as water reclamation but outlines a pattern in water reuse due to

lack of water. Most water reuse in developing countries is used for agriculture or irrigation and often is used without significant treatment (Metcalf et al., 2007).

Within the United States, the technology for water reclamation has also existed for several decades. In 1962 Los Angeles County, a major groundwater recharge project was initiated; in 1977 St. Petersburg, Florida initiated a major urban water reuse system; in 1982 Tucson, Arizona initiated a metropolitan water reuse program that watered golf courses, school grounds, cemeteries, and parks (Metcalf et al., 2007). Despite the advancements in technology and the presence of water reclamation facilities around the country, the United States has not used reclaimed water for consumptive purposes.

*Los Angeles Water Use*

Los Angeles imports most of its water from outside of the city. According to water management advisor Dr. Ken Murray, Los Angeles has three sources from which water is imported: the Delta in Northern California, the Eastern Sierra, and the Colorado River, all of which are declining with global warming (2013). This presents a problem that has grown over the past few decades: the absence of sufficient water available in Los Angeles. In the early 1900s, there was much concern within the city over how LA would "achieve prominence on the West Coast" without a sufficient water supply (Libecap, 2005, p. 2065). This anxiety prompted LA to claim water and land rights from Owens Valley in the Eastern Sierra via the Los Angeles Aqueduct. This solution was opposed by the local residents, and the "effects it would have on the environment, and economy" (Lachman et. al., 2016, p. 13). These oppositions were ignored,

and by the late 1920s, Owens Lake had dried up. Because Southern California is subject to long droughts, and short wet seasons, Los Angeles has relied on distant water supplies to accommodate the region, even if it means the depletion of sources such as Owens Lake. In Los Angeles, the Metropolitan Water District (MWD) manages imported water from Northern California and the Colorado River (Maggioni, 2015).

*Water Independence in Los Angeles*

In the past decade, Los Angeles has set clear goals to become more water-independent. On February 21st, 2019, Mayor Eric Garcetti announced that LA would recycle 100% of its wastewater by 2035, which will "reduce its need for imported supplies" (Boxall, 2019, para. 4). A directive set forth by Garcetti further attempts to source 70% of the city's water locally by 2035 (Luthy et al., 2020). Garcetti's announcement indicates an intention to increase the city's water supply sourced from recycled facilities from 2% to 35% (LA Mayor, 2019). This announcement goes hand-in-hand with a UCLA project known as "the Sustainable LA Grand Challenge" which has a goal of sourcing 100% of water locally from Los Angeles. This is a major shift as the city of LA imports 89% of its water currently from more than 200 miles away (UCLA, 2015). It also comes after a series of legislation promoted by Mayor Eric Garcetti, including Measure W, a $300 million measure, passed in 2018 to "fund infrastructure projects and programs to capture, treat, and recycle rainwater" (LA Mayor, 2019, para. 9). The Los Angeles Department of Water and Power has stated that by 2035, alternative water options will be

increased from 16 percent in 2012 to 42 percent, using stormwater capture, water transfers, and conservation (Lachman et. al., 2016).

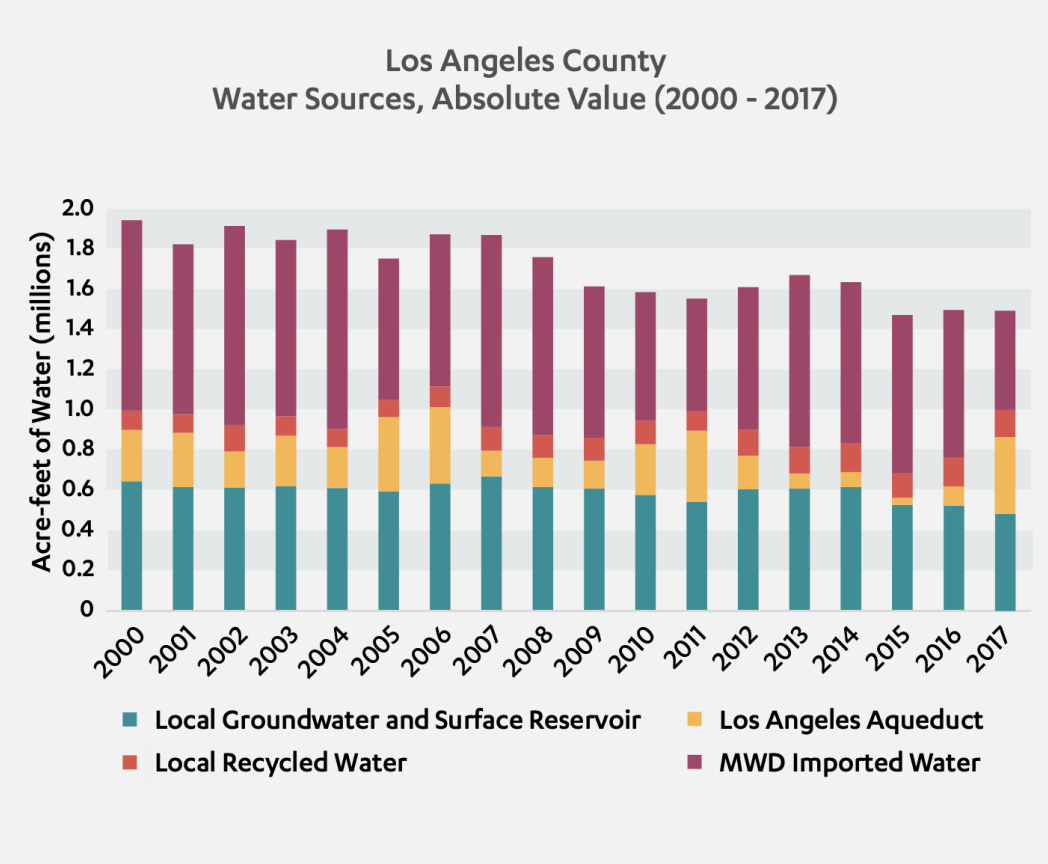
*Reclamation Plants*

Water reclamation plants offer a solution to equalize water use in the sustainability equation. In order for water to be treated so that it is safe to use, and at which point is considered “recycled water” it must go through several stages. The first step of water reclamation is a primary treatment in which water is separated from large particles. Next is secondary treatment, in which “bacteria are added to the wastewater to ingest organic matter” (Ghernaout, 2018, p. 2). Finally, there is a tertiary treatment that filters water to remove any remaining solids, disinfects with chlorine, and removes salts. However, to make recycled water potable, or suitable for consumption, it must undergo a few extra steps. It must further spend time in a reservoir, undergo reverse osmosis, be disinfected by Ultraviolet light, and then added to groundwater reservoirs where it must stay for six months before it is “further purified by natural processes” (Ghernaout, 2018, p. 2). Municipal water constitutes about 10% of water use, however, unlike irrigation and industry, water is not naturally replenished into the water cycle through evaporation or transpiration (Levine & Asano, 2004). Although water reclamation technology exists to treat water to a potable level, it is not being used in practice in most places around the world.

*Water Reclamation Los Angeles*

In Los Angeles, six plants were built by the LA County Sanitation Districts in the early 1960s. There are currently four plants that provide water to the City: Hyperion Water Reclamation Plant (HWRP), Los Angeles Glendale Water Reclamation Plant (LAGWRP), Donald C. Tillman Water Reclamation Plant (DCTWRP), and Terminal Island Water Reclamation Plant (TIWRP) (Mika et. al, 2019). They provide LA County with reclaimed water used primarily for "non-potable reuse for irrigation and for large industrial customers" (Okun, 2000, p. 241). The four water reclamation plants provide water to the city, all of which are used for non-potable practice. After an exceptionally dry year in 2007, Los Angeles embarked on a "visionary plan" championed by then-mayor Antonio Villaraigosa which aimed to develop local water supplies by maximizing water recycling and stormwater capture to reduce demand for imported water in order to secure LA's water supply (Luthy et al., 2020). Figure 1 shows the use of different water sources in Los Angeles County from 2000-2017. However, much of these plans have not resulted in substantial changes.

**Figure 1: Los Angeles Water Sources 2000-2017**




***(Source: Frederico et al., 2019)***

*Water Policy*

The role that water reclamation plays in the United States and Los Angeles is especially shaped by policy and regulation. In 1918, the United States developed its first regulations to address the use of recycled water for agricultural purposes (Olivieri et al., 2020). Over fifty years later, in 1972, the U.S. passed the federal U.S. Clean Water Act to restore and maintain water quality (Metcalf et al., 2007). A decade later, in 1989, the World Health Organization (WHO) published health guidelines for countries that had little to no experience with planned reuse of

wastewater (Metcalf et al., 2007). Despite the strides taken in the last 100 years to promote water reuse, there are currently no federal water quality standards specific to recycled water in the United States (Luthy et al., 2020).

Water quality standards are passed state by state, and in 2017, only 14 states had water reuse policies (Luthy et al., 2020). In California, the Water Conservation Act of 2009 (SB X7-7) established a framework to achieve broad conservation objectives by directing water suppliers to improve water use efficiency, and reduce urban water consumption by 20% in per capita water use by the year 2020 (McCarthy & Dallman, 2019). Historically, many states' water initiatives have been spurred by drought. In Los Angeles, several emergency policies have been passed to manage water during times of drought. The severity of droughts focused the attention of the public on the need for greater sustainability in water use (Luthy et al., 2020). However, when the threat of drought no longer exists, urban water supply agencies are no longer required to comply with strict water conservation standards, and urban water use rises (McCarthy & Dallman, 2019). This proves that any lasting solution will require "bottom-up" in addition to "top-down" reforms, including "an increased awareness of the anthropogenic water cycle and the consequences of the viable water management options to the water cycle" (Bixio et. al, 2008, p. 22).

More recently, Los Angeles County passed $300 million Measure W in 2018 which promises new funding for stormwater capture and water cleaning projects in 2020 (Federico et al., 2019). Measure W is a parcel tax whose revenue will pay for both regional and municipal water projects (Agrawal, 2018). This is a big change in LA County because previous water

projects were dictated by individual cities. This may indicate a possible statewide or nationwide policy change (Federico et al., 2019).

Finally, Los Angeles passed a citywide “Green New Deal” in 2019. The plan establishes the year 2050 as a benchmark for several sustainability goals for the city, including a zero-carbon electricity grid, the creation of 400,000 green jobs, the transfer to emission-free buildings, the phasing out of all single-use takeout containers and plastic straws, and more (LA Mayor, 2019). The plan also aims to achieve 100% recycled wastewater by 2035, plant at least 90,000 trees citywide by 2021, and increase tree canopy in low-income heat impacted areas by at least 50% by 2028 (LA Mayor, 2019). According to Mayor Eric Garcetti, Los Angeles must move ahead with bold climate action, especially because there has not been much federal action (Cowan, 2019). Given the recent 2021 presidential election, an evaluation and critique of federal climate action under the new administration are to be determined.

*World of Water*

Water reclamation is often cited along with several other conservation strategies in the world of water conservation. Alternative water conservation strategies include the process of desalination, in which salt water is treated to be potable. This process is more energy-intensive than imported water and more expensive than alternative methods due to the high cost of emissions in California (Sokolow, 2016). Reliance on groundwater is another suggested solution, however, the source is finite and has issues relating to groundwater contamination. During periods of drought, pollutants in the ground concentrate without natural water replenishment,

posing a health risk for consumers (Sokolow, 2016). One historical conservation strategy has been building pipelines to access water from distant water sources (Hess et al., 2017). The case for rainwater capture and harvest is powerful, according to one scholar “In just one large rainstorm, ten billion gallons of runoff, one-twentieth of our yearly need, end up in the Pacific Ocean” (Murray, 2013, para. 5). However, the technology to capture stormwater in large quantities does not yet exist. Other solutions set forth include water audits, turf replacement, and high-efficiency washers (Maggioni, 2015), as well as accelerating leak repair which would save the government water and money (Lachman et. al., 2016). Within water storage centers, evaporation of water has been a growing concern. To combat this, technologies such as engineered evaporation barriers have been developed such as monomolecular films, plastic covers, and “shade balls” which are spherical plastic balls placed in water storage (Haghighi et al., 2018).

## LITERATURE REVIEW

The following literature review considers how water is used and considered on a global, national, and city-wide scale. It examines policy that has impacted the success of water reclamation, and how social factors such as public perception are currently affecting the expansion of potable treatment processes to wastewater. The review considers how public health and safety concerns are ever-shifting, especially as new diseases and viruses—such as COVID-19—are introduced to water sources. Finally, the review considers the role that economics and costs play in the success of water reclamation.

### *Water Sustainability*

The way in which people consider and use water varies person-to-person but has also been found to vary based on culture as well. One study found that across the globe "two out of ten people do not have access to safe drinking water," and the lack of water access is a global issue (Ghernaout, 2018, p. 1). Meanwhile, the same study found that Americans use up to 90 liters of water daily to flush their toilets (Ghernaout, 2018). As natural water tables are drained and climate change results in more water crises, finding natural water resources will be harder, yet for many who do not see this as an immediate problem, no actions are taken. According to renowned water management expert Daniel A. Okun, in order for water supplies to be sustainable, the rate at which water is withdrawn from water sources needs to be in balance with the rate of renewal or replenishment (2000). Many other scholars and policymakers do not

take the rate of renewal into account when considering water use, but rather focus primarily on immediate water needs.

Precipitation naturally replenishes water supplies, through the process of the water cycle. However, when urbanization, agriculture, dams, and other changes in land use occur, the rate, extent, and spatial distribution of water replenishment are altered. Historically, the water withdrawn for societal needs has not been considered a source in the sustainability equation, however, scholars argue that it is an essential factor and must be recognized (Okun, 2000). In the past decade, it has been established that the United States' old way of coping with water needs — engaging in an overdraft of groundwater, depleting streams, and importing water — is no longer enough to sustain the nation (Luthy et al., 2020). Methods such as water reclamation diversify the country's water supply portfolio, so ratepayers no longer have to rely on old methods that deplete water resources (Luthy et al., 2020). Scholars such as Okun are opening the door to a new understanding of what it means to sustainably use water, for both scholars and the general public.

*Public Perception*

Some scholars argue that Los Angeles is no closer to using reclaimed water for consumptive purposes than it was in the early 2000s, while other scholars argue that California in 2014 marked a turning point in public perception of water use as well as a shift in policy changes. After the 2014 drought in California, in which Governor Jerry Brown declared a state of emergency, public perception of water use shifted. California residents began to realize that

they took water for granted (Storey, 2015). One article published by the New York Times even went so far as to predict “the end of California” (Egan, 2015, para. 1). In 2017, the state of emergency was lifted in California, but the public perception’s shift remained. The Los Angeles Times defined a new concept that emerged around this time, known as “drought shaming.” This term identifies a culture of denunciation for those who use too much water, especially in watering their lawns (LA Times Editorial Board, 2016). In 2015, Mayor Eric Garcetti furthered this narrative with a campaign called “Save the Drop.” This campaign was launched citywide to inform Los Angelenos about the tools available to them for water conservation (LA Mayor, 2015). This shift in public perception was created by extreme weather events, driven by social outrage, and then finally reflected in policy.

According to water-use researcher Standish-Lee, public perception is essential for initiating, implementing, and sustaining long-term reuse programs (1997). One of the major drawbacks of recycling wastewater is the lack of public support. When reclaimed water was marketed to select groups, it suffered “negative branding and [despite more attractive prices] some end users still prefer conventional water” (Bixio et. al, 2008, p. 19). This is because “many people are repelled by the thought of water that’s been in our toilets going to our taps” (Ghernaout, 2018, p. 1). Historically wastewater has been seen as sewage, treated for public health protection, and disposed of. It is only in the past few decades that people have recognized the potential for wastewater as a potable drinking water source (Okun, 2000).

With time and education, public perception can be improved. According to a survey of 3000 participants, it was found that older respondents and those with more knowledge on the topic were more likely to hold favorable attitudes towards using recycled water (Dolnicar et. al,

2011). One study in Australia compared desalinated and reclaimed water and found that people viewed water reclamation as riskier and have more reservations due to disgust factors (Dolnicar & Schäfer, 2006). Another study found that public acceptance of water reclamation differs from community to community and any outreach program must take into account the community which it seeks to address (Bridgman, 2004). This study also found that the strength of public opinion must not be underestimated, and the public is more receptive during times of drought and water scarcity (Bridgeman, 2004). To better understand this public perception, Hartley published a study that determined which factors influenced the public perception of water reuse (2006). U.S. public perception of water reuse was found to be higher when protection of public health, protection of environment, and the benefits of water reuse are clear to individuals. Furthermore, perception was found to be improved when the cost was reasonable, awareness of water supply problems was high, the role of reclaimed water in water supply schemes was clear, perception of quality was high, and when there was high confidence in local management and public utilities (Hartley, 2006). Similar to the response to watering lawns during the 2014 drought in Los Angeles, water reclamation's success and ability to be reflected in public policy is largely influenced by public support.

*Conditions for Conservation*

As climate change worsens, the population grows, and natural water sources deplete, policy changes will be necessary to keep the United States hydrated. There are many differing opinions as to what conditions and what measures will be required for drastic changes. Palazzo

et al. argue that one of the greater conservation methods will require coordination between water districts (2017). Gilligan et al. argue that water conservation policy is most strongly influenced by the characteristics of the city and state, as well as environmental and societal factors (2018). Gilligan et al. further found that predominantly Democratic cities tend to adopt more conservative water policy as opposed to Republican cities (2018). Much of the current research on Los Angeles' water conservation policy reveals that there is a need for more data collection. Manago & Hogue conducted an analysis that found that streamflow records can be used to determine the effectiveness of upstream conservation methods (2017). Manago & Hogue argued for monitoring points along streams to collect data on both pre-conservation and post-conservation efforts, to determine the efficacy of methods as grounding for policy changes (2017).

*Safety and Health Impacts*

Water reclamation systems can have a range of impacts on the community in which they exist. This includes aesthetic, sociocultural, physical, environmental, sensory, and health and safety impacts (Metcalf et al., 2007). One prominent safety concern is that new types of chemicals are constantly being introduced into the waste stream and so water reclamation must constantly address new Contaminants of Emerging Concern (CECs) (Levine & Asano, 2004). One study found that the safety of reclaimed water could be improved and that the neglect of micropollutant impact on human health is due to the difficulty in detecting micropollutants (Ma et al., 2018). These micropollutants, such as bacterial and viral pathogens, are safety concerns

(Ma et al., 2018). The researcher recommended the introduction of an "ecological unit into the water reclamation and reuse system" as a way to measure health risk reduction posed by micropollutants (Ma et al., 2018, p.2). In contrast, a study published based on pre-existing health impact assessments found that expansion of recycled water programs in California would be effective and result in various health benefits (Sokolow et al., 2016).

*Unknown Effects of COVID-19*

Due to the concern over the treatment of viral pathogens in wastewater, COVID-19 poses a new health and safety risk for the water supply and sanitation sector (van der Voorn et al., 2020). One researcher suspected that the COVID-19 virus could be spread in wastewater (Daughton, 2020). In the Navajo Nation, a lack of clean water is resulting in high COVID-19 infection rates (Hansman, 2020). Another researcher found that the lack of clean water access is tied to federal neglect and exclusion, as well as an overallocation of western water amongst a shrinking water supply (Hansman, 2020). However, one experiment conducted within reclamation plants in Spain found that there was a presence of COVID-19 in two out of 18 secondary-treated water samples, and a lack of COVID-19 in any tertiary-treated water samples (Randazzo et al., 2020). It was further found that the risk of spread of COVID-19 is more prevalent in the wastewater of low-income countries, which have poor sanitation and wastewater management policies (Adelodun et al., 2020).

*Market Attractiveness*

The final piece of the puzzle in terms of challenges posed to the success of water reclamation is its rising cost. Costs involved in reclamation include capital costs such as equipment, construction, design, engineering; operating costs such as salary cost for operations and maintenance staff, technical staff, utility costs, chemical costs, carbon regeneration, chlorination, injection, and more (Argo, 1980). The costs of sourcing, supplying, treating, and disposing of wastewater have all been steadily escalating (Bixio et. al, 2008). However, in comparison to desalination, water is more economically attractive (Ghernaout, 2018). One researcher pointed out that "nobody pays the true cost for the water resources" and as a result, the "bankability of water reuse projects is generally low" (Bixio et. al, 2008, p. 20). Water reuse projects require a large upfront capital investment and require years of development before long-term economic, social, and environmental benefits occur (Bixio et. al, 2008). Many efforts to switch from conventional water sources to reclaimed wastewater are primarily thwarted by cost arguments (Bixio et. al, 2008). However, the importance of cost is also debated. For some, water is considered a necessity to survive and is worth any value to ensure long-term sustainability, and for others abundance in the present is prioritized over longevity in the future.

## METHODS

This paper answers the question: What role does water reclamation play in Los Angeles' water infrastructure? I set out to address my research question through qualitative methods, including semi-structured interviewing. I interviewed ten knowledgeable participants on water reclamation, including members of three groups: (1) experts (2) nonprofit workers (3) government workers. These three groups were utilized to address a spectrum of perspectives on water sustainability and water reclamation in Los Angeles. I reached out to these participants in a number of ways, using public resources and contact information found online and over the phone, going through professors and mutual connections, as well as reaching out via email and social media.

I asked each interviewee an array of questions that attempted to understand how water reclamation functions in the current water conservation landscape in Los Angeles, the positive and negative effects of reclamation, progress on city-wide goals, and challenges to the success of water reclamation. The full list of interview questions can be found at the end of this paper *(see Appendix I)*.

After reviewing the interviews, I compiled all of the raw data and coded the interviewees' responses on the different perceived roles of water reclamation in Los Angeles, outlook on the future of water conservation and reclamation, largest perceived challenges, the impact of COVID-19 on the city's water recycling goals, and proposed solutions. I then analyzed to identify themes among the interviewee groups.

In addition to the interviews, I conducted a thorough literary and policy analysis to landscape the current role of water reclamation in academic literature, in community forums, popular news publications, and more. I utilized a literary landscape to gain insight into the differing scholarly views on water reclamation, public perception, conservation policy, safety, and health factors, and market attractiveness to inform my research and to consider the role that water reclamation plays as compared to other drought protection and water conservation methods.

Originally this research intended to include a site visit and tour of a water reclamation facility, however, due to restrictions imposed for public health and safety surrounding the COVID-19 pandemic, this could not be completed.

## FINDINGS

The ten interviews took place during the months of December 2020 and January 2021. All of the interviews were conducted virtually. Interviewees included members of three groups: (1) experts (2) nonprofit workers (3) government workers *(see Table I*). The following four themes were identified as a result of the interviews: *Education and Communication Will Enable Success of Reclamation Projects, LA is Among Global Leaders by Default Due to Scale and Scope, Cost as the Most Pressing Challenge, and It's Unclear How COVID-19 Will Impact Water Reclamation Advancements.*

The consensus among the interviewees is that water reclamation should play an increasingly large role in Los Angeles' water policy and management. All of the interviewees stated that they believe water reclamation advances sustainability. As one nonprofit worker put it, water reclamation is "the single most important thing we can do [to advance sustainability in LA]." However, the level of satisfaction with the progress made thus far varied and resulted in mixed responses to the role that water treatment currently plays in Los Angeles *(see Appendix II)*.

As the following themes explore, there are a variety of opinions on actions that need to be taken for water reclamation to fill its potential, yet it is undeniable that water reclamation is a powerful tool for water conservation and Los Angeles has achieved some major accomplishments in the past few years.

**Table I: Interviewees**

| *(1) Experts* | *(2) Nonprofit Workers* | *(3) Government Workers* |
|---|---|---|
| Author and LA Times Writer | Watershed Coordinator at the Council for Watershed Health | Division Manager of the Water Recycling Implementation Division in LA Sanitation and Environment |
| UCLA Grand Challenge Director | Sierra Club Angeles Chapter Water Committee Chair | Technical Services Department Reuse And Compliance Section Supervising Engineer at Los Angeles County Sanitation District |
| The Mono Lake Committee's former Executive Director | Senior Attorney at Los Angeles Waterkeepers | Senior Water Infrastructure Specialist at the Mayor's Office of City Services |
| | | Program Manager of Operation NEXT - Water Supply Program Water Resources Division |

*Education and Communication Will Enable Success of Reclamation Projects*

During the interviews, eight participants discussed the need for greater education of the public in order for water reclamation to continue to progress in Los Angeles *(see Appendix II)*. Ratepayers and residents need to be educated on the process and importance of water reclamation so that they will utilize the water when it is eventually piped into their homes. Furthermore, there is the issue of trust in the cleanliness and hygiene of LA's water supplies. As one interviewee pointed out, "issues with water and equity… come from government mistrust. There are some industries that feed into that mistrust to sell water."

Several interviewees specifically cited miseducation of the public as a challenge, due to the lasting impacts of campaigns and phrases used to describe water reclamation which reduce the extensive process of water reclamation down to one slogan, and illicit noxious images. Examples of stigmatized language include “toilet-to-tap,” “showers to flowers,” and “flange to flange.” These terms mislead the public to believe that reclaimed water has not been treated sufficiently, when in fact technology has allowed plants to clean water to a perfect standard. Public education can be a powerful tool, especially in order to “change [individual’s] habits,” as one nonprofit worker states. Education can also prove to ratepayers and residents that water reclamation will improve their lives, by reducing costs, saving scarce environmental resources, and creating a store of water in preparation for the next drought.

Nearly every interviewee cited education as a solution to enable the success of water reclamation in the public image, but none of them discussed campaigns or initiatives that are currently implementing this education. One government interviewee states “A lot of [agencies] have public information or public relations committees” and dedicated jobs to disseminate knowledge to the public. Many of the interviewees themselves are part of organizations and government branches whose job is to ensure the success of water reclamation and expansion of Los Angeles, yet one of the most prominent concerns has not yet been addressed.

*LA is Among Global Leaders by Default Due to Scale and Scope*

To understand the role that water reclamation plays in Los Angeles’ water infrastructure, it is necessary to determine the role that water reclamation in LA plays in the world at large. When asked where LA sits on a global stage of water recyclers, the results were split. All four of

the government workers and one nonprofit worker viewed Los Angeles as an “example” and role model for other countries and cities. Meanwhile, the experts and nonprofit workers viewed the current role of water reclamation in LA to be minor compared to other cities.

Los Angeles’ water recycling goals are among the most ambitious of all cities in the world, with the city-wide goal to recycle all wastewater by 2035. One government worker acknowledges that “[Los Angeles] is not paving a new technology or innovating the technology. What's innovative is the scale.” Despite the large scale, the rhetoric amongst some interviewees revealed that they believed the global role to be minor. Perhaps this is due to the fact, as one expert put it “[water reclamation] has been happening since there were cavemen.” Water reclamation technology isn’t new, yet it has been slow to gain widespread traction. The expert continues, “we have a greater need for finding new sources of freshwater and local sources of freshwater.” The responses from the expert and nonprofit workers reflect a frustration with the slow pace that it has taken for the government to take advantage of water reclamation technology.

One of the nonprofit workers voiced their frustration with the lack of measures taken by the government to support water reclamation, and said “[we need] the right legal structures in place… the regulations to allow potable reuse aren't there yet, so it would be technically illegal to do it today.” Although the city of Los Angeles has public goals to conduct potable reuse, they have not yet passed the policy to allow so. Another nonprofit worker stated that the lack of communication between government agencies is “frustrating, because everyone is starting to do the right thing, but not always in an entirely compatible way.”

Los Angeles is considered to many as an "example" for other cities and countries seeking to recycle water. However, LA's slow transition and lack of legal organization disillusions some as to the revolutionary aspect of its reclamation progress. The truth is, LA plays a large role in the global stage of water recyclers because they have a greater need for water.

*Cost as the Most Pressing Challenge*

All of the interviewees discussed a score of challenges that inhibit the growth, expansion, and success of water reclamation projects in Los Angeles. These challenges include lack of communication, organization, education, a need for stronger public policy, public acceptance, technological improvements, and more. However, the most prominent challenge disclosed in the success of water reclamation was the challenge of cost; more specifically, high costs associated with water reclamation.

This challenge proves to be especially difficult because there are costs associated with nearly every aspect of the water reclamation process. This includes capital investment, cost of energy, cost of disposal, cost of constructing new city pipe networks, associated infrastructure costs, costs of operation, costs of maintenance, cost of education and communications, and more.

This challenge has the potential of slowing and even stopping the advancement of water reclamation. One government interviewee stated, "the costs of [water treatment] are something that [will] slow us down in implementing the program." The costs associated will require the government and ratepayers to spend more money. One expert argues that ratepayers *need* to spend more money on water. "The water bills are too low. We need to pay

more for water. The cell phone that I am talking to you on cost me less than the water bill." Many people consider access to water as a right and not a privilege. In reality, it is a commodity, whose price will shift depending on supply and demand. A low water bill may result in overexploitation of the resource, which will reduce supply and raise prices in the long run.

It is a challenge to convince policymakers and ratepayers that water reclamation is worth the cost. Ratepayers want to spend less money, however advances in water infrastructure will result in cost-reduction in the long term. As one government worker says, the investment in water structure will be paid back over time. He explains that Los Angeles uses more water than is available in the region, which results in exorbitant costs from importing water, and costs associated with environmental and ecosystem damage.

The interviewees, from their varying backgrounds and viewpoints, all agree that high costs are the most pressing challenge in advancing water reclamation, but also that there is hope given recent city-wide progress.

*It's Unclear How COVID-19 Will Impact Water Reclamation Advancements*

Many of the interviewees were uncertain of how the unprecedented COVID-19 pandemic would affect progress on Los Angeles' water reclamation goals over the next few months and years. One thing however was unanimous; COVID-19 is not a threat in wastewater. Experts, nonprofit workers, and government workers all agreed that wastewater treatment plants, even those with lower classifications of treatment, successfully remove COVID-19 from waste streams. One government worker summarized it well, "the technology is there to make

[water] as clean as you want it to be." However, this does outline a significant challenge in water treatment and engineering of Contaminants of Emerging Concern (CECs). As one government worker pointed out, CECs "are forever chemicals and pretty much ubiquitous." Although COVID-19 is not particularly dangerous in wastewater, the potential for contamination exists and the need to constantly update wastewater engineering and technology.

For the most part, the interviewees agreed that the pandemic has not affected work at or on wastewater treatment in LA. As one nonprofit worker said, "Board meetings haven't stopped, presentations haven't stopped." Based on the experiences of the ten interviewees, work has not halted or slowed down due to the pandemic, and the transition to virtual management has gone seamlessly. As one expert said, "I don't really feel like COVID has slowed [progress] down much. Because we are in the first year of a fifteen-year march towards this goal." The expert is referring to the city of Los Angeles' goal to recycle 100% of wastewater by 2035.

Although planning efforts have not been interrupted by the pandemic, certain operations have been stalled. This is especially true for neighborhood and community outreach. As one nonprofit worker pointed out, "A lot of [government] projects require community engagement and we haven't been able to do that. There's a lack of community input. Meetings are stalled, there's project delay." With quarantines and public health risks associated with in-person gatherings, there have been few opportunities for community participation in the planning process.

Additionally, water reclamation technology has proved to be an unanticipated tool in tracking COVID-19 outbreaks. As one nonprofit worker points out, "You can track certain

diseases, like COVID-19. Right now, they can tell where the hotspots are." Through testing the water for contaminants, scientists can track outbreaks of the virus.

As the interviewees revealed, there are roadblocks to the success of water reclamation, including miseducation, lack of communication, lack of funding, lack of community input, and the constant evolution of CECs and bacteria. However, in the eyes of the interviewees, these challenges do not diminish LA's achievements in water reclamation nor the necessity for water reclamation as a water conservation tool.

## POLICY RECOMMENDATIONS

The data collected in this paper and the findings from the interviews have pointed to several salient policy recommendations that would aid to maximize the role of water reclamation in Los Angeles' water infrastructure going forward. This includes the recommendation to *Deploy A Wide Scale Educational Campaign*, *Invest in Water Treatment and Infrastructure, Create an Interagency Task Force,* and *Adopt Integrated Water Management.*

*1. Deploy A Wide Scale Educational Campaign*

As identified by the interviews with experts, nonprofit, and government workers, education of the general public on water treatment is a necessity in order for water reclamation to continue to progress in Los Angeles. The public will be more receptive and responsive to water reclamation innovations, when they understand the science behind the processes. This education campaign should include information on the safety procedures and technologies that are in place at water reclamation plants, as well as relevant updates and advancements. This could be achieved through a mechanism of a citywide campaign, and the use of billboards and media education tools. This could alternatively be achieved through an informational flier sent out with the water bill every month to ratepayers. Another possible outreach method is through social media, and infiltration into entertainment. This can help to familiarize the public with water reclamation as a conservation method and break down the stigma associated with reclamation. Furthermore, the educational campaign should be accessible and apprehensible, and should not include acronyms or complex language. It is important to get community input

throughout the education process, and all efforts should involve collaboration with environmental, citizen, and social groups.

*2. Invest in Water Treatment and Infrastructure for Longevity*

In order to implement water reclamation as a long-term pillar of water conservation in Los Angeles, several investments need to be made in order to ensure infrastructural and technological longevity. This includes investment in the development and implementation of water treatment technology, specifically that to treat water to a potable level through tertiary water treatment, reverse osmosis, and Ultraviolet light disinfection. These treatment methods allow water to be consumable, and thus marks a significant benchmark in achieving 100% locally sourced water in Los Angeles. There also needs to be funding policies to build a new system of pipes for potable water transportation and discharge. Investment in infrastructure will allow for a smoother and quicker transition from existing water piping networks, once treated potable water dissemination is approved. Furthermore, there needs to be a significant investment of funds to continually monitor for Contaminants of Emerging Concern (CECs). CECs are constantly emerging in water sources, and will require testing and may require further treatment.

*3. Create an Interagency Task Force to Improve Communication*

The interviews revealed that a lack of communication between government agencies has hindered progress on city-wide reclamation goals. This could be improved through the implementation of an interagency task force, whose primary objective is to improve

communication between water agencies. This task force will ensure that coexisting efforts are compatible with each other. This task force should also dedicate efforts to communicating with nonprofit organizations and the general public to avoid confusion or misinformation. This is dually important for promoting public education and knowledge on water reclamation advancements. Furthermore, an interagency task force can help circulate knowledge between agencies and organizations, to avoid challenges, pitfalls, or miscalculations. An interagency task force will improve efficiency within and amidst water management interests and organizations.

*4. Adopt Integrated Water Management for Best Water Conservation Outcomes*

Finally, water reclamation has the best chance of success if it is promoted through measures of integrated water management. Water reclamation has a higher chance of achieving 100% locally sourced water in Los Angeles if it is used in combination with other water conservation methods. This may include advancement and investment in stormwater capture policies, such as that of Measure W. Water reclamation may also have a higher chance of success if water is considered at a higher valuation by ratepayers, perhaps through price signals, in which increased water rates incentivize people to use less and may limit unnecessary use of water. However if a method like this is utilized, it would be important to consider a sliding scale for water payment, so that access to water is equitable. Furthermore, the passage of legislation and regulations can promote water conservation, for example limits on construction of buildings in fire zones or limits on how many permits are allocated for water extraction. Water reclamation is part of a larger issue of water scarcity, and it is essential to consider a large variety of water conservation methods when considering water reclamation.

Many actions need to be taken, on individual, state, and federal levels. In addition to a need for education, investment, an interagency task force, and integrated water management, water reclamation needs individual accountability and the prioritization of conservation. A wide-scale education campaign provides the opportunity to create a positive impact on public perception, investment in water treatment provides a stable foundation of infrastructure to build on in order to create an abiding system of reclamation, and an interagency task force will aid to improve communication between water agencies and interests. Utilized in tandem, these tools will improve water conservation and will be further strengthened by integrated water management. With these changes, there is hope for an enduring system of water reclamation in Los Angeles that will maintain the city's status as a global leader and drastically improve water sustainability.

## CONCLUSIONS

This paper demystified the role that water reclamation plays in Los Angeles' water infrastructure. As the interviews and literature review uncovered, water reclamation has great potential in Los Angeles as a water conservation method, but its level of success is not currently universally agreed upon. Based on the roles that different water conservationists play, and the sectors that they work in, the perspectives on the role that water reclamation plays in Los Angeles differ. A large part of water reclamation's success hinges on the ability of the city to organize, communicate, educate the public, invest in technology and infrastructure, and pass supportive legislation.

There are many potential avenues for further research, especially concerning the role that the community and general public play in water reclamation's success. Further research could look specifically at COVID-19 in water supplies and its impact on public perception, and its impact on Los Angeles' water recycling goals. One unexpected finding was a lack of communication between water conservation and management agencies and organizations. Further research could delve into that communication gap, and investigate why it exists and how pervasive of an issue it is.

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## APPENDICES

*Appendix I: Intensive Interview Guide*

1. What is ____ organization?
    a. PROBE: What is your role in _____ organization?
    b. PROBE: What actions does _____ take to increase LA's water self-sufficiency?
2. What does sustainability mean to you?
    a. PROBE: How does water reclamation advance sustainability?
3. What do you believe the role of water reclamation is in Los Angeles' water infrastructure?
    a. PROBE: Worldwide?
    b. PROBE: How does that change between LA and the world at large?
4. How do you think the public would react to the implementation of recycled water into major water sources?
    a. PROBE: How can this reaction be altered?
    b. PROBE: What plays a role in how these views are formed?
5. What challenges does water reclamation face?
    a. PROBE: How can these challenges be solved?
    b. PROBE: How big of a problem do these challenges pose?
6. What do you consider to be the positive effects of water reclamation?
7. What do you consider to be negative effects of water reclamation?
8. Mayor Garcetti said LA will recycle 100% of the city's wastewater by 2035. How is progress going on this goal?
    a. PROBE: How has COVID-19 impacted this goal?
    b. PROBE: What needs to be done to help Los Angeles achieve its goal of 100% recycled wastewater?
9. What policies exist that empower/deny progress of Los Angeles's 100% recycled wastewater goal?
10. What will society look like if we continue with water use as-is?

<u>IF TIME PERMITTING:</u>

11. Which method of water conservation do you believe best helps Los Angeles achieve its goal of 100% recycled wastewater?
    a. PROBE: Why?
12. Are you familiar with the Sustainable LA Grand Challenge?
    a. How is progress going on LA's Grand Challenge which aims to achieve a 100% local water supply?

*Appendix II: Summarized Interviewee Data*

## Table II: Summarized Interviewee Data

| Theme | Expert 1 | Expert 2 | Expert 3 | Nonprofit 1 | Nonprofit 2 | Nonprofit 3 | Government 1 | Government 2 | Government 3 | Government 4 |
|---|---|---|---|---|---|---|---|---|---|---|
| Had an optimistic view of the future in if we continue on with water use as is. | x | | | | | | x | x | x | |
| Had a pessimistic view of the future in if we continue on with water use as is. | | x | x | x | x | x | | | | x |
| Believes water reclamation currently plays a major role in water infrastructure. | | x | | x | | x | | x | | x |
| Believes water reclamation currently plays a minor role in water infrastructure. | | | | | x | | | | | |
| Believes water reclamation has the potential to play a major role. | x | | x | | | | x | | x | |
| Cites cost as the most pressing challenge. | x | | x | x | | x | x | | | x |
| Cites public policy as most pressing challenge. | | | | | x | | | x | | |
| Cites public acceptance as most pressing challenge | | x | | | | | | | | |
| Cites CECs or treatment technicalities as most pressing challenge. | | | x | | | x | | | x | |
| Believes communication between orgs need to improve, esp through integrated water management. | | | | | x | | | x | x | x |
| Believes covid will not impact water recycling goals. | | x | | | x | x | | x | | x |
| Believes in need for greater education of the public. | x | x | x | x | x | x | | | x | x |
| Believes that water reclamation will advance sustainabililty. | x | x | x | x | x | x | x | x | x | x |