The Role of Institutions of Higher Education in Water Conservation in Los Angeles

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Executive Summary

With the current drought conditions in California, water purveyors throughout the state have been forced to reduce their water use and cut back on water consumption. Mandates have been placed on water consumption and if reduction targets are not reached, penalties can be issued. Los Angeles must cut down its water consumption by 16% in the next year, and the way the mandates are written a majority of the responsibility falls to water supply agencies to enforce these goals and meet these targets.

In response water agencies have implemented water conservation strategies and offered incentives to encourage water conservation. However, most of these strategies, that include incentive programs and rebates, appear targeted towards residents. Little is said about the rebate and incentive programs that are geared towards institutional consumers of water. Institutions fall under the category of commercial consumers for many water purveyors. These consumers on average consume 30% of the water used by the Los Angeles Water and Power. This study looks to answer the question: how does the Los Angeles Department of Water and Power target institutions of higher education, in their plan to conserve water and their water conservation incentive programs? It looks to expand on this question by asking how institutions interact with these incentive and conservation programs? The study is focused on the Los Angeles Department of Water and Power because this entity manages the account for Occidental College, which was the inspiration for this study. It also looks at Pasadena Water and Power to provide a point of comparison.

To answer this question both quantitative and qualitative data was collected. Quantitative data was collected from pre-existing documents. These documents were collected from the Los Angeles Department of Water and Power website and the Pasadena Water and Power website. They were used to analyze the incentive programs offered by these two water purveyors. Then, four semi-structured interviews were conducted. Two employees of Occidental College, one employee of the University of California Los Angeles, and one employee of the Huntington Gardens were interviewed. These individuals were chosen based on their involvement in sustainability and water use in the institution. They were interviewed to better understand the way these institutions interacted with the incentive and rebate programs offered by the water agencies that presided over them.

The study was able to conclude that institutions are targeted by incentives and rebates because the Metropolitan Water District, and by default the Los Angeles Department of Water and Power, and the Pasadena Water and Power Company, do have incentives that are aimed at institutions of higher education. However, these rebate programs may not be completely sufficient to fund the types of projects that these institutions may be doing. Out of these rebate programs, turf removal incentives and rebates specifically were found to be the applicable to institutions. Furthermore, it was apparent that the institutions studied, are committed to water conservation, so the drought and the guidelines provided by the Los Angeles Department of Water and Power and Pasadena Water and Power only gave institutions a sense of urgency and further commitment. These institutions feel that it takes both infrastructural projects as well as education campaigns to make a real difference on water use, which is why the incentives and rebates issued by water purveyors are not necessarily the most effective. Finally, institutions feel their role in water conservation is to act as both a model and as a think tank for sustainable practices.

Introduction

Many regions in the United States have been forced to improve water management due to drought and water shortages. California has been in a serious drought for over four years, this being the most severe drought in the last 1,200 years. The drought is exceptionally severe due to reduced precipitation and record high temperatures (Griffin and Anchukaitis 2014). In response, California Governor Jerry Brown has placed mandates on the state to cut back water use. If reduction targets are not reached, penalties are issued. In Los Angeles, the Los Angeles Department of Water and Power (LADWP) must cut down its water consumption by 16% in the next year. As the mandates are written, a majority of the responsibility falls to water agencies like the Los Angeles Department of Water and Power, as they are the ones penalized if the goals are not met.

As a result, these water agencies have taken steps to implement water conservation strategies and incentives to encourage water conservation. For the LADWP, most of the strategies and incentives implemented are aimed towards residents of the city. However, residents are not the only consumers of water. Los Angeles is home to numerous institutions of higher education that utilize a tremendous amount of water. By not explicitly targeting these institutions the LADWP could be overlooking very important partners in sustainability. Campus landscapes, if correctly landscaped, can serve as laboratories for conserving water and engaging in sustainable design and practices (Way et al. 2012). Furthermore, because these institutions often have ties to the community, they can serve as examples of water conservation in their regions. If correctly incentivized and prompted, these conservation actions of these institutions could influence the actions of the residents in communities in which they are located.

However, as stated, there appear to be limited incentives aimed towards college campuses to encourage sustainable practices. This study aims to answer the question: how does the Los Angeles Department of Water and Power target institutions of higher education, in their plan to conserve water and their water conservation incentive programs? It looks to expand on this question by asking how institutions interact with these incentive and conservation programs? This is an important question as the drought continues to cause adverse affects to communities in Los Angeles. It is important to know how much water these institutions are using to see if they should be more outwardly included in the conservation incentive programs of the city. Furthermore, if college campuses could be utilized as conservation figureheads in their regions, they could have tremendous impacts on the community sustainability efforts.

Background Information

Occidental College and the Los Angeles Drought

Occidental College is a private liberal arts college located in Eagle Rock, Los Angeles, California. It was founded in 1887 by members of the Presbyterian Church and is one of the oldest liberal arts colleges on the West Coast. The campus is built on a hillside and covers over 120 acres. There are thirteen residential halls, two campus-dining facilities, one campus coffee shop and five academic buildings. It is home to about 2,100 students, with approximately 169 academic staff.

Being located in California, the College is subject to the issues the state faces. Currently these include climate change, a decline in freshwater resources and low water supplies (Griffin and Anchukaitis 2014). California Governor Jerry Brown issued an executive order in January 2014 for cities and towns to significantly cut water use as a response to a fourth year of drought. Consequently the Los Angeles Department of Water and Power must cut its consumption by

16% and state wide there must be an overall drop of 25%. If the LADWP does not meet this water use reduction target it may be subject to fines from the State Water Resources Control Board of up to $10,000 a day. These penalties can also impact LADWP customers (LADWP 2015). To keep track of this water use, the LADWP tracks the city's water consumption each week and records it, publishing it to show whether the states mandate has been met. These restrictions are severe to reflect the severity of the drought. The four-year drought surpasses the historic 1976-1977 and 1980 droughts. It is one of the most arid cases in at least 1,200 years (Griffin and Anchukaitis 2014). The intensity of the drought is a result of low water precipitation and record high temperatures. While a return to normal rainfall or an El Nino event, which could be seen this fall, could help mitigate the symptoms of the drought, the drier and hotter climate that has been projected for California will further expedite the drought. Consequently, Occidental had incorporated water mitigation into many of its current goals and projects.

Within the past year, Occidental has made changes to make sustainability part of the campus. The school notes that irrigation accounts for 60% of their water use and domestic use accounts for the other 40%, so the school targeted both sectors in its attempts to mitigate their water use. In 2014, the school went through a High Efficiency Plumbing Retrofit and installed low-flow toilets and urinals into many of the dorms and academic buildings on campus. These low-flow restrooms are projected to reduce annual consumption by over 3 million gallons per year, which translates to a 6% reduction in campus water use. High efficiency shower heads were also installed that use only 1.5 gallons per minute. The showerheads are projected to reduce water used by showers by 40% (Occidental College).

The college is also working to reduce their landscaping water use. Outdoor irrigation schedules were changed to abide to the drought regulations issued by the LADWP and the school

cut back the frequency and the length of landscaping watering by 30%. To better understand their water use, Occidental is running a pilot project at the Admissions building and the Urban and Environmental Policy Institute with new irrigation controllers and flow sensors that can provide detailed data on water use. Furthermore, recently installed high-efficiency cooler towers in the schools chiller plant will reduce water use and the fountains on the campus are periodically shut off and emptied. With these provisions, the school cut back its water use by 19%, from 91.7 million gallons in 2009 to 78.4 million gallons in 2014 (Veitch 2015).

The school also has sustainable projects in the works for the coming years. Occidental is working on a Landscape Master plan with VanAtta Associates Inc. that incorporates sustainable landscaping practices and water management. They are looking to strengthen the existing sustainable landscaping programs, and work with faculty and the Board of Trustees to amend existing campus goals and initiatives. They planning to formulate a Storm Water Management Concept Plan, which would call for the installation of water permeable pavement and bioswale drainages, to create new open green spaces like courtyard and outdoor classrooms, and to plant native trees that will help the school cut down on water usage. These projects are scheduled for implementation in the coming academic school year to continue to reduce water use on Occidentals campus. However, there are no details in these plans that clearly state what they would achieve and how they would be implemented.

Despite these changes that the school on paper claims to have made, students feel the campus physically appears unchanged in the drought. Admittedly most of these changes the school has made cannot be seen, they lie under the radar of most students on campus. However what all students do see is that many lawns are still quite green and there are numerous plantings not native to California's arid climate still present on the campus. It is difficult to gage how the

school compares to other schools of its kind given that campuses are seemingly over looked the conversation about water conservation. In attempts to provide points of comparison, the University of California Los Angeles and the Huntington Gardens were studied in addition to Occidental College. They are not the main focus of this study but a brief look at these institutions will be given.

The University of California Los Angeles is a public college in Los Angeles California. It houses approximately 43,301 students, but under and postgraduates and has about 4,016 academic staff. Its policy target is to see a 20% reduction in potable water use per capita by 2020. Unlike Occidental, UCLA has a clear goal of how much water they on their own are looking to conserve. They school's conservation efforts have reduced annual water use by over 70 million gallons since 2000.

The Huntington Garden is not an institution of higher education. It is a private, nonprofit botanical garden located in Pasadena, California. This institution was chosen because it lies within the jurisdiction of the PWP. Despite not fitting the criteria as a college or university, it too serves as an example for its visitors.

Water in Los Angeles: The Department of Water and Power

The Los Angeles Department of Water and Power (LADWP 2015), is the largest municipal water and power utility in the nation. It provides services to approximately 3.9 million residents and businesses in the Los Angeles area, and serves 469 square miles. 70% of LADWP's demand for water comes from residential customers. To break down this 70 percent, 38% of this residential demand comes from single-family homes, 32% comes from multi-family residents and 30% comes from commercial, industrial or institutional customers (Blanco et al. 2012).

Present Sources of Water

Today, Los Angeles and the Department of Water and Power import approximately 74% of its water supply. The LADWP utilizes water from the Los Angeles Aqueducts, and local groundwater, and supplements this supply with water purchased from the Metropolitan Water District of Southern California (Blanco et al. 2012). The official report states that LADWP acquires 34% of their water from the LA Aqueduct, 53% from its purchases from the Metropolitan Water District, 12% from groundwater and 1% from recycled water (LADWP 2015).

The Los Angeles Aqueduct

The Los Angeles Aqueduct is one of the oldest sources of water in Los Angeles. It was established after a drought struck the city in the 1990's, forcing the city to search for a more reliable source of water than the Los Angeles River. William Mulholland, the director of the Los Angeles Department of Water and Power at the time, was sent to search for water sources to meet the city's needs. He saw the Owens Valley region to be a potential solution (History 2015) and a route was planned that would become what today is known as the Los Angeles Aqueduct. It spanned from the Owens River in Owens Valley, into the San Fernando Valley, which is 223 miles. It was completed in 1913. However, this route was also deemed an insufficient supply of water.

In response, the Mono Basin Extension was started in 1930, which would obtain a larger and more dependable flow of water for the aqueduct. This is a 105-mile extension and takes flows from Rush Creek, Lee Vining Creek, Walker and Parker Creeks, and diverts them towards Los Angeles. This extension had tremendous impacts on Mono Lake because it diverted the water that would have flowed into it elsewhere. Thus, in the 1970's, the City found it could not

divert the full amount that it had been authorized in 1940 because of the tremendous impacts it was having on the environment.

As a result, the Second Los Angles Aqueduct began to be constructed in 1965. This aqueduct was designed to be 137 miles long and flow from the Merrit Diversion Structure at the junction of the North and South Haiwee Reservoirs and runs parallel to the first aqueduct. It connects with the first aqueduct at the North Portal of the Elizabeth Tunnel near the Fairmont Reservoir. When this extension was completed in 1970, it spanned a total of 137 miles (History 2015).

The Metropolitan Water District

The Metropolitan Water District of Southern California is meant to provide a supply of water for domestic and municipal uses to its member agencies. It serves all of its twenty-six member agencies, which includes fourteen cities, eleven municipal water districts and one county authority, as a water wholesaler. The Los Angeles DWP is a member agency and relies on water purchased from the MWD to meet its water supply requirements not otherwise met from its other sources (LADWP 2015). The two major sources of water for the MWD is the State Water Project, which is owned by the state and operated by the California Department of Water Resources and The Colorado River Aqueduct (Blanco 2012) The project transports Feather River Water stored in and released from the Oroville Dam and unregulated flows diverted from the San Francisco Bay and Sacramento-San Joaquin River Delta south via the California Aqueduct to delivery points near the northern and eastern boundaries of MWD's service area (LADWP 2015). The Colorado River Aqueduct was established in 1928, and was MWD's original source of water. It now transports water 242 miles from the Colorado River to Lake Mathews in Riverside County.

Groundwater

As stated, groundwater accounts for about 30% of the City's water supply during the recent drought years, and over the last ten years it has provided nearly 30% of the total water supply. The LADWP has water rights to five local groundwater basins: San Fernando, Sylmar, Eagle Rock, Central and West Cost. The San Fernando Groundwater Basin accounts for 80% of this supply. The LADWP plans on gradually increasing investments and focusing on projects that increase groundwater recharge and well production (LADWP 2015).

Recycled Water

As the water crisis continues, and Los Angeles's imported water supply becomes critical, the need to expand local and sustainable water resources rises. Water recycling is an economically feasible and an environmentally sensitive method of doing this. The recycling programs treat wastewater, which can then be used for irrigation, industrial purposes and groundwater replenishment. The LADWP aims to increase the total amount of recycled water to 59,000 acre-feet per year by 2035 (LADWP 2015).

Pasadena Water and Power

Pasadena Water and Power (PWP) is another water purveyor that is studied in this paper, however it is not the main focus. It was included to account for the water purveyor that the Huntington Gardens is supplied by. Pasadena Water and Power supplies water to a much smaller population than the Los Angeles Department of Water and Power (LADWP). To put this in context, table 1 below shows a breakdown of the characteristics of the LADWP and the PWP.

Table 1: Los Angeles Department of Water and Power vs Pasadena Water and Power

	Los Angeles Department of Water and Power	**Pasadena Water and Power Company**
Population Served	3.9 million	162,011
Average Gallons of Water Used in a Month	14,360,891,594	834,929,117
Percentage of Water used by Residential Consumers	67%	67%
Percentage of Water Used by Other Consumers	33%	33%

Another crucial characteristic to note is that both the LADWP and PWP are members of the Metropolitan Water District. This will be of more importance later in this study.

Background Conclusion

This background was meant to provide a framework for understanding why this study is pertinent. It depicted how one small liberal arts college in Los Angeles has approached the issue of water conservation and gave more insight into the drought situation in Los Angeles. It laid out information regarding the two other institutions included in this study, the University of California, Los Angeles and the Huntington Gardens. As stated in the introduction, this paper looks to answer the following question: how does the Los Angeles Department of Water and Power target institutions of higher education, in their plan to conserve water and their water conservation incentive programs? Because Pasadena Water and Power is also included in the study, this question will be applied to them as well. The literature review that follows this will give a more analytical look at concepts pertinent to the questions at hand.

Literature Review

The following literature review will examine the situation of water in Los Angeles and the incentives the Department of Water and Power uses to encourage water conservation to better understand the meaning behind the research question and structure the issue within previous research done on relevant topics. It will begin by examining the drivers of water use in

residential neighborhoods. It will then analyze the water conservation policies, both non specific and specific to Los Angeles. Finally, it will discuss how academic institutions of higher education have approached both regional and individual sustainability. What is apparent when analyzing these studies is that there is not much available literature on incentives targeted towards institutions of higher education. This study aims to bridge this gap in literature and provide information and analysis on how academic institutions fit into regional movements of water conservation and how they are incentivized to do so.

Drivers of Water Use

When creating methods to incentivize water conservation it is important to keep in mind what drives water use. Studies have identified that residential water use in Los Angeles is mainly driven by household income, landscape greenness, water rates and water volume allocation (Mini 2013). A dissertation at UCLA looked into these factors and the role they play.

Income was identified as one of the primary drivers of water use in Los Angeles. On average wealthier neighborhoods consume three times more water than less affluent ones (Mini 2013). Furthermore, across the city there is a distinct clustering in water use and income. Higher water users are generally located in the more affluent neighborhoods and census tracts, whereas low water users are generally situated in less affluent areas. A study conducted on demand sided residential water use policies further linked income to water use by concluding hat low income households are five times as price responsive as wealthy households. Typically, the water bill for these low income households constitutes a larger share of the household budget, and thus, they are more responsive to price changes than other households (Renwick and Archibald 1998).

The study at UCLA went on to indicates that residential water use is influenced by the size of the lots, gardens and buildings and well as the existence of greenness in landscapes also

influences water use. Outdoor water use accounts for 54% of single-family residential water consumption within LADWP's range. The study pointed out that there is a strong correlation between the existence of greenness in a landscape and water use. This may be in part because many of the greener areas are also those of higher income, however the finding helps to explain the factors driving specifically outdoor water consumption in Los Angeles (Mini 2013). Relating this back to issues in Los Angeles, this study depicts how wealthier people seem to believe that they have a "right" to these finite resources like water because they pay higher taxes. As a result, they feel they can use water more than those who are less privileged during times of crisis because they are entitled to the resource due to their financial "contribution" to the area.

Finally, the price of water greatly influences water consumption. The LADWP has a two-tier structure. These rates are different for residential, single-dwelling unit customers, multiple unit residential and commercial, industrial and governmental customers (LADWP 2015). Those for commercial, industrial and institutional are the ones charged to Occidental College and other institutions of higher education in Los Angeles. Tiered pricing is where the customer pays a different price per unit of water delivered depending on the amount that is used, with a higher price charged for larger quantities (Hanemann 2006). The motivation behind the two-tier structure in Los Angels is to encourage efficient water use and confront future droughts without having to increase rates for customers practicing conservation and remaining in the first tier usage block (LADWP 2015).

An issue with the tiered systems in general is that it can be perceived as a punishment for the heavier water users. Agencies must prove that high water rates are actually reflective of the cost of delivering the water (Stevens 2015). Furthermore, in Los Angeles, there are cases where the two-tiered system has not incentivized water conservation to the extent it is intended. Those

who make a lot of money are not that incentivized by the high costs to conserve as much as those who do not earn as much (Lopez 2015). Furthermore, it is criticized because it permits water users to make decisions on what kind of conservation method they are going to employ rather than having it dictated to them. Thus, this type of incentive often does not send a very effective message about the conservation of water. It does not effectively incentivize water conservation to those who use the most water. Those who are privileged are generally able to pay regardless of the tier system and therefore it mainly impacts those who are under privileged and cannot afford the price increase.

When looking at the drivers of water use of institutions of higher education, one could assume they would be similar to those for residential consumers. There is one critical difference however, that being that the some of the largest consumers of water on campuses, the students, do not feel the direct impacts of their water consumption. Thus, drivers like price may not be applicable for the domestic water use on campus because students on the campus are not aware of the price the school pays for water. However, given that the largest water demands on campuses of institutions of higher education come from building-use, particularly restroom, irrigation and utilities like cooling and electricity (Zellner 2014), it would be correct in assuming that price would play a role in things like the water use in buildings, irrigation systems and utilities. It is important to keep this in mind when analyzing water conservation policies that could be utilized efficiently on campuses.

Analyzing Water Conservation Policies

Numerous studies have been done to analyze water conservation policies similar to those that are being employed by the Los Angeles Department of Water and Power during the drought. This section will outline some of these different studies to create a framework for how these

water conservation strategies are discussed and viewed by those in the field. These incentives are generally aimed toward residents of Los Angeles, not necessarily institutions, however in theory they could be applied to college campuses.

Types of Water Conservation Policies: Price and Non-Price

Until recently, the main solution to addressing water shortages was to exploit new sources of supply. However, there has been a growing thought that reducing human demand is a more sustainable way of mitigating the imbalance between water supply and demand (Inman and Jeffrey 2006). Residential water management policies have stimulated discussions among economists, water utility managers, and policy makers. Each group advocates for different types of policies to solve the issue. Economists generally advocate for residential water prices that reflect the marginal cost to reduce demand during periods of limited water supply. Others argue that water supply is inelastic, meaning it is constant rather price, and state other efforts are needed (Renwick and Green 2000).

Currently, the two main approaches to water conservation, and lowering the demand for water include price and non-price conservation policies. Price based approaches are those that adjust water rates to encourage water conservation (Olmstead and Stavins 2007). In terms of economics, price and demand are negatively correlated, meaning that generally when the price of a good goes up, the demand for said good goes down. Thus, intuitively it would make sense that by raising the price of water, the demand for water would fall shifting the demand for water down. Non-price based approaches that also influence the demand for water, are types of policies that encourage water consumers to actively change their mindsets and their interactions with water. Policies of this nature include the adoption of sustainable, more efficient technologies, rebate programs or education campaigns. These are meant to encourage water conservation,

without altering the price of water. Because water management has typically been approached as an engineering issue rather than an economic one, water supply managers are often reluctant to choose price increases as a water conservation tool. Instead, they look towards non-price demand management techniques. These included policies like the adoption of more sustainable technologies, and restrictions of particular uses, like lawn watering (Olmstead and Stavins 2007). Thus, non-price water management techniques are more common than price management techniques. However, that says little of the success of the two types of management approaches. It has been shown that demand sided management policies overall, both price and non-price are effective in reducing water use (Renwick and Green in 2000). These two categories of water conservation strategies are often compared to one another in terms of their cost-effectiveness, monitoring and enforcement, equity, and their ability to achieve water conservation goals (Olmstead and Stavins 2007).

Price vs Non Price Approaches: Effectiveness

Looking more in depth to compare the two, price based approaches to water conservation are more cost-effective than non-price approaches. Cost-effectiveness refers to trade-off between the cost of implementing the program and the impact the program has on the water use. Thus, because price based approaches do not require a particular technology to be installed, or the employment of any incentive efforts, while often times non-price approaches require both, price based programs are often much more cost-effective because they cost much less (Olmstead and Stavins 2007). Furthermore, in terms of the enforcement and monitoring efforts, non-price demand management policies require much more of an effort. They are easy to violate. In the context of pricing methods, non-compliance requires households to consume water "off the meter." Raising prices may create a higher incentive to do this, however even still enforcement

requirements of non-price approaches are much higher than those of price approaches. In terms of equity, price-based approaches to water can often impact low-income households more than those with higher incomes (Olmstead and Stavins 2007). This means that while price based approaches may be the least expensive to implement, they often penalize those who cannot afford to spend any more on water. Those with higher incomes however are still able to pay for the water, and do not have to cut their water consumption by that much.

In terms of these management approaches and their ability to achieve water conservation, both approaches are successful in that they do address water conservation. While water demand is sensitive to water prices only slightly, the demand for residential water is similar to that of the demand for gasoline and electricity. Thus the effectiveness of price-based approaches is strong. However, that does not mean that non-price demand policies are insignificant (Olmstead and Stavins 2007). These non-price approaches can be successful, however generally the magnitude of the reduction in water use caused by different approaches within this category varies (Renwick and Green in 2000). One study administered a survey to collect the single-family water use, and cost data from agencies in California, along with data regarding the types of water policies in place. The non-price water policies included in the study were voluntary measures, subsidies that encouraged the adoption of water efficient technologies, and public information campaigns. From the data gathered, a statistical analysis of the results in the form of a regression model was created to identify the reduction in the water demand attributable to different price or alternative demand sided management policies. The study found non-price demand sided management policies, the study found that public information campaigns, retrofit subsidies, water rationing, and water use restrictions specifically were influential in lowering water use. The more stringent mandatory policies, like water rationing and water use restrictions reduce

demand more substantially than other voluntary measures (Renwick and Green 2000). A further study concludes that non-price demand management policies such as water restrictions and low flow fixture studies vary significantly. It stresses that there should be an increased application of the benefit-cost analysis in comparing price increases with non-price water conservation programs because often these non-price management programs cost more than they save (Olmstead and Stavins 2007). Thus when looking at non-price management practices it is important to analyze each practice specifically, rather than analyzing the entire non-price management approach itself.

Thus, when looking at these management policies, it is clear that from a financial standpoint, price based management policies may be the most successful and effective, meaning that they have the most impact for the least amount of money. However, looking at it from a more equitable lens, non-price management policies are most effective because they do not penalize those who have the most trouble paying for water in the first place. They apply the same standards to all consumers. Ideally, there could be a successful combination of the two types of policies, price management policies applying strictly to those who consume the most water, and non-price policies applying to everyday consumers.

Successful Implementation of Management Policies

Regardless of if price or non-price management policies are utilized, a successful implementation of these types of policies requires a commitment form the local water utility and its costumers, as well as political will and leadership from governments (Inman and Jeffrey 2006). Furthermore, because policy makers generally adopt more than one policy when addressing a water shortage, it is important for them to understand how they interact in reducing the overall aggregate demand for water (Renwick and Green 2000). When looking to implement

incentives that address college campuses, it is important to remember that the drivers of some of the key players in water consumption on these campuses may be different than others. As stated, a majority of the residents who live on campuses do not feel the impacts of their water consumption; they do not have to pay for their water and as such are not affected by shifts in the price. However, the cost of water is felt by the university itself and universities are actively trying to conserve their water to meet city standards. That being said, a majority of the burden to cut back this water consumption falls upon the administrators and facility managers at the schools. Thus, while price management policies will definitely impact these consumers, it may not be the most efficient way to target these institutions. Institutions may be forced to make infrastructural changes. Looking at Occidental College in particular, because landscaping accounts for 60% of its water use, the school may consider cutting down water use in this area. Not only does it account for the larger percentage of water used, but it also is something the institution can directly influence and control. Combining price policies with different types of nonprice incentive programs could work to the schools advantage in that they would be able to use things like retro-fit subsidies to better address the residential and landscaping water consumption taking place. Thus as stated, understanding the multiple types of consumers on the campus is necessary, and understanding how different policies work together is important as well.

Current Water Conservation Policies in Los Angeles

Water conservation has been a topic of conversation for the LADWP for over 25 years. Since the 1990s, the city has been using ordinances, rates, rebate programs for indoor and outdoor fixtures and education and information to customers (Blanco 2012). Three of the

incentives utilized by the Los Angeles Department of water and power are water pricing, the California Friendly Landscape Program and the Technical Assistance Program (TAP).

Water Pricing

To reiterate, The LADWP has a two-tier pricing structure for water. There are different rates for residential, single-dwelling unit customers, multiple unit residential and commercial, industrial and governmental customers (LADWP 2015). Again, tiered pricing is where the customer pays a different price per unit of water delivered depending on the amount that is used, with a higher price charged for larger quantities (Hanemann 2006). The motivation behind the two-tier structure in Los Angels is to encourage efficient water use and confront future droughts without having to increase rates for customers practicing conservation and remaining in the first tier usage block (LADWP 2015). However, a criticism of this system is that the budgets allotted under the different tiers vary by the type of user. For example, single family uses with larger lots have a larger water allotment in tier 1, thus there are varying levels of water use within the first tier (Blanco 2012). Furthermore, there is no way to claim that customers that fall into the first tier usage block are practicing conservation because each user makes their own decision on what methods to use, rather than having them dictated to them (Addink 2005). Again, this means that certain individuals may be getting penalized even though they are practicing conservation methods and using less water in than the other members in their tier. Thus, using water prices alone, especially within the tier system that Los Angeles employs, may not be the best method for water management, because it could unfairly burden certain individuals who are attempting to be water conscious and would not correctly incentivize those who are using a lot of water to conserve because they do not feel the price shifts as severely as those who are less privileged. However, it is used in an attempt to lower the demand for water.

Using price to shift water demand is a technique is a price-based approach. From an efficiency standpoint, the price per unit of water should reflect the marginal cost of water. Economists differ on their opinions as to whether or not the residential price for water reflects the cost of water itself, and disagree on whether or not it should be used to reduce demand during times of limited water supply. Some economists claim that demand is only price elastic up to a certain point, so price is a ineffective demand sided management tool (Inman and Jeffrey 2006). Others claim that because water prices are low, and customers are generally unaware of prices, price cannot be used to manage demand (Olmstead and Stavins 2007). However, some studies do show that price elasticity can be expected to be greater under higher prices, meaning that when prices are raised to a certain point, the demand for water does fall (Olmstead and Stavins 2007). In Los Angeles, single-family residential consumers are generally more sensitive to increases in tier 1 water prices, rather than tier 2 water prices. This means that when tier 1 water prices change, consumers react more strongly then when those in tier 2 change. Tier 2 rates generally impact low-income customers more than other groups, but do not sufficiently compel higher users to lower their consumption. This raises equity issues (Mini 2013). These lower income groups are less able to cut back on their water use, for often they are already living to the minimum. For this reason, if price mechanisms are to be used as a water conservation tool, there should be observations to monitor the paying capacity and incapacity of different social groups.

California Friendly Landscape Incentive Program

The "California Friendly Landscape Incentive Program" was launched in 2009. This program involves replacing turf grass with California Friendly plants, mulch, permeable pathways and drip irrigation. The California Friendly Landscape Incentive Program is claimed to be a way for both residential and commercial costumers of LADWP to save money and water.

This fact in itself is debatable. Most agencies rely on external funding to run their turf rebate program, and once these funds run out, the program is put on hold (Seapy 2015). These funds often run out quickly because the cost of these programs is very high and at times outweighs the benefits. These high costs come from the expense of creating aesthetically pleasing drought tolerant landscapes and installing drip irrigation systems that go with these landscapes (Addink 2005). There is risk that participants will undertake lawn transformations that ultimately do not save water. Climate appropriate or native landscapes require different irrigation techniques and at times still use roughly the same quantity of water as efficiently watered turf grasses (Seapy 2015) Furthermore, it has been found that these landscapes can induce residents to use more water then they would with traditional landscapes. Drought tolerant species, are drought tolerant, however in drought conditions they are often less aesthetically pleasing so people may be more inclined to water them more to get the look they want (Addink 2005). Any water savings that take place generally come from the replacement of the turf with the more water friendly landscape, and the installation of a more efficient irrigation system, a drip irrigation system. These drip irrigation systems use approximately 20% less than in ground sprinkler systems (Addink 2005).

Those who want to be involved in the program must submit an online application, which is approved on a first-come-first serve basis and is subject to funding availability. The program also has eligibility terms: the project must have existing grass in the project area, the new landscape cannot include any live turf or turf looking plants, it must be permeable to water and air and comply with local laws and ordinances and the property must not have undergone this process before. These eligibility terms can be difficult to meet because often the existing lawns must be well maintained prior to the rebate conversion. However, lasting drought can stress

lawns, and agencies should no longer expect to see watered lawns pre-inspection (Seapy 2015). For residences the project minimum size is 250 sq. ft. and the project maximum size is 1,500 sq. ft. The rebate per square foot is $1.75. For commercial and multi-family customers, the rebate is the same for the first 10,000 sp. Ft. at $1.00 and then from next sq. ft. to 43,560 sq. ft. the rebate is $0.50. These rebates are cumulative (LADWP 2015). Generally, roughly 90% of participants in the program come from the residential sector, while only 10% come from the commercial sector. 85% of these participants hire a contractor to do the work, as most are not capable of doing it themselves (Seapy 2015). After the turf rebate conversion is complete, it requires little commitment from its customers. Even very efficient irrigation systems can be subject to improper use or failure absent proper maintenance. It has been documented that some rebate customers see no water savings despite replacing their turf. These "non-savers" include people who convert a low percentage of their landscape, people who have a higher percentage of plant cover pre conversion and people who have newer homes, and more valuable property (Seapy 2015). To remedy some of the issues, studies suggest things like emphasizing long term customer education throughout the rebate process and having post-conversion inspections. (Seapy 2015).

The Technical Assistance Program

The Technical Assistance Program or TAP is another financial incentive program that offers commercial, institutional and multi family residential customers in Los Angeles up to $250,000 for the installation of pre-approved equipment and products which demonstrate water saving (LADWP). The program has an application that residents must fill out, print and mail to the DWP. Examples of pre-approved projects include cooling towers, wastewater recycling systems, recirculation systems and upgrades to existing industrial equipment (LADWP 2015).

These non-price rebate programs have varied success. The water savings attributable to these types of programs, such as low-flow fixture subsidies, vary from zero to significant, which is a very wide margin (Olmstead and Stavins 2007). Furthermore, these non-price management policies require management and enforcement, since they are easy to violate. In a study of 85 urban water utilities in California during the drought in the 1990's, more than half of customers using these types of programs violated the quantity-of-use restrictions, and compliance rates with type-of-use restrictions were very low (Olmstead and Stavins 2007).

Institutions of Higher Education

Role in Regional Sustainability

The role of universities in regional innovation has evolved over time. While academic institutions were once were largely focused on teaching and research within their own communities, they are now adopting a role in regional economic development (Gunasekara 2005). It is widely accepted that universities play a role in the development of many high technology regions across the world (Lukman, Krajnc, and Glavič 2009). This role in their surrounding region is often underestimated even though many academic institutions interact and have close relationships with organizations located in these areas. Furthermore, many universities are only acknowledged for their contributions in the regions economic development because they are seen as economic entities (Boucher, Conway, and Meer 2003).

Institutions and Regional Sustainable Practices

A study conducted by Sedlacek in 2013 looked into the role that universities play in in the development of sustainable processes in communities, specifically how universities can serve as a bridging institution between government, businesses and society to support sustainable regional development (Sedlacek 2013). Seven hypotheses were derived from literature on the

subject, each with a different view on how academic institutions relate to sustainable development. A case study and interviews were conducted based on the analytical concepts underlying each of these hypotheses. It was concluded that because universities fulfill three main functions, education, research and governance, they are qualified to be facilitators of sustainable development. The case study conducted examined the University of Graz in Austria, a school who from very early integrated sustainability into its mission and vision. The results showed that specific institutions do support the bridging of activities between the individual and social learning, and that these institutions have sufficient financial and human resources to manage the different activities (Sedlacek 2013).

Stakeholders in Regional Development

Another study looked specifically at the University of Maribor, which is looking to link stakeholders to achieve sustainable regional development in their area. The University wants to collaborate with regional development agencies, the local community and industry to explore sustainability values. The University sees that an inclusion of sustainable development into education, research and outreach would allow for sustainable development in their school as well as the surrounding region. The report proposes a strategic approach to creating a successful collaboration between the university, non-governmental organizations, enterprises, municipality, the media and societal groups within the university. It lists the commitments the participating partners would need to make, sites an action plan that has been developed to carry out projects and defines a sustainability assessment that would be important to evaluate the university and regions progress toward sustainability (Lukman, Krajnc, and Glavič 2009). This is an example of a University that is just beginning to build a relationship with their community to create regional sustainability.

Linking these two studies together, it is apparent that schools specifically of higher education can play a role in the sustainable development of the regions around them. Both the University of Maribor and The University of Graz had sustainability integrated in their missions and visions (Sedlacek 2013), meaning that both were already committed to maintaining sustainability within their campus before trying to create these plans to impact their communities. Furthermore, both schools appear to already have relationships with entities within their immediate region, which is built upon when attempting to take on projects such as this. Therefore, it is definitely easier for schools with these two characteristics already in place to begin to approach the idea of being sustainable models.

Schools that choose to embrace their role as a sustainable model for their region can do so by embracing the protection of regional habitats, using recyclable materials and sound waste management, including sustainability in the curricula, encouraging sustainable consumption and transportation and then cooperating with other enterprises in the community to do the same. They must do so by making sure all of the stakeholders are able to agree with one another, and participate equally in the plan (Lukman, Krajnc, and Glavič 2009). The difficulty surrounding this task may be the reason that few schools are looking to implement a plan that achieves regional sustainability. Many are mainly focused on achieving individual sustainability. However, it is interesting to note the concept of Universities being intertwined with their regions development and sustainability. This type of movement could be the next step for schools that successfully integrate sustainability into their own missions.

Examples of Exemplary Institutions

There are many instances of schools taking extra steps to become more sustainable. There is not much literature on specific incentives directed towards higher education institutions to mitigate

their water use. Mainly these literatures focus on the methods schools employ to become more sustainable and evaluate these methods and their results. These methods and sustainable solutions are location specific, and it is essential to keep in mind that the same solutions for one school may not be as effective in different locations (Way et al. 2012).

A study conducted at the University of Toronto looked to identify the leading universities in campus design and green space initiatives. The University of Oregon and Seattle University were chosen as the leading examples in sustainable campus design due to their College Sustainability Report Cards of 2008, and their commitment to sustainability. Collecting qualitative research, looking at Campus Plans and Assessments, as well as conducting semi-structured interviews, the researchers identified why these schools were the successful in their sustainable initiatives, challenges that they have experienced along the way and recommended steps for other schools to take to achieve similar success. The main sustainable practices the campuses utilized to mitigate water use were implementing new irrigation systems, planting compatible, native and adaptive plants that require less water and establishing storm water collection and management systems. The challenges the researchers saw these schools as facing, specifically in terms of water sustainability on these campuses was simply the costs of the technologies needed to reduce water. Installing completely new campus irrigation systems and storm water management systems is not cheap and it is often difficult for the school to shift from the conventional practices they are used to (Chan et al. 2009).

A thesis published at the University of Texas at Austin in 2014, when that region was facing water shortages and drought, looked to collect data focused on water conservation methods and their perceived effectiveness. The study identified institutions of higher education as being comparable to small and medium sized cities, meaning their resource use is

considerable in areas facing drought conditions. Furthermore these higher education institutions can act as living laboratories where technological and behavior innovations can be explored, specifically in terms of water conservation. Student involvement in water conservation on college campuses is crucial. Reaching out to the students on campuses that are already involved in activities related to sustainability can allow students to reach out and connect with others, sparking a push for change in student behavior and even how the institution uses water structurally. A survey was conducted in higher education institutions that had been effected by a drought. A majority of these reported that the most important considerations in investing into water conservation methods were factors like regulation requirements and cost savings, rather than things like incentives, educational demonstration, administration demand and building code requirements (Zellner 2014). The survey also concluded that some methods of conservation are more widely used than others, and are perceived to be more effective. These include native and adaptive plants, weather informed irrigation techniques, low flow plumbing and metering, maintenance and reusing water methods.

A consensus in much of these texts is that water conservation and sustainability in general is something important that schools can and should look to invest in. A specific barrier to alterations mentioned in the text's that is agreed on is the costs that these alterations to the campus can accrue. Furthermore, these examples revealed that a majority of the campuses look to conserve water in their built environment by planting native species gardens, implementing efficient irrigation systems and installing low flow plumbing and metering. This could be in an effort to mitigate the issue that was discussed earlier, that a majority of the water consumers on college campuses do not feel the impact of their water use. Thus these schools look to mitigate the impacts of their residents' water consumption by implementing more technical alterations

rather than life style changes. To integrate changes in the mindsets of students and their water consumption, sustainability methods must be implemented in an integrative process, in a "whole-of-university" approach should be taken when looking at sustainability. The "whole-of-university" approach links research, educational, operation and outreach activities and engages students in each to encourage a collaborative space to reflect on the schools performance in regards to sustainability (Mcmillin and Dyball 2009). This type of approach would allow for water conservation efforts to be approached on a wider scale within college communities. As seen in the examples of schools that have started to reach out regionally in their conservation efforts, having a curriculum and student body that reflects the values of conservation is crucial.

Water Conservation Incentives

Throughout this research and literature, there appears to be a lack of literature when it comes to incentivizing water mitigation on college campuses. Generally institutions appear to conserve water in response to water shortages, similar to residents in the regions they are located, and do so to make their campuses look more sustainable, which has been a goal for colleges since a concern for sustainability arose in the early seventies as people realized the degradation of the environment would undermine expanding prosperity (McFarlane 2011). However, there is a major lack of literature into how colleges are incentivized to conserve their water by their municipalities, and what impact their conservation has on a region. When determining which types of conservation incentives could be successful in institutions of higher education, it is important to remember that a large portion of the consumers of water on the campus do not feel the direct impacts of their own water use. Thus, the incentive must be strong enough that the school looks to either educate its students on efficient water use, or implement alterations to the infrastructure to do what they can to mitigate the impact of the domestic water use on campus,

which is essentially out of the control of institution. Thus when analyzing the conservation policies in place currently in Los Angeles, while the pricing system may lower the water use of the actual campus facilities, it will do little to address the domestic water use. Things like the California Incentive Program and the Technical Assistance Program may both be more influential in campus water conservation because they offer college campuses the opportunity to at least mitigate the water use habits of their residents and also efficiently upgrade the technical campus water use as well. That being said, the purpose of this study is to fill the gap in the literature about incentives aimed towards college campuses to conserve water and provide information from people involved in these efforts regarding how institutions of higher education fit into water conservation efforts and what impact this conservation has on their communities.

Methods

To answer the question at hand, both quantitative and qualitative data was collected and analyzed. The aim of this study is to better understand the role that institutions of higher education play in the water conservation movement of the Los Angeles Department of Water and Power. To gain this understanding, information and perspectives were needed from both the LADWP and members of staff committed towards sustainability on college campuses.

A comparative case study approach was used to answer the research question. Three institutions were chosen to compare to one another, these being Occidental College, the Huntington Gardens and the University of California Los Angeles. To reiterate, Occidental College and the University of California Los Angeles fall under the jurisdiction of the Los Angeles Department of Water and Power, while Huntington Gardens falls under the jurisdiction of Pasadena Water and Power. These water purveyors were also compared to one another to better understand the different incentive programs that the institutions would have offered to

them. Within the case study approach, interviews of relevant figures in the institutions were conducted as well as an extensive document analysis of the institutions websites.

To understand how colleges view their role in water conservation, I interviewed members of the facilities staffs or sustainability directors of colleges in Los Angeles. Appendix one shows the interview questions posed to these individuals. These interviews took place between December and January of 2015-2016. They were semi structured to allow for the questioning to be more open and in-depth. These interviews were crucial in gaining an understanding of how academic institutions and the role they play in water conservation are viewed by members of the institution responsible for water conservation in Los Angeles and the colleges themselves. They were also able to provide information as to which incentive methods to conserve water are most successful on college campuses and what types of incentives the schools would be the most responsive to if implemented. Originally I had planned to interview members of the Los Angeles Department of Water and Power staff who are involved in the residential incentive program. However, this proved to be harder than expected. No employees were willing to speak on the subject, so I was unable to do what I had intended.

As a result, a detailed look at existing documents was conducted to analyze the incentives offered by the LADWP and Pasadena Water and Power (PWP) to provide a point of comparison and a richer data set. Specifically, a look at the both the LADWP and PWP websites residential and commercial incentive program pages was conducted. These pages were studied to better understand the incentives and their applicability to institutions. The specific web pages looked at, and the titles of the documents studied are compiled below.

Web Pages	Documents
https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-water/a-w-conservation/a-w-c-commercialmulti-family?_adf.ctrl-state=tfti54nv8_21&_afrLoop=157565803936399 https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-water/a-w-conservation/a-w-c-residential?_adf.ctrl-state=tfti54nv8_21&_afrLoop=158215526956730 https://www.ladwp.com/ladwp/faces/wcnav_externalId/a-w-cstm-wtr-prjct-tap?_adf.ctrl-state=tfti54nv8_21&_afrLoop=158397775389376 http://www.cityofpasadena.net/waterandpower/SaveWater/ http://socalwatersmart.com/# http://socalwatersmart.com/commercial/	Commercial/Multifamily/Industrial Step-by-Step Instructional Presentation Technical Assistance Program Application Educational Facilities Rebates

Findings and Analysis

The purpose of this study was to investigate the role of institutions of higher education in the water conservation plan in Los Angeles, more specifically, how water suppliers target these institutions with programs and incentives to conserve.

To answer this question, I analyzed information about incentive programs provided by the LADWP and the PWP. I categorized the incentives provided on these water company's websites to understand which types of customers they were targeting.

To understand how institutions of higher education used these incentives and how institutions perceived their role in the water conservation effort, I interviewed employees of large institutions about water conservation. These institutions being Occidental College, the main inspiration of this study, The University of California Los Angeles (UCLA), an institution of higher education also located in Los Angeles, and the Huntington Gardens, botanical gardens located in Pasadena, California. One of these interviews, the interview with the UCLA employee took place over the phone while the others took place electronically. In total, four interviews were conducted:

Emma Sorrell – Sustainability Manager at The University of California Los Angeles

Maxx Echt – Botanical Department Systems Manager at The Huntington Gardens

James Tranquada – Director of Communications at Occidental College

Thomas Polansky – Director of Facilities at Occidental College

Unfortunately, as stated, I was not able to get in touch with anyone within the Los Angeles Department of Water and Power or the Pasadena Water and Power Company. This is a weakness of this study because it means the evaluation of these incentives may be biased because only perspectives from institutions are represented. This also speaks to the challenges of accessing LADWP employees, which is in itself a finding of this study.

Finding One

Thus *finding one is that it is incredibly challenging to access employees of water purveyors for interviews.* This finding was gathered during the methods of this study. Employees of water supply companies are incredibly busy, and shy away from having drawn out discussions with researchers. Furthermore, when confronted with the necessary consent forms for this study, the employees encountered were nervous to engage in an interview because they did not feel they had enough information to accurately answer the questions posed. Thus, further research conducted on this subject would benefit from having solid researcher connections within these companies. A connection with a member of the Los Angeles Department of Water and Power or a similar company would ease the challenge of a researcher getting in contact with an employee.

The following sections lay out the data and findings collected about the incentives from existing documents and websites, and then will analyze the findings gathered through the interview process.

Water Conservation Incentive Analysis

By examining the information on the Los Angeles Department of Water (LADWP) and Pasadena Water and Power (PWP) websites, the incentives geared towards commercial consumers were documented. Under the LADWP and PWP, institutional consumers fall under the commercial consumer category. One of the most crucial characteristics to remember is that both the LADWP and PWP are members of the Metropolitan Water District. That being said, when it comes to their incentive and rebate programs, both water purveyors participate in a program called SoCal Water$mart.

SoCal Water$mart is a program funded through a partnership between the Metropolitan Water District of Southern California and its 26 member agencies and cities throughout Southern California. These members include:

Cities:	Agencies:
▪ Anaheim ▪ Beverly Hills ▪ Fullerton ▪ Glendale ▪ Pasadena ▪ San Fernando ▪ Santa Monica ▪ Burbank ▪ Long Beach ▪ San Marino ▪ Compton ▪ Los Angeles ▪ Santa Ana ▪ Torrance	▪ The Calleguas Municipal Water District ▪ Inland Empire Utilities Agency ▪ Las Virgenes Municipal Water District ▪ Three Valleys Municipal Water District ▪ Upper San Gabriel Valley Municipal Water District ▪ Eastern Municipal Water District ▪ Municipal Water District of Orange County ▪ West Basin Municipal Water District ▪ Foothill Municipal Water District ▪ San Diego County Water Authority ▪ Western Municipal Water District of Riverside County ▪ Central Basin Municipal Water District

Each of these agencies has made it their commitment to find water and meet present and future needs in an environmentally and economically responsible way. Because all of these agencies and cities are part of the Metropolitan Water District and the SoCal Water$mart program, all of their customers qualify for the rebates offered through the SoCal Water$mart

program. Appendix 2 provides a map of the qualifying service areas to visually show what regions are able to apply for these types of rebates. Table 2 lays out the SoCal Water$mart incentive and rebate program. Both the residential customer rebates programs and the commercial customer rebate programs are documented, however for the purpose of this study the main concern are the programs offered to the commercial customers. As stated previously, institutions fall under the commercial customer category for both the LADWP and PWP.

Table 2:Incentive and Rebate programs offered by SoCal Water$mart ("SoCal Water$mart – Rebates" 2016)

	Residential Customers	**Commercial Customers**
Indoor Rebate Products	1.High Efficiency Clothes Washers 2.Premium High-Efficiency Toilets (PHETs)	1.Rebates on Plumbing Fixtures: PHETs, Urinals, Control valves 2.Rebates on HVAC Equipment: Cooling Tower Conductivity Controllers, Cooling Tower ph Controllers
Outdoor Rebate Products	1.Weather-Based Irrigation Controllers (WBICs): adjust irrigation to account for changing weather and conditions 2.Rotating Sprinkler Nozzles 3.Rain Barrels and Cisterns 4.Soil Moisture Sensor System: detects water needs by gauging moister in soil 5.Turf Removal Program (funds have been exhausted)[1]	1.Rebates on Landscaping Equipment: Irrigation controllers, rotating nozzles for pop-up spray heads, large rotary nozzles, in-stem flow regulators, soil moisture sensor systems 2.Turf Removal Program (funds have been exhausted)[1] 3. On-Site Retrofit Program: provides financial incentives to convert potable water irrigation to recycled water use

Looking at this information, for every residential rebate or incentive program there is an alternative commercial option with a similar purpose. For example, both the residential and the consumer incentive list offer the option to install efficient plumbing fixtures and irrigation systems that are applicable to the customer type; the resident customers are offered washing machines and efficient toilets while the commercial customers are offered cooling towers and bulk plumbing equipment. Thus, when looking at the incentives offered to all of these service areas and agencies through SoCal Water$mart, one could say that they look to accurately target

[1] While these funds have been exhausted in the SoCal Water$mart Program, some participating agencies are still offering local Turf Removal Incentive Programs. These will be discussed further in this section.

each customer type. The program offers similar incentives and rebates for each customer type. However, to more accurately assess these programs a more detailed look is necessary. A break down of specifically the commercial rebates is provided in table 3 below to offer a closer look at each rebate program listed in table 1 under the commercial customer category.

Table 3: In depth look at commercial incentives ("SoCal Water$mart – Rebates" 2016)

Rebate/Incentive Program	**Program Details**
Rebates on Plumbing Fixtures	Premium High-Efficiency Toilets (PHETs): Base rebate: $40 Ultra Low and Zero Water Urinals: Base rebate: $200 Plumbing Flow Control Valves: Base rebate: $5/Valve (minimum of 20)
Rebates on HVAC Equipment	Cooling Tower Conductivity Controllers: Base rebate: $625 Cooling Tower ph Controllers: Base rebate: $1,750
Rebates on Landscaping Equipment	Irrigation Controllers: Base rebate: $35/station Rotating Nozzles for Pop-up Spray Heads: Base rebate: $2/nozzle Large Rotary Nozzles: Base rebate: $13/set In-stem Flow Regulators: Base rebate: $1/regulator Soil Moisture Sensor Systems: Base rebate: $35/irrigation controller station
Turf Removal Program (funds exhausted)	Receive $1 per square foot, up to $25,000 per property each fiscal year.
On-Site Retrofit Program	Provides $195 per acre-foot for five years of estimated water use, up to actual retrofit costs.

*Projects requesting over $100,000 will be reviewed on a case-by-case basis, depending on the availability of the budget

The most important aspects of this chart arguably is the note that states that projects requesting over $100,000 will be reviewed on a case-by-case basis and that the turf removal program only allocates up to $25,000 per property each fiscal year. Taking into account that institutions of higher education which have numerous facilities and large athletic fields, most of which are the size of at least a football field of 57,600 square feet, these programs do not offer

sufficient funds to do the large projects that would make a difference on a college or university campus. Special accommodations would have to be made for these institutions to use the rebates offered if they were to make a difference on the campus and towards the cost of the projects.

Not all water providers use only the incentive and rebate programs offered by SoCal Water$mart. Some water providers, like the Los Angeles Department of Water and Power have their own local incentive programs in addition to those offered through SoCal Water$mart. Pasadena Water and Power, does not provide alternatives to SoCal Water$mart, so their customers can only apply for rebates through the Water$mart program.

While Pasadena Water and Power does not offer any local rebates, it does have more stringent water restrictions than the Los Angeles Department of Water and Power. The PWP has a Level 2 water shortage plan in effect, which means that outdoor watering is limited to only Saturdays before 9am or after 6pm. The PWP aims to reduce water consumption by 28% by the end of February 2016. On the other hand, the LADWP has limited watering days based on the last number of the street address, so odd numbered addresses can water on Mondays, Wednesdays and Fridays, while even numbered addresses can water on Tuesdays, Thursdays and Sundays. The LADWP plans to reduce water consumption by 16%. These differences could be due in part to the different sizes of the areas that these two agencies serve. The LADWP has a much larger area, so it offers more local incentives and does not have as ambitious of a water conservation goal because of its large population. The PWP does not have as any local incentives because of its smaller area, and has a higher conservation goal because of its smaller population. Table 4 provides a breakdown of the incentives offered locally by the LADWP

Table 4: Local Commercial Incentives Offered by the LADWP

Rebate/Incentive Program	**Program Details**
Free showerhead, aerator, and pre-rinse spray nozzle program	Free
CII water conservation rebate program: provides rebates for high efficiency toilets, urinals, weather-based irrigation controllers, turf replacement etc.	Turf Replacement: $1.00 per square foot for the first 10,000 Sq. Ft and $0.50 per square foot thereafter up to 43,560 Sq. Ft. maximum.
The Technical Assistance Program (TAP): provides incentives for customer water conservation projects such as recycling systems, gray water systems, major irrigation upgrades, etc.	Provides up to $250,000 for the installation of pre-approved equipment and products that demonstrate water saving.

These additional local incentives are not as expansive as those offered through SoCal Water$mart, however they do provide larger funds. The TAP program provides up to $250,000 and the turf replacement program provides $0.50 per square foot after 10,000 feet up to 43,560 feet. This gives more room to commercial consumers to do larger projects. However they still are not completely sufficient. The replacement of an average lawn of 2,000 square feet costs about $6,000 dollars, or $3.00 per square foot (Goldenstein 2016). So, if an institution was looking to remove and replace an entire foot ball field, which again is 57,600 feet, the project would cost the institution approximately $172,800. The rebates under the LADWP would give them $31,780, meaning the institution would still need to pay $141,020. This is not an insignificant amount. In terms of the TAP program, all of the prices for the appliances are the same as those provided under the SoCal Water$mart program for the plumbing fixtures and the landscaping equipment. That being said, it provides a larger amount of money to the institutions, so theoretically they can implement bigger projects.

Finding Two

This data depicts that *the Metropolitan Water District, and by default the Los Angeles Department of Water and Power, and the Pasadena Water and Power Company, do have incentives that are aimed at institutions of higher education. However, these rebate programs*

may not be completely sufficient to fund the types of projects that these institutions may be doing. Thus, institutions of higher education are considered, when agencies create their rebate and incentives. However, these rebates may not be as financially incentivizing as they need to be to encourage large projects. How these institutions utilize these incentives will be discussed in the following section when the findings from the interviews are analyzed.

Interview Analysis

The interviews allowed for a more detailed analysis of the water conservation incentives. To restate, the interviewees were Emma Sorrell (The University of California Los Angeles), Maxx Echt (The Huntington Gardens), James Tranquada (Occidental College) and Thomas Polansky (Occidental College).

Finding Three

The interviews shed light on the incentives that the water suppliers offer to institutions and the way that institutions interact with these incentives and rebate programs. Emma Sorrell and Maxx Echt specifically stated that the *turf removal incentives and rebates are arguably the most successful and applicable to institutions.*

Maxx Echt stated that while the Huntington does not use the turf removal rebates offered by the PWP, the turf removal incentives are the most influential programs. The Huntington has saved a tremendous amount of water by letting some of the larger lawns die off. He does offer critiques for this program however, stating that many of these incentives are only valid for homeowners who replace their lawn with drought tolerant planting. He argues that it makes more sense to completely remove the lawns because no plants at all use even less water than drought tolerant ones. Furthermore the incentives do not account for the loss of watering to the trees

within the resident's yards. Because watering to lawns has been reduced, the trees in them are not receiving sufficient amounts of water.

Emma Sorrell also stated how important turf removal has been on UCLA's campus. In July of 2015, UCLA received a rebate from the DWP for approximately $697,604 to replace the campuses 8-acre Intramural Field with artificial turf (Hewitt 2016b). The college estimates that it will save 6.4 million gallons of water annually due to this transition. The college has also replaced much of the campuses landscaping with drought tolerant installations, including around Murphy Hall, the Court of Sciences Student Center, the Edie & Lew Wasserman Building and the teaching and Learning Center for Health Sciences. This the college estimates will save them over 3 million gallons of water annually (Hewitt 2016a). Therefore, the turf removal incentives and rebates have been in practice the most applicable to these institutions.

Looking forward, this finding indicates that in order to continue to be water conscious, campuses may opt to completely convert their fields to artificial turf, or allow their unused fields to go brown. This process allows campuses to make sustainable changes without necessarily disrupting campus activity. Installing new showerheads, toilets and sinks is a very involved process, and with students always living in and using campus facilities, it is difficult to do without interfering with student life. Replacing turf on the other hand, while it is a long process, does not directly interfere with campus living. Not all campuses may be inclined to take this step however. Brown lawns and turf fields are not ascetically pleasing, and not ideal when looking to sell a school. This may be why Occidental College, seems to be reluctant to let their fields go brown or make expansive alterations to their plantings. Their newest landscaping project features drought tolerant plantings, like olive trees, pennisetum grass and field sedge. However, the campus still has many rose plantings and grassy fields. With the new climate and drought, people

will need to change their mindsets towards what are normal plantings for colleges campuses in Southern California.

Finding Four

Another conclusion drawn was that *most institutions are committed to water conservation, so the drought and the guidelines provided by the DWP and PWP only gave institutions a sense of urgency and further commitment.* Emma Sorrell, Maxx Echt, James Tranquada and Tom Polansky stated that their respective institutions have not felt overwhelmed by the guidelines the water purveyors have mandated. Each of these institutions committed to water sustainability before the drought, and now they follow these guidelines because they are in place, but do not struggle to do so.

To reiterate, Maxx Echt is the Botanical Department Systems Manager at the Huntington Gardens. The Huntington Gardens falls under the jurisdiction of Pasadena Water and Power (PWP). In the interview with Maxx Echt, Echt stated that the Huntington has often been able to exceed the guidelines put in place by Pasadena Water and Power. This is due in part by the irrigation system the institution has in pace. The water for the gardens and other water features comes from water wells located on the property, managed by The Raymond Basin Water Board. The Raymond Basin Water Board is a collection of water purveyors in the region that pump groundwater. They are committed to the current and future quantity and quality of water resources ("About Us | Raymond Basin | Raymond Basin Management Board" 2016). At the onset of the drought, the management board reduced collective pumping rights by 33% over five years. As a result, while the state and the PWP has imposed a mandatory 28% reduction in water use, the Huntington already greatly reduced its water use before hand. Furthermore, aware that new construction and expansion would increase the Huntington's water demand, the institution

took steps to install high efficiency systems to help reduce this demand. The institution installed miles of low-flow drip irrigation to replace old-fashioned spray systems. A centralized control platform was also installed to maintain the programs and records for the many irrigation valves across the property. These were steps that the institution took without pressure from the PWP, and with little consideration to the incentives the PWP offers.

Emma Sorrell offered similar testimony in her interview. As stated, Emma Sorrell is the Sustainability Manager at the University of California Los Angeles (UCLA). This institution falls under the jurisdiction of the Los Angeles Department of Water and Power. Emma Sorrell stated that the University of California Los Angeles has been committed to sustainable practice policies since their founding under the University of California Commitment. The Office of the President is the system wide headquarters of the University of California. It gives shape to the vision of the universities and manages the activities that are central to the UC's public mission (University of California, n.d.). The Office of the President has a Sustainable Practices Policy which establishes goals in nine areas of sustainable practices, one of these being green building, clean energy, transportation, climate protection, sustainable operations, waste reduction and recycling, environmentally preferable purchasing, sustainable foodservice and sustainable water systems (Energy and Sustainability Office 2015). This is the entity Sorrell states that UCLA follows, and while the drought and the mandates made by the state and the DWP did provide a sense of urgency to UCLA's conservation practices, they were already committed to water conservation.

James Tranquada and Thomas Polansky also stated that Occidental College acknowledged the importance of their institution to be proactive in water conservation even before the extent of the drought was apparent. The college cut annual water use on campus by

19%, from 91.7 million gallons in 2009 to 78.4 million gallons 2014. This is not as detailed of an account as those described by Sorrell and Echt but it does suggest that the institution did look to make sustainable changes prior to the drought.

The commitments to sustainable practices made by these institutions prior to the drought reflects the goals of these types of institutions to be models in their communities and produce people who are conscious of their surroundings. The University of California Los Angeles, Occidental College and the Huntington Gardens are all institutions that stand for community development and enrichment. The UCLA mission aims to apply knowledge for the "betterment of our global society" (University of California Los Angeles, n.d.) while the Oxy mission aims to fulfill individual aspirations and a "deeply rooted commitment to the public good" (Occidental College, n.d.). The actions they took prior to the drought to conserve water and maintain sustainable practices reflect these commitments. That being said, perhaps standards for institutions of higher education should be less about the amount of water they conserve, and more about their duty to their duty to further these missions by acting as examples for communities and sustainable practices.

Finding Five

A further conclusion drawn from these interviews was that *these institutions believe that it takes both infrastructural projects as well as education campaigns to make a real difference on water use.* This is a concept that was discussed often throughout the literature review. Sustainable change cannot take place without a shift in the mindset of the people who actually consume and use water. Maxx Echt, Emma Sorrell, James Tranquada and Tom Polansky stated the importance of changing personal water use habits and educational programs to do so in the water conservation movement.

Echt stated that the Huntington Gardens have been engaging in educational programs to help spread the word about water conservation. The institutions use actual gardens to demonstrate sustainable practices. They have also provided demonstrations to students and the public to show how water conservation can be applied to the homeowners level as well. Sorrell similarly spoke about the importance of educational programs. She stated that one of the most successful water conservation movements on UCLA's campus was a five-minute shower campaign. She said that this campaign had quite an impact on student's perceptions of water use, and on their actual shower habits. She stated that residential water use did decline with the onset of this movement. Tranquada and Polansky also mentioned the importance of changing the personal habits of Occidental students water use. Domestic water use accounts for 40% of Occidental's water use. To reduce this portion of water consumed, it will be necessary to target students and their personal habits.

That being said it is important to notice how important the existing educational campaigns are in water conservation, and how influential they could be in altering water use. Long lasting change can only be made when people change their perceptions about water and their own water use habits.

Finding Six

Throughout the interviews, another reoccurring statement was made that supported the literature review earlier in this study, and helped explain how institutions see themselves in relation to water conservation and sustainability. Both Emma Sorrell and Maxx Echt stated that *they feel that their institutions role in water conservation is to act as both a model and as a "think tank" for sustainable practices*.

Institutions, they stated have a responsibility to demonstrate that conservation efforts are important, and how they can be applied on an institutional level and a homeowner's level as well. Furthermore, because of their recourses, it is important for higher education campuses to utilize their "brainpower" and influence in their communities to research new sustainable practices. Emma Sorrell discussed a how a UCLA researcher had conducted research and created a new water filtration with the idea that the energy plant used by the school, their cogeneration plant, could use this new water filtration system to recycle water. This would allow, what Emma Sorrell argues, is one of the largest water users on the campus to recycle water and reuse water.

This is an important example of how colleges can serve as a research center for new sustainable technology that can be then implemented in other areas. This finding demonstrates how crucial institutions are to water conservation and advancements in related technologies and practices. Because they see themselves as examples for the community, they should be utilized as such. They should be targeted by water providers to showcase sustainable practices and should be rewarded when they do so. This links back to finding four in which it was stated that these institutions of higher education often have missions that relate to the betterment of society or the public good. They strive to offer an education that allows students to interact with these concepts and goals. With these missions already in place, they should be urged to take these commitments to the next level and should be aided to do so.

Finding Seven

The final finding that can be deduced from the previously stated findings and the information provided in the background section of this study, is that *in comparison to the other institutions in the area, Occidental College is not doing as much to conserve water and create a more sustainable campus*. The most tangible and apparent thing that Occidental has done to

conserve water was the High Efficiency Plumbing Retrofit the school went through in 2014 to install low-flow toilets and urinals in the dorms and academic buildings on campus. The showerheads are projected to reduce water used by showers by 40%, however domestic use only accounts for 40% of the schools water use, the other 60% is used by irrigation. The only strides that the school seems to have made in this area all appear to be still in the works. They have plans to create a new Landscape Master plan, and create a Storm Water Management Concept Plan, however publically they have not.

Looking at the University of California, Los Angeles in particular, the institution has its own target water reduction rate. Occidental is only looking to abide by the goals set by the state and enforced by the LADWP. UCLA also has a clear set of five main initiatives that school needs to take to achieve their self-determined goal. These include a satellite treatment plant partnership with the LADWP, a cogeneration plant blowdown water-recycling program, intramural field artificial turf installations, on campus housing fixture replacement and a tiverton greywater system. Also in this plan, UCLA states that it perceives itself as a living laboratory for sustainability. This clearly stated commitment to sustainability is why the school is so determined to fulfill these initiatives (The University of Claifornia, Los Angeles Campus Sustanability Committee 2013). This clear dedication and straightforward plan to achieve a more sustainable campus is lacking at Occidental College. Occidental does not have a public document listing the institutions goals and plans and the only existing information about any plans to achieve a more water conscious campus are incredibly vague.

Furthermore, James Tranquada and Tom Polansky seemed to be much less interested in conducting the interviews than the other two interviewees, suggesting, while not necessarily implying, that they were less interested in the subject. Most students do feel that the school's

commitment towards water conservation is less than what should be expected from a college that prides itself on maintaining a mission deeply rooted in public good while adapting to an ever changing world. On a daily basis, students see fountains running, and plants being watered. This gives them the idea that the college does not care at all about the current crisis. Even though the school has made infrastructural changes, they need to make changes that alter the appearance of the school, and show students how they are approaching the water crisis. The school may believe that because of its size and water use in comparison to the larger campuses around the city, it does not need to do as much to conserve water. However, this is not the mindset that students expect or appreciate. Recommendations as to how to overcome this will be discussed further later in this study.

Findings and Analysis Conclusion

The findings discovered offer relevant information as to how these institutions perceive their roles in the environmental movement towards water sustainability. They also provide insight into which existing rebates and programs offered by water purveyors are most applicable towards intuitions of higher education, and also provide some information as to how water purveyors could expand their incentives to be more applicable towards this client base. These findings, and the actions to take once they have been acknowledged will be discussed briefly in the recommendations section to follow.

Recommendations

There could be real benefits to focusing on institutions of higher education to conserve water and act as examples for the communities they reside within. Furthermore, if these institutions acknowledge their influence in the communities that house them and recognize the resources they have, they could be further utilized to act as examples of ideal conservation

efforts and sustainable practices. A recommendation will be provided for the water suppliers, the institutions of higher education and further research.

Water Suppliers: Expand Incentives Offered to Institutions of Higher Education

The incentives offered to institutions of higher education are those meant for commercial institutions as well. For that reason, they are not perfectly ideal for educational institutions. James Tranquada and Tom Polansky both stated this in their interviews. They stated that those under the custom water conservation projects are more applicable than those that are actually geared towards their institution. This should not be the case. Either there should be an incentive program specific to institutions of higher education, not under the umbrella of commercial consumers, or there should be more incentives that are specifically applicable to institutions of higher education under this commercial umbrella. These incentives could include a subsidy for partaking in educational programs for students and faculty, higher turf removal rebates or more extensive TAP rebates that are quickly implemented. They could also be some form of low-interest or no-interest financing for necessary infrastructure to reduce water use, as Tom Polansky and James Tranquada stated in their interview. Furthermore, Universities and Colleges are unique in that they have a population of residents essentially all year long. Any construction that is done on their facilities, these being dorms, athletic fields or academic buildings needs to be done quickly and efficiently so as not to inconvenience the students and faculty. That being said these new incentives should be conscious of that and those that require construction should be made more readily available over the summer months.

Institutions of Higher Education: Utilize Research Component of the Institution

The schools in this study, and those discussed in the literature review, are all unique to the average commercial or residential water consumer. They have a multitude of researchers on

their premises. These researchers should be utilized to conduct studies regarding water conservation and sustainable practices. Whether these projects are simple, like installing water gardens or more extensive like the technology invented by the research student at UCLA, they could be important stepping-stones towards a sustainable future. To utilize this "brain power," academic institutions could offer academic incentives to encourage students or faculty to conduct sustainably relevant research. Looking at Occidental College specifically, the summer research program that is sponsored by the Undergraduate Research Program could be expanded to include a water sustainability research program. Students could apply to this program with the goal of developing a sustainable practice or technology to replace one that the school utilizes. Teachers could mentor these students to legitimize their findings and guide them throughout the research process.

Furthermore, for Occidental College it is imperative that the school begins to make changes to the schools appearance to show their commitment towards water conservation and sustainability. The school needs to show this commitment not only to the students who are already committed towards water conservation, and expect more from their college, but also to those who are unaware of the implications of the issue and need to be educated by their school. This type of initiative could be sparked students and faculty who are passionate about sustainability and water conservation could organize to petition the school not only to make changes to the facilities own infrastructure, but also to the institutions curriculum. It could also come from the LADWP, who could create more specific standards for institutions of higher education and their landscaping. Occidental, and all the schools in Southern California need to begin to stop perpetuating the mindset that Los Angeles is an oasis in a desert. It is a desert that

is quickly loosing the only thing that makes it livable, and as its tenants, we must learn to respect the landscape it provides us with.

Further Research: Contact Employees of Water Suppliers

The major shortcoming of this project was that I was unable to get in touch with any employees of the Los Angeles Department of Water and Power or Pasadena Water and Power. These companies are very difficult to get in contact with and given the time and resource limitations that I faced, it was impossible to get insight from members of these organizations. The analysis of the water conservation incentives was meant to act as a replacement for the possible information I would have gained from interviews with these employees, however this is not a perfect replacement. I was unable to speak to anyone who could have given me more in depth information about these incentives or explained things that were unclear to me. That being said all of the conclusions drawn from this information were entirely made upon my interpretation of the data and the way the interview subjects discussed the data. To conduct a more in depth analysis of this topic, further research should be done that includes the views of an employee from a water purveyor. Appendix 3 provides a set of questions that were to be directed to employees of the Los Angeles Department of Water and Power specifically, but they could be altered to include any water supply company's title.

Conclusion

Institutions of higher education could be perfect places for the exploration of water conservation methods. If properly incentivized by the water purveyors that preside in their areas, these institutions could be key in creating and researching sustainable practices. Currently, water purveyors do target these institutions with incentives and programs. However, these programs do

not necessarily have the impact they could if they were more attentively aimed at college and university campuses.

This study depicted how members of institutions are targeted by incentives and rebates because the Metropolitan Water District, and by default the Los Angeles Department of Water and Power, and the Pasadena Water and Power Company, do have incentives that are aimed at institutions of higher education. However, these rebate programs may not be completely sufficient to fund the types of projects that these institutions may be doing. Turf removal incentives and rebates are arguably the most successful and applicable to institutions. Furthermore, it was apparent that the institutions studied, are committed to water conservation, so the drought and the guidelines provided by the DWP and PWP only gave institutions a sense of urgency and further commitment. These institutions feel that it takes both infrastructural projects as well as education campaigns to make a real difference on water use, which is why the incentives and rebates issued by water purveyors are not necessarily the most effective. Finally, institutions feel their role in water conservation is to act as both a model and as a think tank for sustainable practices.

The intention of this study was to look deeply into water conservation and institutions of higher education. The drought in Los Angeles does not look to be ending any time soon, so this research can help to guide key members in institutional water conservation. It can provide members of water supply agencies with insight into the incentives that most applicably target institutions of higher education and can help College and University officials understand where the most impactful changes can be made on their campuses.

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Appendix

Appendix One: Interview questions for employees of institutions of higher education

1. What role do you see your institution as playing in the drought and the overall water conservation movement in Los Angeles?

2. What steps has your institution taken to respond to the drought in terms of water consumption or sustainable plantings?

3. Where do you see your institution having made the most strides in water conservation?

4. Where do you feel your institution could make improvements in water conservation?

5. Do you look to DWP to follow their water conservation guidelines or do you have your own internal benchmarks? Do these meet or exceed the DWP guidelines?

6. What do you see as some challenges that institutions face when looking to reduce their water use? How could these be overcome?

7. How do you evaluate the incentives from DWP to conserve water use have influenced these steps in conserving water?

8. What incentives from the DWP do you feel have been most effective in influencing water use decisions if any?

9. In your opinion, how could DWP alter its incentives to be more efficient in curbing water use for larger institutions?

10. What is your opinion of the role of larger institutions in water conservation? Do you feel larger institutions like yours play a key role in water conservation in Los Angeles?

Appendix Two: The Metropolitan Water District Service Area

Appendix Three: Questions to ask employees of The Los Angeles Department of Water and Power or another water supplier

1. In your opinion, how do large institutions like colleges, universities and museums fit into the water conservation agenda in Los Angeles?

2. How are these institutions incentivized to conserve water? Are these by the DWP? Are these internal incentives by the board or inside the organization? How do these incentives differ from those targeted towards residential homes and domestic water use?

3. If academic institutions are not being correctly incentivized and targeted, how could they be?

4. If academic institutions are not being correctly incentivized and targeted, why are they being overlooked?

5. Do you think that targeting large institutions to mitigate water use could be important in cutting back water use in Los Angeles? Would seeing academic institutions conserve water further incentivize residents to cut back on their use?

6. Have you seen any very successful instances where institutions have made large strides in mitigating water use? If so, where did these take place?

7. For these institutions that have been successful, what types of mitigations did they undertake? What were the steps they took to be successful? Which of these steps do you believe were the most successful tactics in water conservation?

8. What should be done to get institutions more involved in water conservation in Los Angeles?

9. Specifically looking at Occidental College, how can Oxy become more water friendly and more of a leader in the water conservation movement?

10. What are some other groups of people that should be targeted other than residences of Los Angeles to mitigate water use and why?