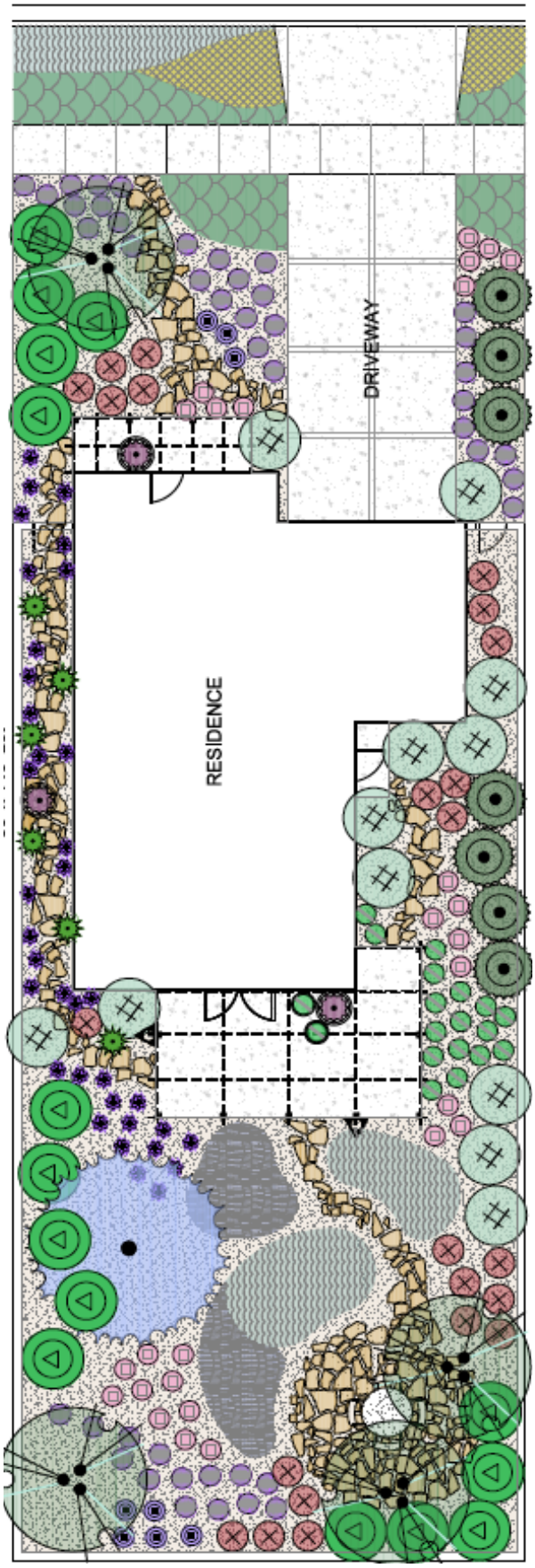

Source: LADWP. California Friendly Landscaping in Los Angeles. LA Basin Design.

Water Conservation Efforts: An Evaluation of the "Cash for Grass" Turf Replacement Rebate Program in Los Angeles City Council District 3

An Applied Policy Project submitted in partial fulfillment of the core requirements of the Masters of Public Policy Program at the University of California, Los Angeles Luskin School of Public Affairs.

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This report was prepared in partial fulfillment of the requirements for the Master in Public Policy Degree in the Department of Public Policy, at the University of California, Los Angeles. This report was prepared at the direction of the Public Policy Department and our client, Councilmember Bob Blumenfield's Council District 3 Office. The views expressed herein are those of the authors, and do not represent those of the Public Policy Department, the UCLA Luskin School of Public Affairs, UCLA as a whole, or the client.

EXECUTIVE SUMMARY

As cities in California seek to reduce water consumption due to the worsening drought conditions, local leaders are looking to individual households to do their part in the water conservation effort. Lawns are seen as an area where significant water savings could be achieved; for example, a recent University of California, Los Angeles (UCLA) study found that outdoor water use represents 54 percent of the total water use for single-family households.[1] The practice of "xeriscaping"—utilizing landscape in water-efficient ways by planting low-water plants—offers households a viable way of conserving water.

In the City of Los Angeles, the turf replacement rebate program, also known as the "Cash for Grass" program, encourages households to convert their landscapes by offering a rebate of $3.75 per square foot up to 1,500 square feet, and then $2.00 for every foot thereafter. The rebate program is managed by the Metropolitan Water District (MWD), and funded jointly by MWD and the Los Angeles Department of Water and Power (LADWP).

While there have been many reports analyzing the potential water savings that households could experience by converting their lawns to drought-friendly plants, few reports have analyzed the financial aspects of participating in this action. Specifically, this report seeks to analyze the short- and long-term financial effects for households participating in this program. We believe that calculating the average amount of money that households could save will strengthen the argument that the City of Los Angeles uses to promote and justify funding the rebate program.

Our analysis uses Council Member Bob Blumenfield's Council District 3 (CD3) as our focus area due to its high number of single-family households, which have a relatively higher percentage of income, larger land percentage, and hotter climate[2] when compared to other districts in the city. In order to evaluate the program, we considered the following policy questions:

1. **How do the rebate levels affect participation rates?**
    a. **Does the current rebate level cover the up-front cost of "xeriscaping?" If not, how quickly does a single-family household recoup the switching cost in annual water savings?**
    b. **Would changing the current rebate level or its structure be cost effective?**
2. **Do the long-term benefits of the turf rebate program justify the immediate investment?**

[1] Caroline Mini, "Residential Water Use and Landscape Vegetation Dynamics in Los Angeles," (PhD diss., University of
[2] Mini, "Residential Water Use."

a. **How do the rebate levels affect the rate at which LADWP recoups the cost of those rebates?**
b. **How do the rebate levels affect LADWP's ratepayers in the long run?**

We also considered potential barriers to participation, as highlighted by our analysis and findings. These barriers led us to consider both financial and non-financial aspects of the turf rebate program, such as planting requirements or potentially modifying the rebate structure.

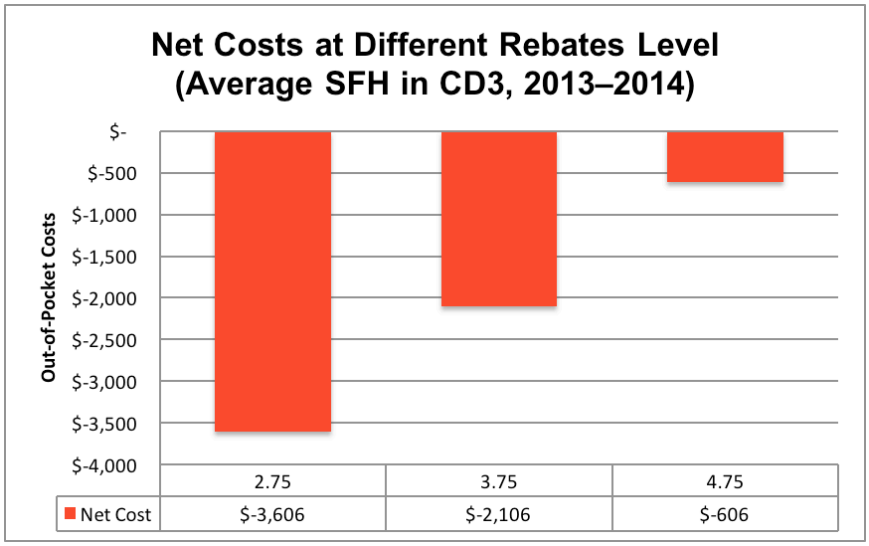
In order to answer the policy questions, we performed the following: (1) a financial feasibility analysis for the average single-family household in CD3 to find the net cost for participating in the turf replacement rebate program and the long-term household water savings from participating; and (2) a ratepayer impact analysis, which identifies the time it takes LADWP to recoup their investment of the rebate through a reduction of water imported in the long run. Additionally, our policy was informed and guided by pertinent literature findings and interviews with experts in the field.

Findings and Results of Analysis

Single-Family Household Financial Feasibility Analysis and Savings Horizon:

Our analysis used the average landscape size of 1,730 square feet that households converted in CD3 from July 2013 to December 2014.[3] The results of our analysis are as follows:

- ***Single-Family Household Net Cost:*** For the average participant in CD3, the net out-of-pocket costs of participating in the turf replacement rebate program is $2,106 at the current $3.75 rebate level (as shown in graph below).



[3] Martha Gonzalez (Lead Utility Service Specialist Water Conservation, LADWP), e-mail interview, February 18, 2015.

- ***Household Water Savings:*** Due to participation in the rebate program, the average single-family household saw a net reduction of 73 percent in their annual out-door watering consumption.[4] Households went from consuming 363 gallons of water per day to 98 gallons per day. This resulted in an average household savings of $627 annually after participating in the rebate program.

- ***Recoupment Timeline*:** Given that the average turf rebate participant experienced $2,106 in out-of-pocket expenses not covered by the rebate, it would take roughly three years (at both a two percent and a six percent increase at the Tier 1 water rate) for the costs to be recouped through water savings.[5]

LADWP Ratepayer Impact through Investment and Long-Term Water Savings:

Through our modeled five percent increase in household turf rebate participation rates of 2,685 single-family homes in CD3 over a five-year period, our findings show:

- LADWP would pay anywhere from $3 to $11 million in rebates, depending on the rebate level, to convert a total of 4.6 million square feet of turf, thereby saving the utility 795.5 acre-feet of water each year.

Rebate Amount	Payout for SFH in CD3	Total Rebate Payout for 5% of SFH in CD3
$0.75	$1,125	$3,020,625
$1.75	$2,625	$7,048,125
$2.75	$4,125	$11,075,625

- It would take LADWP roughly six to eleven years to recoup their investment in the rebate, depending on the rebate level. For any year thereon, the utility would see compounded water savings due to the reduction in the amount of water purchased from MWD. We also took into account the price of water, which has averaged an increase of about 6.4 percent each year.[6]

[4] Kent A. Sovocool, *Xeriscape Conversion Study* (Las Vegas, Nevada: Southern Nevada Water Authority, 2005).
[5] It should also be noted here that this calculation includes the cost of drip irrigation.
[6] Stephen A. Ott, Maral J. Sarkissian, and Evelyn Cortez-Davis, "Groundwater Remediation & Clean-up Initiatives and Groundwater Replenishment" (Southern California Water Dialogue, Los Angeles, CA, October 23, 2013).

Rebate Amount	Recoupment Timeline
$0.75	6 Years (2021)
$1.75	9 Years (2024)
$2.75	11 Years (2026)

Given the amount of water that could potentially be saved in a five-year period, we believe that a five percent citywide increase in the rebate program participation rate would allow LADWP to scale back how much Tier 1 and Tier 2 water they purchase from MWD, potentially saving ratepayers money in the long run.[7]

Policy Recommendations

From our research, we designed several policy options that were guided by five evaluative criteria that consider the financial and non-financial aspects of the rebate replacement program, as well as how modifying those aspects affect: (1) financial returns to household; (2) household participation rates; (3) ratepayer payback in the long run; (4) access to participation (equity); and (5) impacts on environmental sustainability through the lens of water conservation and efficient landscape use. With the aforementioned criteria, we evaluated our options and identified the following policy solutions:

1. **Offer Financing Options**: Perhaps one of the biggest barriers for residents to participate in the program is the financing component. Currently, the program is structured so that the LADWP reimburses households *after* they have converted their project area. From our household financial analysis, we noticed that the average cost of conversion is just over $8,000 for 1,730 square feet of landscape. The high up-front cost of participating may be a significant barrier for those who would like to do the conversion, but do not have the savings or credit to pay for it. For example, in 2011, the average household in California had an average $5,785 in personal savings accounts;[8] therefore, we presume that many households would prefer not to use their savings to pay for the conversion. Conversely, households could opt to use their credit cards to pay for the conversion. However, if the process of conversion takes longer than one month, there will be accrued interest and minimum payments that must be paid, which would increase the households' participation costs. Given this large financial barrier, LADWP and MWD could partner with low-interest lending organizations to offer households financing

[7] Mark Gentili (Water Conservation Supervisor, LADWP) e-mail interview, March 14, 2015.
[8] Dominic Weeks, "Savings Account Balances Decline for Residents in Four Electoral Swing States," Pitney Bowes, October 22, 2012, accessed March 1, 2015, http://news.pb.com/press-releases/savings-account-balance-decline-for-residents-in-four-electoral-swing-states.htm.

options at no higher than the rebate amount in order to remove the financial barrier that some households would experience otherwise.

2. **Increase the Tier Structure**: Increase the $3.75 tier cap to 2,000 square feet. This change will act as a monetary incentive for households in CD3 to convert more of their turf in addition to helping them cover more of the net cost that households bear. Increasing the tier structure would cost LADWP an extra $403 per the average household and increase their recoupment timeline by one extra year.

3. **Invest in Public Education**: As one of the most cited barriers to participation found through our research, to enhance the household experience of converting their landscape, we believe that LADWP could benefit from the following: (1) offer more workshops throughout the city, and have them conducted in different languages; (2) centralize MWD and LADWP's turf rebate Web sites so that consumers could access data and resources from one single Web site; and (3) communicate the potential savings to households that are related to turf conversion.

    - **Aesthetics**: Many households have concerns about the aesthetics of their converted lawns. In some cases, households have a misperception that low-water plants are "ugly." We believe that overcoming the issue of aesthetics is possible through demonstration projects and public-awareness campaigns, showing beautiful alternatives to turf.

    - **Plant Selection:** Another frequently mentioned challenge was households having little knowledge of the types and varieties of low-water plants. For example, many households have little understanding of what native California plants are, and how they differ from Mediterranean plants. We believe that if more households were exposed to the wide variety of plants they would better appreciate them.

    - **Qualified Landscape Contractors:** We presume that, in most cases, households may not have the time to do their own turf conversion, and therefore, they will hire a landscape contractor. While there are landscape contractors that perform turf removal and replacement with low-water plants, the quality of the job will be questioned by those households. We believe that the LADWP could provide a running list of certified contractors that can offer their services to households that are interested in converting their lawn, thus saving households time and money searching for the most qualified landscape contractors.

GLOSSARY OF TERMS

Break-even point: The point at which one recoups all of their capital investment but have yet to make a profit from that investment.

California-friendly plants: Plants not native to California, but that thrive in California weather.

Cost incidence: The occurrence of a financial burden placed on an individual or entity.

Evapotranspiration (ET): The "amount of water that evaporates from the soil surface and is transpired by plants through the foliage during a certain time period. It is a way to compare water needs of different plants."[9]

Hundred Cubic Feet (HCF): The measurement unit that LADWP uses to calculate ratepayer water usage. One HCF equals 748 gallons.

LADWP Tier 1 and Tier 2 water prices: LADWP-allotted water, based on a number of factors, such as zip code and climate, which represent the Tier 1 allotment. If an LADWP customer uses more than their Tier 1 allotment, they will be charged at Tier 2 water prices, which is more expensive.

Native plants: Plants indigenous to California.

Net Present Value (NPV): "The difference between the present value of the future cash flows from an investment and the amount of investment. The present value of the expected cash flows is computed by discounting them at the required rate of return."[10]

Opportunity cost: "A benefit, profit, or value of something that must be given up to acquire or achieve something else. Since every resource (land, money, time, etc.) can be put to alternative uses, every action, choice, or decision has an associated opportunity cost."[11]

Ratepayers: A customer of a public utility. Here, ratepayer specifically relates to a customer Los Angeles Department of Water and Power.

Sensitivity analysis: "Simulation analysis in which key quantitative assumptions and computations (underlying a decision, estimate, or project) are changed systematically to assess their effect on the final outcome."[12]

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[9] Metropolitin Water District of Southern California, "Six Elements of a California Friendly Landscape," accessed February 1, 2015, http://www.watersmartsd.org/sites/default/files/ca-friendly-landscape-training-six-elements.pdf

[10] "What Is Net Present Value (NPV)? Definition and Meaning." *BusinessDictionary.com*, accessed February 1, 2015, http://www.businessdictionary.com/definition/net-present-value-NPV.html.

[11] "What Is an Opportunity Cost? Definition and Meaning." *BusinessDictionary.com*, accessed January 1, 2015, http://www.businessdictionary.com/definition/opportunity-cost.html.

[12] "What Is Sensitivity Analysis? Definition and Meaning." *BusinessDictionary.com,* accessed February 1, 2015, http://www.businessdictionary.com/definition/sensitivity-analysis.html.

Single-family Household (SFH): Household that contains no more than one family residing on the premises at any one time.

Turf: Grass.

Xeriscape: A landscape which requires little or no irrigation, and uses water-efficient landscape designs.[13]

[13] UNLV Facilities Management, "What is Xeriscaping?," *University of Nevada*, last modified 2015, http://facilities.unlv.edu/landscape/xeriscaping.html.

INTRODUCTION

On two separate occasions,[14] California Governor Jerry Brown declared a "drought emergency," urging Californians to reduce their total water usage by 20 percent.[15] In addition to these announcements, Governor Brown also introduced the "Emergency Water Conservation Regulation" that "requires water suppliers and residents to work together to save water during the drought, primarily through reduced outdoor water use."[16] On February 3, 2015, the State Water Resources Control Board, a water regulatory board, and one of the six branches of the California Environmental Protection Agency, announced, that "the statewide urban water conservation rate climbed to 22 percent in December, aided by a very wet end of 2014."[17] Even though more than 20 percent was conserved during 2014, a key challenge for 2015 will be to save on outdoor water use during the warmer seasons as the state currently has only about one year of water supply stored.[18] For example, on average, outdoor water use during the warmer months contributes greatly to about a 50 percent increase in water use by urban residents.[19] As such, it is imperative that Californians continue to focus on reducing outdoor water use during the dry seasons.

In the greater Southern California region, the City of Los Angeles has been the most proactive in its conservation efforts since the 1990's. Such efforts include the raising of utility prices, increasing residential irrigation restrictions, outdoor watering mandates, and public-awareness campaigns. In 2008, the LADWP, the department that manages Los Angeles' water and power service delivery systems, launched the turf rebate program. Conservation incentive efforts were rolled out as instrumental parts of LADWP's three strategic goals. These goals were aimed at (1) reducing reliance on imported water; (2) reducing overall water demand by implementing conservation measures; and (3) increasing the use of alternative water sources, such as local groundwater and recycled water.[20] The result of these conservation efforts played a

[14] Once on January 17, 2014, and then again on April 25, 2014.
[15] State Water Resources Control Board, Notice of Approval of Emergency Regulatory Action (2014), accessed February 27, 2015, http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/emergency_regulations/oal_app2014071810e.pdf.
[16] George Kostyrko, "State Urban Water Users Exceed 20 Percent Conservation Goal For December, Individual Water Use Continues to Decline," *State of California,* last modified February 5, 2015, http://ca.gov/drought/topstory/top-story-24.html.
[17] Ibid.
[18] Zoë Schlanger, "NASA: California Has One Year of Water Left," *Newsweek,* March 13, 2015, accessed May 5, 2015, http://www.newsweek.com/nasa-california-has-one-year-water-left-313647.
[19] Ibid.
[20] Ibid.

large role in Los Angeles' "lowest water consumption per capita per day" in 2011 as compared to U.S. cities having one million people or more.[21]

Despite all of the water conservation efforts implemented by LADWP over the last 20 years, residential outdoor water use in Los Angeles still represents a large portion of the city's total water. In response, recent, targeted water-reduction efforts by LADWP have been increased to curb high usage. On October 14, 2014, Los Angeles Mayor Eric Garcetti issued an executive directive encouraging Angelenos to reduce their total freshwater use by 20 percent by 2017,[22] bolstering LADWP's efforts in the process. The directive also ordered city departments to reduce their water use by "replacing lawns and city landscaping, including street medians"[23] with plants that require less water maintenance. Additionally, Mayor Garcetti increased the LADWP residential turf rebate, also known as the "Cash for Grass" program, to $3.75 per square foot, which is a 75 cent increase from the previous amount. Though there were no outdoor water restrictions imposed on Los Angeles residents, the mayor urged single-family homeowners to voluntarily reduce their outdoor watering by converting their lawns to drought-resistant landscaping.

The first half of our report will frame what led us to analyze this policy issue and what evaluative criteria we used to weigh our policy recommendations. Next, we analyze the cost that single-family households bear by replacing their lawns, the water saved annually, and their future financial savings. Additionally, we analyze LADWP's investment in the program and future financial savings from a reduction in water that would need to be imported. Finally, we conclude with our policy recommendations, based on our analysis and the criteria laid out earlier.

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[21] Mini, "Residential Water Use"

[22] Matt Stevens, "Amid drought, mayor directs L.A. to cut water use 20% by 2017," *Los Angeles Times*, October 14, 2014, accessed October 15, 2014, http://www.latimes.com/local/lanow/la-me-ln-city-water-cut-20141014-story.html.

[23] Mayoral Executive Directive No. 5 "Emergency Drought Response - Creating a Water Wise City," Oct. 14, 2014.

PART I - POLICY PROBLEM AND CLIENT

Policy Problem

Given the realities of California's semiarid geography and ongoing drought, Southern California's current water consumption cannot be sustained. As our reliance on imported water becomes less reliable, as a consequence of the ongoing drought conditions, the cost to maintain the current consumption level will only become more expensive. In her dissertation, Caroline Mini, from the Department of Civil Engineering at the University of California, Los Angeles, found that outdoor residential water use for single-family homes in Los Angeles City represents 54 percent of all of residential water use and 32 percent for multi-family homes.[24] The same study found that residential customer accounts represent about 70 percent of LADWP's total service area accounts, and about 38 percent of the total water usage comes from single-family homes.[25] These studies show that single-family customers constitute the largest water delivery category in Los Angeles. It is, therefore, essential that single-family households do more to conserve water since the majority of outdoor water is used to maintain home landscaping.

Since the launch of the grass-replacement rebate program in 2009, Los Angeles has replaced 8 million square feet of lawn, one-third of which is residential, thus saving the city a total of 250 million gallons of water per year.[26] However, to this day, single-family households who attempt to participate in the rebate program face great challenges during the process of conversion. The main challenges come primarily from a lack of knowledge and resources, which the present report will expand upon.

Policy Questions

This report focuses on the "'Cash for Grass' Turf Rebate Program," managed by the Metropolitan Water District (MWD) and funded by both the MWD and the LADWP. The goal of this project is to understand and analyze the structure of the rebate program as it currently exists, which is meant to incentivize Los Angeles single-family households to replace their lawns

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[24] Mini "Residential Water Use."

[25] Hilda Blanco, Josh Newell, L. Stott, and M. Alberti. *Water Supply Scarcity in Southern California: Assessing Water District Level Strategies* (Los Angeles, CA: Center for Sustainable Cities, Price School of Public Policy, University of Southern California, 2012), http://sustainablecities.usc.edu/quicklinks/H%20Blanco%20WSSC%20Exec%20Summary%2012%202012.pdf

[26] Dana Bartholomew, "L.A. Company Saving Water by Offering Drought-tolerant Lawns for Free," *Los Angeles Daily News*, June 6, 2014, accessed January 5, 2015, http://www.dailynews.com/environment-and-nature/20140629/la-company-saving-water-by-offering-drought-tolerant-lawns-for-free.

with drought-resistant plants.[27] We also studied LADWP's investment in the turf rebate program to reduce the water demand of single-family households, which also reduces water importation from outside of the city. As such, this report seeks to answer the following policy questions:

1. **How do rebate levels affect participation rates?**
    a. **Does the current rebate level cover the up-front cost of "xeriscaping?" If not, how quickly does a single-family household recoup the switching costs in annual water savings?**
    b. **Would changing the current rebate level or its structure be cost effective?**
2. **Do the long-term benefits of the turf rebate program justify the immediate investment?**
    a. **How do the rebate levels affect the rate at which LADWP recoups the cost of those rebates?**
    b. **How do the rebate levels affect LADWP's ratepayers in the long run?**

In the course of answering the above questions, our analysis and research also highlight potential barriers to participation. These barriers led us to consider both the financial and non-financial aspects of the turf rebate program, including planting requirements and modifying the rebate structure since the current structure pays $3.75 per square foot up to 1,500 square feet and $2.00 per square foot thereafter. Mayor Garcetti's executive directive in October 2014 increased the rebate amount per square feet from $3.00 to $3.75 per square foot, no data or information has been available to explain if the increased rebate amount covered the total cost of xeriscape conversions, nor has any data been available to answer whether LADWP's investment in the program is bearing fruitful results. This report provides our analysis and findings based on our evaluative criteria; this work informs our policy options and recommendations.

Client

Our client is the Office of Los Angeles City Councilmember for Council District 3 (CD3), Bob Blumenfield, who has been in office since July 2013.[28] Councilmember Blumenfield has an extensive environmental track record. For example, he is currently Vice-Chair of the Energy and Environment Committee for the City of Los Angeles. His district has certain unique characteristics that make water conservation especially relevant for him. His committee work includes matters related to the LADWP "including but not limited to its fees, rates, property, leases, tariffs,

[27] Native plants are indigenous to California, and California-friendly plants are plants that thrive in California weather, such as Mediterranean plants.

[28] Throughout our work with this project, our communications with the office has been primarily with Legislative Director John Popoch and Policy Director Stephanie Magnien Rockwell.

contracts, and required or requested audits of this department."[29] He is also a member of the Budget and Finance Committee. He has previously represented the 45th District in the California State Assembly, which also covered the San Fernando Valley area.

In addition to other work, Councilmember Blumenfield has also been promoting low-water-use alternatives for landscaping by hosting a workshop on native landscaping in the San Fernando Valley, and by replacing his own council office lawns with California-friendly landscaping.[30] Moreover, last October, Councilmember Blumenfield passed legislation to develop standards for the use of artificial turf in Los Angeles parkways in order to diversify conservation methods.[31] Blumenfield also has introduced a proposal to utilize permeable pavers and California-friendly plants in recreation areas, parks, and other facilities within the city.[32] With Councilmember Blumenfield's commitment and ongoing efforts to "green the Valley," this report focuses on evaluating the turf rebate program for the population of Council District 3.

Los Angeles Council District 3

The following section presents key demographic information on Council District 3 (CD3). There are two main reasons why CD3 makes an interesting study area. First, the district has a large number of both single-family households and multi-family households. Second, the district is located in a traditionally warmer part of the City of Los Angeles, as it sits in the city's northern section. In a span of 10 years, from 2000 to 2010, CD3 has used more water than any other part of the city.[33] CD3 is also less dense when compared to other parts of the city. In addition, CD3 has a high enhance vegetation index (EVI), which measures the amount of vegetation. A high EVI score correlates with high water use.[34]

CD3 is located on the southwest side of the San Fernando Valley. It is divided into five communities: Woodland Hills, Tarzana, Winnetka, Reseda, and Canoga Park (see Figure 1 showing the map of CD3). CD3 covers seven zip codes, which are 91303, 91304, 91306, 91335, 91356, 91364, and 91367.

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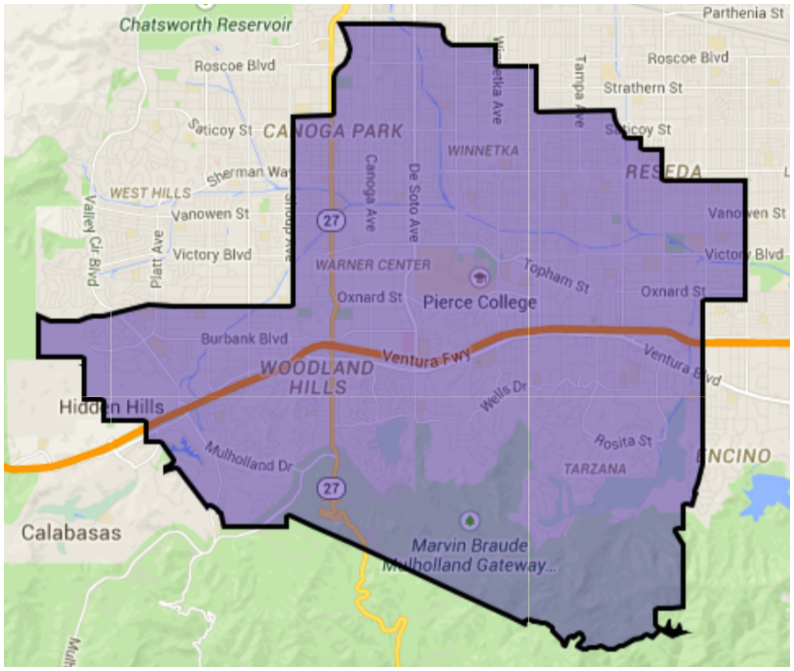
[29] Council District 3, "Committees," Councilmember Bob Blumenfield - Council District 3, accessed February 28, 2015, http://blumenfield.lacity.org/committees.
[30] Council District 3. *The Blumenfield Buzz* (Los Angeles: Councilmember Bob Blumenfied - Council District 3, October 2014).
[31] Ibid.
[32] Ibid.
[33] Mini, "Residential Water Use."
[34] Ibid.

Figure 1. Map of Council District 3



Source: Google Maps

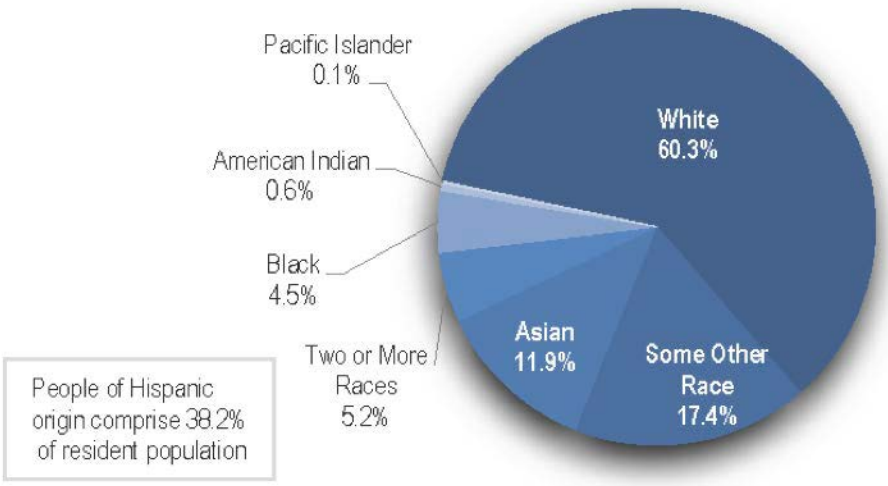
A 2013 report published by the Economic and Policy Analysis Group of the Los Angeles County Economic Development Corporation provided both demographic and land-use profiles for council districts. The report estimated that in 2012 the population in CD3 was 261,577 residents, had 90,765 households (with the average household size of 2.86) with a total a median income of $57,257, and a per capita income of $28,341. The racial and ethnic makeup of CD3's population is shown in Figure 2 below.

CD3's population is predominantly white, non-Hispanic and Hispanic, with pockets of Asian Americans, particularly in Winnetka. When looking at the ratio of income to poverty level of the resident population of CD3, 69 percent have a ratio of income to poverty level by two or more, and 8 percent have a ratio between 0.5 and 0.99. The report also mentions that 10.8 percent of the resident population had an income below the poverty level in the year 2012.[35] Looking more closely at the makeup of the households by size, 28 percent of the CD3 resident

[35] Cooper, Christine, et al. *Industry and Labor Market Intelligence for the City of Los Angeles* (Los Angeles: Los Angeles County Economic Development Corporation, 2013), accessed February 28, 2015, http://laedc.org/wp-content/uploads/2013/09/Industry-and-Labor-Market-Intelligence_LA_CITY_DOC.pdf

population lives in a household size of two persons, 24.1 percent in a household size of one person, and 17.2 percent in a household size of three or more persons.[36]

Figure 2: Race and Ethnicity of the Resident Population of CD3



Source: Economic and Policy Analysis Group of the Los Angeles County Economic Development Corporation

About 20.5 percent of those gainfully employed living in CD3 earn $1,250 or less per month, 35.5 percent earn between $1,251 and $3,333 per month, and 43.9 percent earn more than $3,333 per month.[37] Among these employed individuals, the largest shares in the industry sector are involved in retail trade (13.3 percent), finance and insurance (12.3 percent), and health care and social assistance (14.7 percent).[38]

In terms of land use, 62.9 percent of CD3's land is residential, amounting to approximately 13,400 acres, and 20 percent is commercial, which is approximately 4,300 acres.[39] The remaining 17.1 percent of the land are used for industry, agriculture, transportation, communication and utilities or are vacant.[40] Comparing the percentages of residential land use with other Los Angeles districts, CD3 is one of the top three districts with the highest residential land percentage, after District 8 and District 10.

[36] Ibid.
[37] Ibid.
[38] Ibid.
[39] Ibid.
[40] Ibid.

PART II - TURF REPLACEMENT REBATE PROGRAMS IN THE U.S.

Values and Attitudes toward Turf Lawns

Over the past few decades, there has been a shift in the emphasis of the aesthetic value of turf. A recent study, which sampled middle-class Americans in Northfield, Minnesota, found that "most people had ambivalent, negative or neutral feelings toward their lawns, that many of the traditional values once associated with lawns are not as strong as they once were, and that a significant portion of respondents are interested in reducing the amount of turfgrass in their lawn."[41] Respondents' interest in reducing turf was mainly due to their interest in using less water and fertilizer. As such, xeriscaping started becoming a viable option for some. However, there is still a general perception that links a well-groomed green lawn to "your duty to your immediate community," as well as to a perception of wealth and prestige.[42] Occasionally, even the American relationship to turf lawns is one of patriotism.[43]

The traditional values of green turf lawns have also been based on the care one puts into them. Some studies have shown that high-income and highly educated households "spend more time, money, and inputs to upkeep their lawns."[44] The importance of lawn care throughout the United States has gone to the extent that, when one home does not keep up with their lawn in a neighborhood, the property values of the surrounding homes decrease. Thus, changing the strong turf lawn culture in America poses a challenge throughout the country.

The introduction of xeriscape lawns did not immediately change the traditional aesthetic values placed on turf lawns. Yet, to some extent, it did challenge the idea of maintenance, as xeriscapes do not require as much care. Another study showed "low-input maintenance attributes significantly influence consumer choice behavior and identify a strong consumer preference for reduced irrigation and mowing requirements"[45] Xeriscaping, however, has not been as attractive as traditional turf landscapes. This is a perception that continues to be a participation barrier for many, which has an effect on the existing turf rebate programs in the country. In Los Angeles, as one way to combat this barrier, the LADWP and other water agencies created demonstration gardens to "help homeowners and professionals make the connections, demystify complex concepts and provide a viewable template for any residential property in the

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[41] Lara Brenner, et al., "The American Lawn: Examining our Cultural Commitment to an Energy-Intensive Institution," (Environmental Studies Comprehensive Project, Carleton College, 2013).
[42] Ibid.
[43] Ibid.
[44] Ibid.
[45] Chengyan Yue, Kari Hugie, and Eric Watkins, "Are Consumers Willing to Pay More for Low-Input Turfgrasses on Residential Lawns? Evidence from Choice Experiments," *Journal of Agricultural and Applied Economics* 44, no. 4 (November 2012): 549.

region."[46] Such demonstrations make homeowners more comfortable with caring for their new xeriscape.

Background on Turf Rebate Programs in the U.S.

In 1981, the water department in Denver Colorado (officially known as Denver Water) began the xeriscape movement.[47] Their goal was to show "that it was possible to both conserve water and maintain beautiful, lush gardens by promoting the use of plants that are well adapted to the region."[48] This movement highlighted the many benefits of xeriscaping, which include "reduced energy and site-maintenance costs, increased property values, lower water bills, improved landscape aesthetics, protection of native habitat including estuaries, streams, ponds, and lakes, and reduced desertification."[49] Popular beliefs created roadblocks to these new climate-appropriate landscapes. For example, two of these entrenched beliefs were that xeriscape landscapes require no water and that they were aesthetically unfavorable. Because of the traditional aesthetic values associated with lawns, these viewpoints are no real surprise.

Eventually, around the mid-1990s, the demand for native lawns increased due to the involvement of radical factions who supported xeriscape landscaping over traditional lawns to "improve American society more broadly, for aesthetic, environmental and cultural reasons."[50] Environmental problems caused by traditional lawns became apparent around this time. However, despite certain significant drawbacks to having a lawn, they do have some environmental benefits, such as nitrogen retention, as well as "proven social benefits such as evaporative cooling" and providing comfort and a sense of community.[51] For areas in the United States where there are high variable climate zones, mainly in the southwestern part of the country, cities have implemented turf rebate programs as one way to reduce residential outdoor water consumption.[52]

A 2013 study comparing seven rebate programs in various U.S. cities provides useful insights to understanding the process of turf rebate program implementation. Each program included social, financial and environmental benefits, the barriers that arose, recommended policy changes, and summaries of the implementation to show the varying levels of effectiveness. The study found that the effectiveness of turf rebate programs was fairly positive

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[46] Santa Monica Office of Sustainability, "Garden to Garden: A comparison of native and traditional gardens in Santa Monica," 2013.
[47] Brenner, et al., "The American Lawn."
[48] Ibid.
[49] Ibid.
[50] Ibid.
[51] Kelli L. Larson et al., "The Influence of Diverse Values, Ecological Structure, and Geographic Context on Residents' Multifaceted Landscaping Decisions," *Human Ecology* 38, no. 6 (2010): 747-761, doi:10.1007/s10745-010-9359-6.
[52] Ibid.

and beneficial in creating awareness and education regarding the need to conserve water.[53] Minor complications resulted from the need to revise the structure of the applications and to clarify requirements for those who qualified for the rebate. Successful implementation was found in cities where homeowner associations (HOAs) worked closely with city officials, and in cities that used mass media extensively to raise awareness.[54] When it came to changing the city landscape norms, the 2013 report showed that success was indeed possible. However, turf rebate programs also faced numerous challenges, including structural housing, climate, and water pricing variables.[55]

[53] Dan MacSwain, "Local Governments and Water Conservation: Case Studies in Lawn Conversion Programs," (master's thesis, University of Wisconsin-Green Bay, 2013).
[54] Ibid.
[55] Mini, "Residential Water Use."

Part III - Los Angeles City and the Turf Rebate Program: "Cash for Grass"

Where Los Angeles' Water Comes From

In large part, Los Angeles' residential water is provided by LADWP, and comes primarily from three water sources: (1) water from the Owens Valley/Mono Lake through the Los Angeles Aqueduct, managed by the LADWP; (2) water from the Colorado River, managed by the MWD; and (3) water from northern California, delivered through the California State Water Project, which is managed by the California Department of Water Resources and MWD.[56] Los Angeles' climate is termed "Mediterranean," much like the climates of Australia and South Africa. It receives, on average, about 15 inches of rain per year.[57] In the last 10 years, the lowest rainfall occurred during the 2006–2007 seasonal year, with 3.27 inches.[58] In the last two seasons, however, Los Angeles set "the lowest total ever recorded in back-to-back seasons," with 6.08 inches in 2013–2014, and 5.85 inches in 2012–2013.[59] Having such a low amount of rainfall, not only in the city but also throughout the state of California, does not help Los Angeles, as about 90 percent of city's water is dependent on snowpack.[60] This means that when Los Angeles has a dry season, the city's dependence on imported water is heightened.

Background History of Los Angeles' Turf Rebate Program

The turf rebate program in Los Angeles was launched by MWD's SoCal Water Smart Rebate Program in 2009, which was also operated through the MWD.[61] MWD is a consortium of 26 Southern California regional cities,[62] and is bound by law to provide reliable and "high-quality water to meet the region's needs in an environmentally and economically responsible way."[63] MWD launched the rebate program due, in part, to a grant received from the California Department of Water Resources and from the federal government's Bureau of Reclamation. In turn, MWD used this grant to incentivize cities to increase the rebate.[64] The turf rebate program for the City of Los Angeles City jointly administered by the MWD and the LADWP, with both

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[56] Ibid.
[57] Ibid.
[58] Los Angeles Almanac, "Total Seasonal Rainfall (Precipitation)," Given Place Media, last modified 2014, www.laalmanac.com/weather/we13.htm.
[59] Dana Bartholomew, "Los Angeles Sets Mark for Driest Back-to-back Seasons Ever," *Los Angeles Daily News*, September 2, 2014, http://www.dailynews.com/general-news/20140702/los-angeles-sets-mark-for-driest-back-to-back-seasons-ever.
[60] Mini, "Residential Water Use."
[61] Penny Falcon, personal interview, Los Angeles, January 8, 2015.
[62] Metropolitan Water District of Southern California, "Home Page," Metropolitan Water District of Southern California, last modified March 11, 2015, http://www.mwdh2o.com.
[63] Keving Roderick, "Fleming Appointed to MWD," *LA Observed*, March 35, 2009, accessed March 15, 2015, http://www.laobserved.com/archive/2009/03/fleming_appointed_to_mwd.php.
[64] Metropolitan Water District of Southern California, "Regional Progress Report," February 2014.

agencies sharing the goal of reducing the amount of water they import. LADWP is a municipally-owned, proprietary agency, which has revenues that come from the ratepayers.[65]

The turf rebate program was modeled after Las Vegas' turf rebate program, taking into account both what worked and what did not work for them.[66] In Los Angeles, the program, like any other business, began small. First, public outreach was performed in various forms. This included promoting the program through bill inserts, flyers, workshops, booths, and community events.[67] Eventually, the program turned to television and radio advertisements, which doubled the turf rebate participants in 2013.[68] By the fall of 2014, the incentive program had initiated more than 8.9 million square feet of turf replacement, resulting in 390 million gallons of water that was saved.[69]

[65] Mini, "Residential Water Use."
[66] Falcon.
[67] Ibid.
[68] Ibid.
[69] "Mayor Garcetti Announces Increased LADWP Rebate for Residential Turf Removal to Highest Level in Southern California" *LADWP News,* November 3, 2014.

Turf Rebate Program Features

Like most turf rebate programs in the country, the Los Angeles turf rebate program has its own requirements and application process. Table 1, below, describes the requirements of L.A.'s program:

Table 1: Features of the Turf Replacement Rebate Program

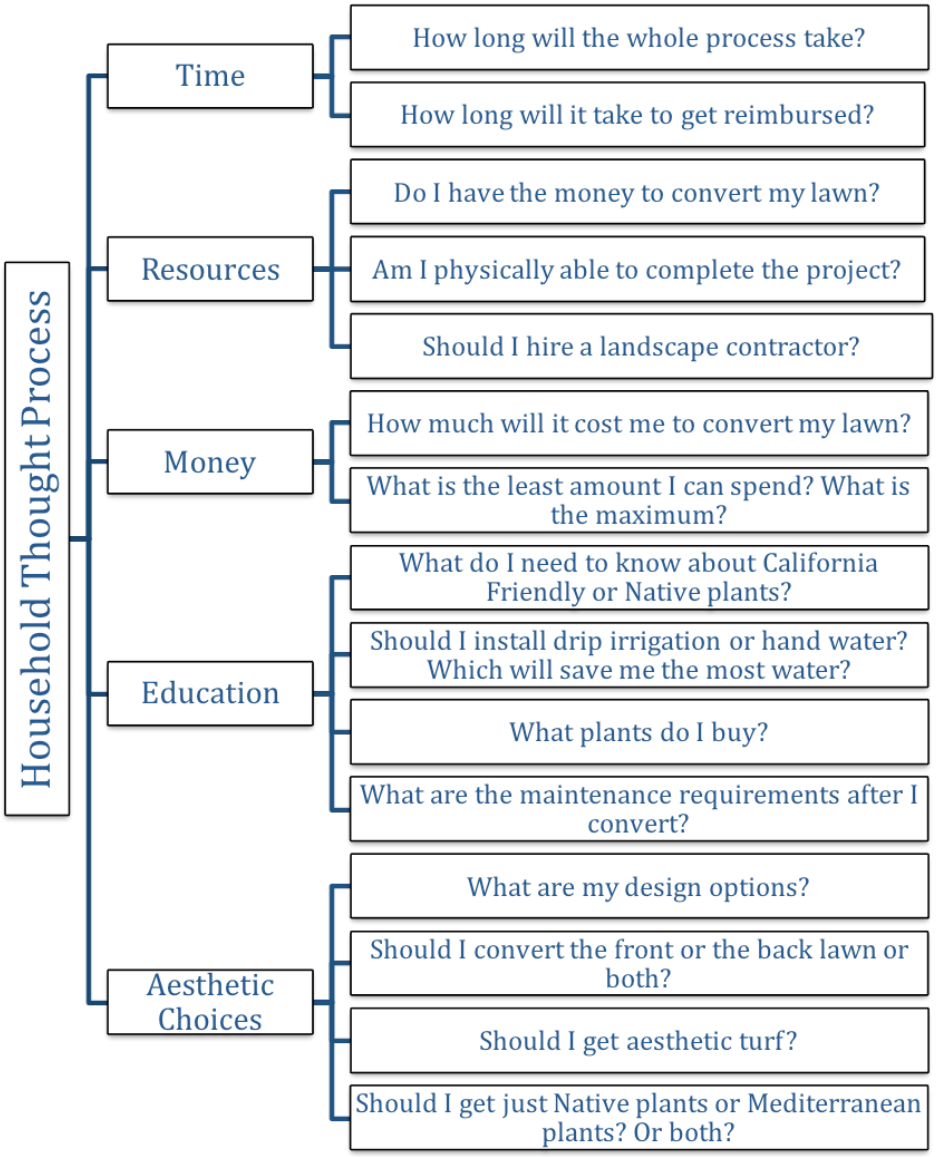
Household Requirements to Participate	● A household is only able to apply for the rebate program once, and has to receive project approval before removing turf. ● Have grass in the proposed project area. ● Turf must not be dead. Only those households with live and green grass are eligible to apply.
Eligibility to Receive Rebate	● Forty percent of the total turf removed must be covered with drought-tolerant, California-friendly, and/or native California plants. ● New landscape cannot have live turf or turf-looking plants. ● Synthetic turf is eligible as a turf replacement. ● Compliance with city requirements and applicable local laws, ordinances, and other restrictions. ● Cannot receive the turf rebate before removal.
Rebate Structure	● $3.75 per square feet up until 1,500 square feet. ● $2.00 thereafter.
Conversion Timeline	Complete the project within four months of project approval; some extensions are granted.
Irrigation Requirement	The project area must either be drip-irrigated or hand-watered. Sprinklers may not be installed.
Rebate Refund Timeline	Rebates will be mailed four to six weeks after final materials and documentation has been submitted and approved.
Program's Shared Cost	Currently, the LADWP and the MWD share the cost of the program. For the first 1,500 feet, MWD pays $2.00 per square foot and LADWP pays $1.75 per square foot for footage about 1,500 square feet.

Considerations Prior to Participation

To highlight the challenges faced by the program, it is necessary to take into account a single-family household's thought process prior to engaging in the program. These challenges

and other considerations can inform our model and analysis. Here, in Figure 3, we consider the following questions that households may ask before participating.

Figure 3: Household Thought Process before Turf Conversion



The questions in Figure 3 suggest barriers that could keep single-family households from participating in Los Angeles' turf replacement rebate program. For example, the wide variety of California-friendly and native plants can be overwhelming for households, especially when considering how the plants will grow as they mature. Another example is when households consider the amount of money they will spend. This can particularly be the case when they choose to hire a landscape contractor, which can be costly. In addition, our study showed a large

up-front cost to convert a project area. This requires a household to have thousands of dollars saved in advance, as they will not receive their rebate until after the completion of the landscape conversion and the proper documentation has been filed. Thus, the questions listed in Figure 3 were used to create our evaluative criteria, which we will discuss in the following section (Part IV), and to guide our financial analysis (Parts V and VI) and policy options (Part VII).

PART IV - EVALUATIVE CRITERIA

From our research, it is clear that there are significant water savings to be had if single-family households replace their turf with drought-friendly landscaping. Bearing in mind the features of the turf replacement rebate program and the many questions that single-family households need to consider before converting their landscape, we created an evaluative criterion to guide our analysis and policy options, which will be discussed after our research findings, as follows:

1. **Financial Returns to Household:** The amount of the rebate permit households to choose the most aesthetically desirable substitutes for turf from a simple conversion relying only on a few plants, but mainly mulch, to a more complicated conversion using a variety of plants and trees. However, in some cases, households may go above and beyond their rebate amounts, resulting in costs not covered by the rebate. For example, some households would pay an additional amount to install drip irrigation. **For each policy option, we consider how changing the rebate levels and tiers affect the affordability of the program and the households' long-term savings horizon.**

2. **Household Participation:** According to our interviews with experts and analysis of historical participation data (see "Appendix A"), factors that influence household participation rates include the following: rebate levels, financial feasibility, knowledge of plant selection and design options, and trusted landscape contractors with specialties in drought-tolerant plants who can perform the entire conversion. For instance, our analysis found that the average cost of conversion is over $8,000 for the average household in CD3. These high up-front costs may impede households from participating without a financing option in place. **For each policy option, we consider the aforementioned factors to weigh how they may affect household participation**.

3. **Ratepayer Impacts:** This criterion is based on an assumption that when more households participate in the turf replacement rebate program, LADWP will import less water for the City of Los Angeles, thereby reducing the costs that ratepayers would have to pay to import water. When LADWP imports less water, the amount of water ratepayers pay will also decrease, thus saving ratepayers money in the long run. **For each policy option, we consider how modifying the rebate program will impact the price ratepayers pay in the long run.**

4. **Equity**: On the basis of reasonable economic access, we examine affordability, program features, and language barriers. For example, regarding the last issue, workshops are currently conducted by LADWP to educate households about turf conversion only in English. Additionally, economically, the structure of the rebate reimbursement process necessitates that households cover up-front costs for the conversion, which can effectively bar certain families that do not have either substantial credit or cash available to participate. **For each policy option, we consider how modifying the rebate program may impact household's ability to access the rebate program.**

5. **Environmental Sustainability**: Based on our literature review and the insights that we gained from interviews with environmental experts,[70] when it comes to the rebate program, there is more to consider than just water conservation. For example, native California plants are more environmentally sustainable than California-friendly plants because the former support the local ecology, which is a fact that may not be immediately apparent by program participants. In cases where we consider altering the planting requirement (i.e., the percentage of landscape covered by vegetation), **we evaluate the impact it would have on the environment through the lens of water conservation efforts and land-use sustainability.**

To elucidate the last criterion, local environmental experts whom we interviewed recommend that households utilize native plants instead of alternative, drought-resistant plants, such as Mediterranean plants, as native plants support the local animals and insect ecosystem.[71] In addition, native plants have lower evapotranspiration (ET) than most Mediterranean plants, which have medium ET, meaning that native plants have lower water needs.[72] Moreover, written materials from MWD encourage households to take on a "watershed approach" when considering a drought-resistant landscape so that homes can become more dependent on rainwater.[73] While it is ideal that all households should employ all excellent approach to water conservation and to promote environmental sustainability, many households do not find native plants aesthetically pleasing,[74] which is a barrier to native plant landscaping. Nevertheless, we believe that households will be more likely participate if the rebate covers most of the conversion costs and when they see the long-term return on their investment.

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[70] See Appendix N for a list of interviews.

[71] "Why Garden with Natives?," California Native Plant Society, last modified 2015, http://www.cnps.org/cnps/grownative/why_native.php.

[72] "Becoming a Watershed Wise Gardener" (presentation, California Friendly Landscape Workshop, Los Angeles Department of Water and Power, Los Angeles, CA, February 7, 2015).

[73] Metropolitan Water District of Southern California, "Six Elements of a California Friendly Landscape." http://www.watersmartsd.org/sites/default/files/ca-friendly-landscape-training-six-elements.pdf; "Becoming a Water Wise Gardener."

[74] Anne Phillips, phone interview, February 26, 2015.

PART V - HOUSEHOLD PERSPECTIVE

Single-family Household Financial Feasibility

One of the main objectives of this research was to determine whether it is financially feasible for the average single-family household (SFH) in CD3 to participate in the turf replacement rebate program. We chose to perform this analysis because the turf replacement program is one of the most expensive water conservation programs that LADWP offers (see Appendix B).

We explored all the costs associated with turf extraction and xeriscape installation in order to determine whether the average SFH bears any net costs not fully covered by the rebate. If an SFH does bear any costs beyond their rebate amount, we identify the time it would take for the SFH to recuperate their out-of-pocket expenses through annual water savings after the turf conversion. We believe that this information will be useful in determining how participation costs may impact program participation.

In addition to the **SFH financial feasibility analysis**, we conducted a **sensitivity analysis** to analyze how sensitive the rebate amount and the subsequent net costs are to variations in small, medium, and large landscapes (see Appendix C). The rationale behind this analysis stems from the heterogeneity that exists among different communities in CD3 landscape sizes. As such, this analysis examined the effects on costs and savings at the $2.75 and $4.75 rebate levels.

Before we began our analysis, we calculated two important factors that serve as important underpinnings of our analysis to determine the amount of potentially convertible turf, including the costs associated with the conversion process. These are: (1) the calculation of the average household landscape size for CD3, and (2) the average xeriscape conversion cost for a household with varying landscape sizes. We next describe how these calculations were made.

Average Household Landscape

In order to estimate the average landscape size for SFHs for CD3, we began by calculating the overall average of the five communities in CD3. The following publicly-available sources were used: (1) Zillow, an online real estate database; (2) the Property Assessment Information System from the Los Angeles County Office of the Assessor, which provides property values and assessments done by the County's assessor; and (3) Google Maps. Fifteen homes were randomly selected from each of the five communities surveyed in CD3, totaling 75 homes.

- **Zillow:** Zillow had already broken down real estate areas by neighborhoods that aligned with CD3 neighborhoods. The pieces of information that were gathered were

the address (i.e., house number, street name, and zip code), the number of bedrooms and bathrooms, the square footage of the home, and the lot size.

- **Property Assessment Information System:** We then used the address collected from Zillow to look up the property assessment information. Los Angeles County's updated system includes a map that shows the lot size, the position of the property on the lot, and a color-coded map that differentiates where the landscaping might be located on the lot.[75]

- **Google Maps:** Geometry was used to estimate the landscape size by estimating the percentage of the landscape size from the full lot. To estimate the per-house landscape percentage, we compared a county map and Google Maps to determine which parts of the lots had turf, and then estimated what percentage the turf represented in relation to the lot. Once a percentage was estimated, we then calculated the total amount of landscaping in square feet.

After calculating the averages of the five neighborhoods (see Appendix D to see the information we gathered on the 75 homes), we then calculated the **average landscape converted** per household in CD3 after obtaining rebate participation data from LADWP, spanning July 2013 to December 2014. The average of converted landscape in CD3 is 1,730 square feet. This average will be used to represent the average turf rebate participant in CD3 and will serve as the basis of comparison for further analysis. While we used these figures for Winnetka, Canoga Park, and Tarzana to represent sampled small, medium, and high averages, 1,730 square feet figure was the "guiding average" for the majority of the analysis that follows. This is because it represents the most up-to-date and accurate activity of the turf rebate program in CD3. The averages for the three communities are shown in Table 2.

Table 2. Average Landscape Sizes in CD3

Landscape Size	Square Feet
Small (Winnetka)	2,486
Medium (Canoga Park)	4,052
Large (Tarzana)	8,556
Average (ProgramParticipation Rates)	1,730

[75] "Property Assessment Information Sysem," Los Angeles County Office of the Assessor, last modified 2015, http://maps.assessor.lacounty.gov/GVH_2_2/Index.html?configBase=http://maps.assessor.lacounty.gov/Geocortex/Essentials/REST/sites/PAIS/viewers/PAIS_hv/virtualdirectory/Resources/Config/Default.

Xeriscape Conversion Cost: Prior to estimating the cost of conversion, we made a broad assumption that most households would opt to hire a landscape contractor to do the conversion rather than doing it themselves. We made this assumption because we hypothesized that the majority of households do not have expertise in this area nor the time to perform the entire conversion themselves, and thus will opt to have the work contracted with a licensed professional. However, through our interviews with environmental experts, we acknowledge that households could perform most of the work themselves at a substantially lower cost than contracting professionals for all of the necessary conversion activities.[76] Nevertheless, for this analysis, we erred on the side of contracted work, as it seems a more representative indicator of typical household behavior. The associated costs of turf replacement consisted of the following:

- **Turf Removal:** After consulting with landscapers and online home-improvement estimate generators, we found that, on average, an SFH could expect to pay approximately $1.92 per square foot for turf removal.[77] Thus, the average CD3 participant could expect to spend about $3,321 just to remove their existing turf grass.

- **Plant Coverage:** A typical household could expect to pay about $30 per 7.25 square feet of California-friendly plants (including installation).[78] Taking into account the 40 percent vegetation requirement for the turf rebate program, the typical households has paid, on average, $2,863 for vegetation installation.

- **Landscape Fill:** For analysis purposes, we assumed that households will use mulch to fill the unaccounted 60 percent of their landscaped lots. Based on discussions with contractors and a sample of online estimate generators, we found that, on average, a typical homeowner will pay out $1 per single square foot for mulch installation. The average typical household would thus expect to pay $1,038 for this stage.

- **Drip-irrigation Installation:** Although not a mandated requirement of the rebate program, this project assumes participants will install drip irrigation as an additional water savings measure over hand watering. For an average household, drip-

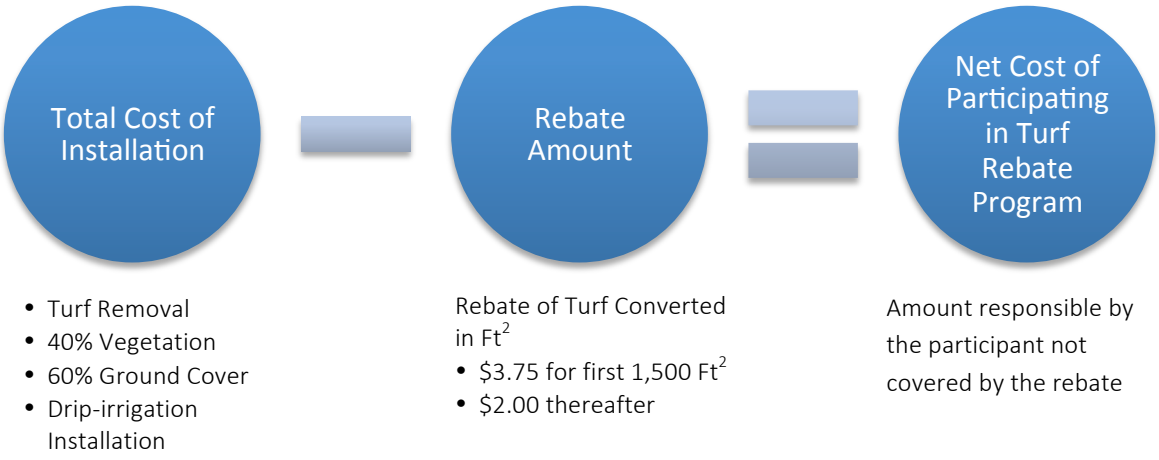
[76] Lisa Novick, personal interview, Los Angeles, CA, February 17, 2015.
[77] "Homewyse Calculator: Cost to Remove Lawn," *Homewyse*, January 1, 2015, accessed February 1, 2015, http://www.homewyse.com/services/cost_to_remove_lawn.html.
[78] Kristen Shapiro, Andrew Chan, Elliot Carson, and Romina Tayag, "Outdoor Water Use Conservation through Native Plants," accessed February 1, 2015, http://watermanagement.ucdavis.edu/teaching/.

installation costs required to cover the 40 percent of the vegetation would be approximately $967.[79]

Single-Family Household Net Costs

Methodology: To identify the financial impact on single-family households participating in the turf rebate program, we calculated the total installation cost and the total rebate disbursement to determine the net cost of installation (see Figure 4). Next, we calculated the total rebate amount an SFH would receive. Holding constant the amount of turf converted in the installation costs, the total rebate payout was calculated as the product of the amount of turf converted at $3.75 for the first 1,500 square feet and $2.00 for every square feet thereafter. The net cost is the difference between the cost of the conversion and the rebate payout. Any negative value would constitute the total out-of-pocket cost that SFHs would be required to bear.

Figure 4: Financial Feasibility Model



Findings: The results of the financial feasibility analysis reveal that, for an average CD3 SFH, the net out-of-pocket cost of participating in the turf replacement rebate program is approximately $2,106. Predictably, as the average landscape size increases, the net out-of-pocket cost borne by the household grows. For example, for Winnetka, the net cost is approximately $4,000 while larger lot sizes in Tarzana could be closer to $40,000. Midsized lots, such as in Canoga Park, face about $8,400 of net cost, but they can make up the difference through water savings over an adequate amount of time.

[79] "Homewyse Calculator: Cost to Install Drip Irrigation System." *Homewyse*, January 1, 2015, accessed February 1, 2015, http://www.homewyse.com/services/cost_to_install_drip_irrigation_system.html.

For the average participant, the roughly $2,000 in net cost is not particularly daunting given the water savings induced from converting. However, given that the rebate is not disbursed until a few months after the conversion process begins, the roughly $8,000 conversion cost must be entirely financed up-front by the household. Conversely, larger lot sizes face $40,000 in net up-front costs. Table 3 summarizes our findings.

Table 3: Net Cost of the Rebate Program for Select CD3 Communities

Size of Landscape	Net Cost	Repayment Timeline
Small (Winnetka)	$4,338	5 Years
Medium (Canoga Park)	$8,419	6 Years
Large (Tarzana)	$40,470	10 Years
Average (Current Participation Rates)	$2,106	3 Years

In addition, Figure 5 summarizes the net costs at different rebate levels for the average SFH in CD3.

Figure 5: Average Net Cost for Participants

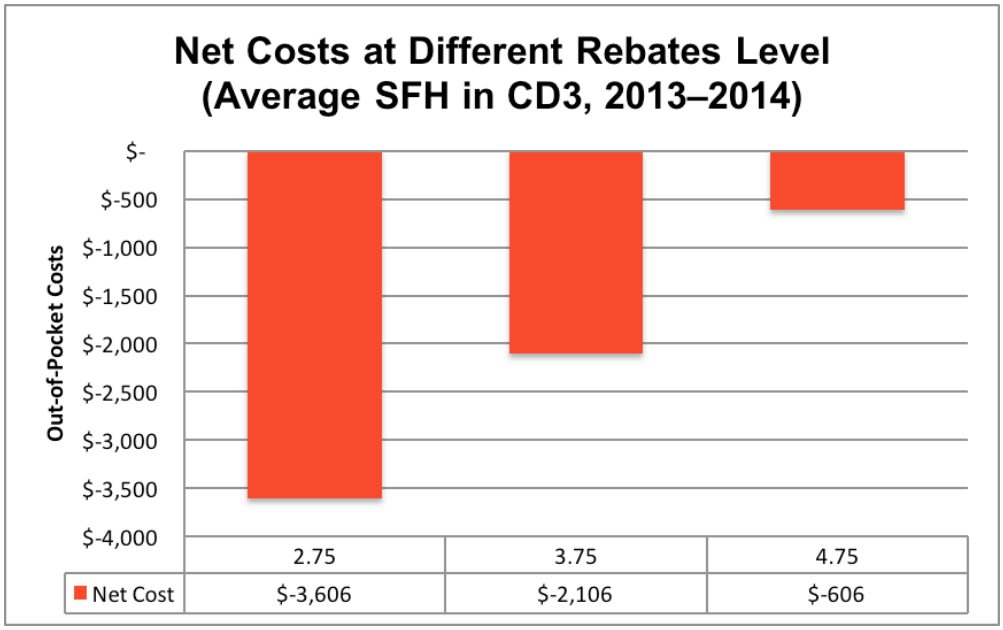


Figure 5 demonstrates the out-of-pocket expenses households will bear, i.e. the expenses not covered by the rebate, at the varying rebate levels. Clearly, the highest modeled rebate level of $4.75 will produce the smallest net costs for households.

Sensitivity Analysis

The sensitivity analysis examined the cost incidence at rebate levels of $2.75 and $4.75 to test the sensitivity of the rebate against varying landscape averages of different CD3 communities (see Appendix E).

Methodology: To test the sensitivity of the rebate amount of different landscape sizes, the rebate amount was adjusted to $2.75 and $4.75 to observe the effect that different rebate levels have on small, medium, and large households' net costs. The cost figures from the financial feasibility analysis remained constant in the sensitivity analysis for the purposes of comparison.

Findings: The $3.75 rebate level covered most of the conversion costs for Winnetka, and it was similar to the average landscape size converted. Winnetka SFHs would realize repayment through water savings in 4 years. Even at the $2.75 rebate level, participants in Winnetka would see savings within six years. At the highest rebate level, Winnetka households would only have to wait 3 years to realize repayment.

As was mentioned earlier, as average landscape sizes increase, the potential for cost savings quickly decrease. Even for midsized landscape lot sizes, such as those in Canoga Park, at the current rebate level, participants would not realize savings during the five-year study period. Only at the highest level would participants from this area see repayment and cost savings within five years. For the largest households in CD3, the net cost alone would be about $40,000, and the water savings at the current rebate level would only net about $16,000 in water savings over a five-year period. It is clear that, at any rebate level, large landscape households will face sizeable out-of-pocket costs that will not be recouped within a short time period.

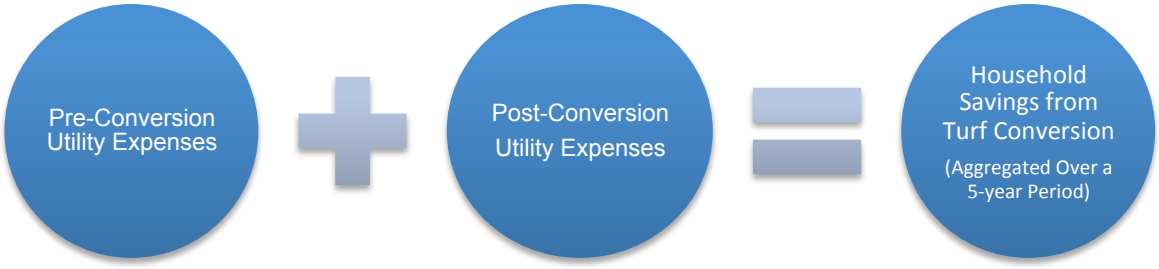
Household Water Savings

This report also considered the savings horizon for SFH participants who incurred costs not covered by the rebate. As mentioned above, a savings horizon is the total amount of elapsed time needed for households to realize repayment from water savings due to reduced water consumption.

Methodology: The savings horizon for SFH participants was calculated to determine the amount of years necessary for households to recover out-of-pocket costs not covered by the rebate, as well as the time when these households could expect annual cost savings from reduced water usage. This was done by first calculating the difference in annual water use due to converting traditional turf to xeriscape, which was done to achieve the annual water savings due to turf conversion (see Appendix F).

Using a five-year study period, this report calculated the break-even point for single-family households and the times when they could expect to start realizing annual savings from turf conversion. Figure 6 summarizes how the savings from turf conversion was calculated.

Figure 6: Cost-Savings Horizon Model



Using the 2014–2015 Tier 1 water-rate data collected from LADWP, we calculated the average annual water rate, and then used that figure as the base water rate for the five-year projection plan.[80] However, over the next five years, the price of water is expected to rise due to complications arising from the ongoing drought, such as dwindling water reserves and the rising cost of importing water to the Los Angeles Basin (see Appendix G). Since 2006, MWD, as the organization from which LADWP purchases water, has steadily been increasing water rates at about 6.4 percent per year.[81]

Additionally, since LADWP cannot unilaterally raise Tier 1 water rates, the savings horizon model cannot assume that LADWP would directly pass on the price increases that they experience to ratepayers. Given this insight, this project assumes a 2 percent and a 6 percent average annual water-rate increase to consumers; these percent increases were then used to project costs and savings from the average annual base rate over five years. The 2 percent increase was chosen to represent a modest water-rate increase due to worsening drought conditions, whereas the 6 percent increase represents the water-rate increase that LADWP experiences, which they could potentially pass on to ratepayers, particularly given a favorable political climate. Lastly, all projected costs and savings in the future were adjusted to present day values using the NPV formula of a 6 percent annual interest rate.[82]

The non-varying aspects of the cost-savings horizon analysis are the annual average landscape converted for CD3 obtained from LADWP, which represents the current average

[75] The Tier 1 water rate data was used because households usually stay within their Tier 1 allotments. Once households use more than LADWP allots them, they are charged at Tier 2 rates, which are generally much more expensive.
[81] Ott, Sarkissian, and Cortez-Davis, "Groundwater Remediation."
[82] "National Rate on Non-Jumbo Deposits (less than $100,000): Savings," Federal Reserve Bank of St. Louis, accessed January 1, 2015. http://research.stlouisfed.org/fred2/series/SAVNRNJ.

program participant. This analysis also projected an annual, Tier 1 water-rate increase between 2 and 6 percent per year over five years to reflect the increasing cost LADWP pays for water. We assume that the rebate amount (i.e., $3.75 for first 1,500 square feet converted, and $2.00 for all converted turf thereafter) will not vary in the same five-year period.

Findings: The average SFH participant in CD3 saved $627 in the first year of turf conversion when compared to their water usage in the previous year. When applying to other CD3 neighborhoods, the annual savings that SFHs in could realize would translate into $901 for Winnetka, $1,469 for Canoga Park, and $3,102 for Tarzana.

Through a forecast model and by using an annual, Tier 1 rate increase of 2 percent and 6 percent, projected savings for a typical single-family household would be between $3,957–$3,550 in the next five years (in 2015 dollars, using a 6 percent annual interest rate) (see Figure 7). Given that the typical turf rebate participant experienced a loss of $2,106 for out-of-pocket costs not covered by the rebate, it would only take three years (at both 2 percent and 6 percent) for the costs to be recouped through water savings.

It should also be noted here that this calculation includes the cost of drip irrigation. As mentioned, drip irrigation is not a requirement for the rebate program; the household could choose to hand-water their plants instead. As such, drip irrigation may have presented an undue cost that, in the past, might have deterred households from utilizing this option (in lieu of hand watering). This finding suggests that investing in drip irrigation, and consequently, its value in mitigating over watering, is worth the opportunity cost of the $968 needed to have it installed. Figure 7 summarizes the five-year water savings for the typical household in CD3.

Figure 7: Five-Year Water Savings for Average SFH in CD3

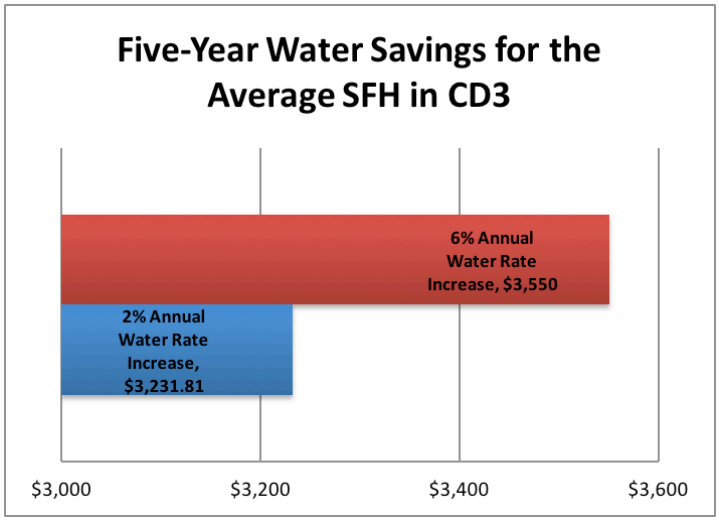


Figure 7 shows that at a 6% annual water rate increase households will save $3,550 dollars over a period of five years. At a 2% water rate increase, households would only save $3,231.81. At the moment, it does not appear as if LADWP will increase their water rates making a 2% increase more current.

Comparatively, SFHs can expect to save between $4,644 to $5,101 in Winnetka, $7,569 to $8,316 in Canoga Park, and $15,983 to $17,559 in Tarzana over the next five years. The average Winnetka landscape conversion nets a negative $4,338 in out-of-pocket costs, but will recoup all of those costs in four years. Larger residential lot sizes, however, will not see savings within the five-year study period. For example, at all rebate levels ($2.75, $3.75, and $4.75) a typical Canoga Park house will need at least six years to recoup their out-of-pocket costs. Tarzana participants, the largest average convertible landscape community, will likely need an excess of ten years before their out-of-pocket costs are recouped (see Table 4).

Table 4: Five-Year Water Savings for Select District 3 Communities

	2% Annual Water Rate Increase	**6% Annual Water Rate Increase**
Average Participant	$3,231.81	$3,550.36
Winnetka	$4,643.88	$5,101.61
Canoga Park	$7,569.44	$8,315.52
Tarzana	$15,983.51	$17,558.94

PART VI – RATEPAYERS PERSPECTIVE

Utilities Financial Analysis

To gain a more thorough perspective regarding a potential increase in the participation rate of the rebate program this report sought to analyze what effect the increase would have on ratepayers by analyzing LADWP's overall financial burden. Moreover, this analysis sought to explore if LADWP could potentially spend less money in the future by reducing the current demand of imported water immediately. The rationale for this analysis follows from the idea that if there is a significant amount of single-family household participation in the rebate program citywide, then the overall demand for water will be reduced both now and in the future, thus compounding participation increases every year.

Currently, MWD and LADWP share the cost burden of the turf rebate program, with LADWP covering $1.75 for the first 1,500 square feet, and MWD reimbursing $2.00 for every square foot thereon.[83] MWD finances this cost burden through a grant from the California Department of Water Resources and grants funding from the federal Bureau of Reclamation.[84] Conversely, LADWP uses ratepayer money to pay their portion of the rebate.[85]

This portion of the analysis, referred to as the cost-savings horizon model, will inform how long it will take LADWP to recoup their investment in the rebate program at their current reimbursement rate, as well as at two other reimbursement levels. Our model relies on the assumption that there will be an annual one percent increase in single-family household participation for the next five years, from 2015 to 2020. Current participation rates in CD3 represent less than half a percent of the total number of single-family households;[86] conversely, CD3 is considered to have higher participation rates compared to other districts in the city.[87] This analysis also assumes the average single-family household in CD3 will convert an average 1,730 square feet of their turf (see Part V of this report). We modeled the rebate levels to reflect the three levels in the financial feasibility model to calculate the potential subsidy payout that both utilities would have to reimburse to program participants. In addition to this disbursement-

[83] Falcon.
[84] The Metropolitan Water District of Southern California, *Implementing the Diversified Resource Portfolio* (Los Angeles: The Metropolitan Water District of Southern California, February 2014), accessed March 13, 2015, http://goo.gl/HnS0Qa
[85] Mark Gentili, (Water Conservation Supervisor, LADWP), e-mail correspondence, March 14, 2015.
[86] Martha Gonzalez (Lead Utility Service Specialist Water Conservation, LADWP), e-mail interview, February 18, 2015.
[87] Molly Peterson, Denise-Marie Guerra, and Chris Keller, "Cash for Grass: How Well is It Working?," 89.3KPCC Southern California Public Radio, last modified July 14, 2014, http://projects.scpr.org/maps/turf-removal-in-southern-california/.

forecasting model, we also developed an investment recuperation timeline for the utilities, based on the long-term water savings from reduced water demand. We chose three rebates levels to coincide with the household financial feasibility analysis. They are the following:

- **Low-end Rebate:** $2.75 per square foot up to 1,500 square feet; $2.00 thereafter. LADWP pays $0.75 per square foot up to 1,500 square feet.

- **Status Quo Rebate:** $3.75 per square foot up to 1,500 square feet; $2.00 thereafter. LADWP pays $1.75 per square foot up to 1,500 square feet.

- **High-end Rebate:** $4.75 square foot up to 1,500 square feet; $2.00 thereafter. LADWP pays $2.75 square foot up to 1,500 square feet.

Methodology: In order to estimate the total subsidy payout for a five percent participation increase in CD3 over a five-year period, we began by finding the total number of single-family household units in the district. The 2000 Census data shows that there were 53,652 single-family household units in that year,[88] five percent of which make up roughly 2,685 single-family housing units.

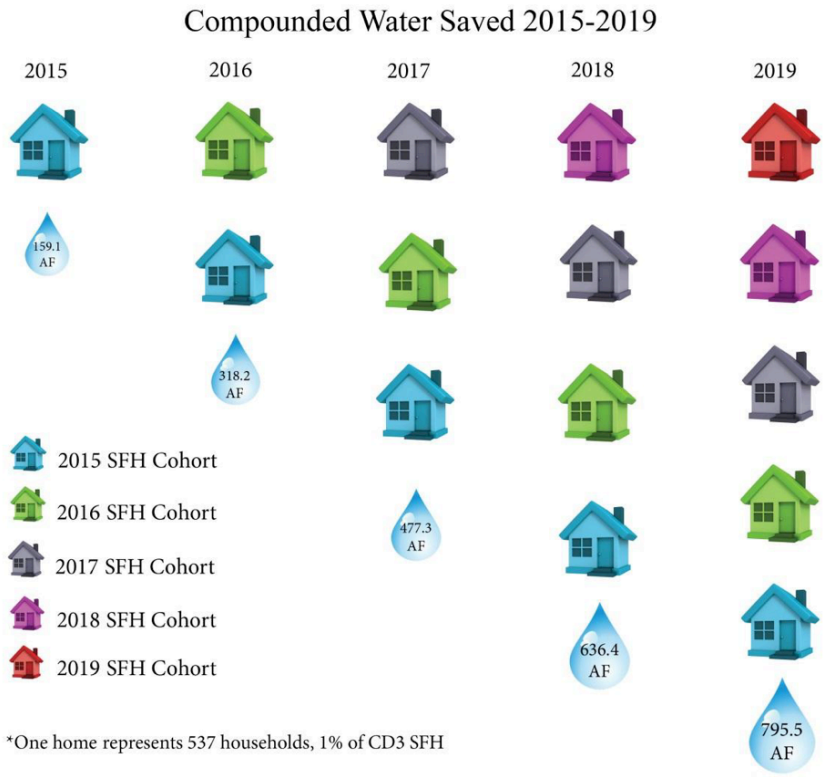
Next, we calculated the total amount that MWD and LADWP would have to pay in rebates at the $2.75, $3.75, and $4.75 levels for a one percent participation increase by multiplying the three rebate levels by the one-percent increase. We then multiplied the rebate payout for that one year by five to account for the five percent increase in participation over the five-year period to determine the total rebate amount paid out for the five year period.

After this calculation, we calculated the average household water savings for 1,730 square feet converted. Using our water calculations (see Appendix H), we multiplied the average water saved per household by five percent of the single-family households in CD3. We converted the gallons of water saved to acre-feet, the measurement unit that MWD uses when determining LADWP's water usage, and then multiplied that amount according to the price of importing water (for water prices, see Appendix G). The net difference in water saved by not having to irrigate a lawn was then used to determine LADWP's water savings.

To determine the investment recuperation timeline, we had to take into account the compounded water saved over a five-year period (see Figure 8). More specifically, for every year in the range of 2015 to 2019, we rolled over the water savings from one percent of the households from the previous year into the next. Using the compounded water savings, we were able to determine what the recovery times would be for the various tier levels.

[88] Los Angeles Department of City Planning, "City of Los Angeles, Population And Housing Estimates, Report Frame Set," Los Angeles Department of City Planning, last modified April 1, 2000, http://goo.gl/yos8Sk

Figure 8: Compounded Water Savings over a 5-Year Period



The figure above demonstrates how compounded water is saved (in acre feet) each year if 5% of SFHs in CD3 were to participate in the rebate program.

Investment Recoupment Timeline

LADWP & MWD Payouts at Different Rebate Levels

If five percent of the single-family households in CD3 were to participate in the program over the next five years, the combined utilities would pay $12.3 to $20.3 million in rebate reimbursements. Table 5, below, summarizes the utilities' total investment in the rebate program given a five percent SFH participation rate in CD3.

Table 5: LADWP & MWD Investment in Rebate

Rebate Levels	Payout for One SFH	Total Rebate Payout for 5% of SFH in CD3
$2.75 – up to 1,500 sq ft, $2.00 – thereafter	$4,585	$12,310,725
$3.75 – up to 1,500 sq ft,	$6,085	$16,338,225

$2.00 – thereafter		
$4.75 – up to 1,500 sq, ft., $2.00 – thereafter	$7,585	$20,365,725

Investment Recoupment Timeline for Utilities:

Our results show that the money invested by the utilities at the various levels would be recuperated within 16 years. At the current $3.75 level, the utilities would see full recoupment by 2028 (See Appendix M). Table 6 shows the recoupment timeline for other different rebate levels.

Table 6: Recoupment Timeline in Years

Rebate Level	Recoupment Timeline
$2.75	11 years (2026)
$3.75	14 Years (2028)
$4.75	16 Years (2031)

LADWP Share – Investment Recoupment Timeline:

Currently, LADWP's financial obligation is $1.75 of the $3.75 rebate (for the first 1,500 square feet of turf converted); amounts exceeding the 1,500-tier cap will be covered by MWD. If five percent of the households in CD3 participate in the rebate program, LADWP's projected financial obligation would be approximately $7 million. Table 7 summarizes LADWP's investment share in the program and the projected payout at each rebate level.

Table 7: LADWP Investment at 1,500 Sq Ft Tier Cap

Rebate Amount	LADWP Payout for One SFH	Total Rebate Payout for 5% of SFH in CD3
$0.75	$1,125	$3,020,625
$1.75	**$2,625**	**$7,048,125**
$2.75	$4,125	$11,075,625

However, by 2022, or within nine years, LADWP would have recouped their investment, and would be realizing compounded water savings every year thereafter (See Appendix M). Our analysis takes this into account because the price of water that LADWP purchases from MWD

continues to rise, and thus there will be an accumulation of money saved due to a reduction in imported water. Table 8 below shows when LADWP would realize their investment.

Table 8: LADWP Investment Recoupment Timeline

Rebate Level	Recoupment Timeline
$0.75	6 Years (2021)
$1.75	**9 Years (2024)**
$2.75	11 Years (2026)

Figure 9, below, summarizes the compounded water savings for five percent of CD3 single-family households at the $3.75 rebate level.

Figure 9: Compounded Water Savings

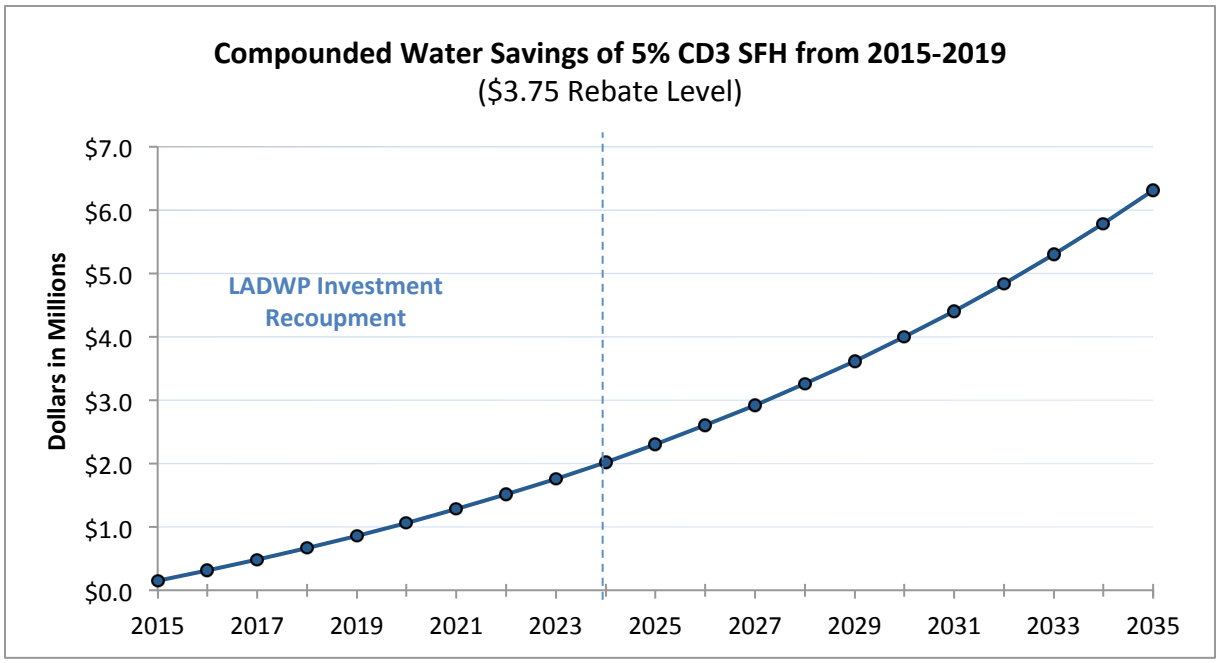


Figure 9 Demonstrates the compounded water savings LADWP will experience over a 10-year period. As each year passes, there is a higher amount saved so that by 2024 the utility would have recovered their portion of the $3.75 rebate.

Modeled Increase in Tier Cap from 1,500 Sq Ft to 2,000 Sq Ft:

If LADWP were to expand the tier cap from 1,500 to 2,000 square feet, the resulting increase would cover more than the current 1,730 square feet average landscape converted by households in CD3. In monetary terms, the increase would raise the amount that the average

CD3 household would receive by $863 at the current $3.75 level ($403 of which LADWP would cover). We presume that a higher reimbursement rebate level would shorten the total amount of time needed for households to break even on their investments in addition to incentivizing households to convert more of their lawns. In Table 9, we see the rebate payouts when the tier cap is increased to 2,000 square feet at the different rebate levels and the recoupment timeline (See Appendix M).

Table 9: LADWP Investment for Increased Tier Cap to 2,000 Sq Ft for the Average SFH Conversion in CD3

Rebate Structure	LADWP Payout for One SFH	Total Rebate Payout for 5% of SFH in CD3	Recoupment Timeline
$.75	$1,298	$3,485,130	6 Years (2021)
$1.75	$3,028	$8,130,180	10 Years (2025)
$2.75	$4,758	$12,773,888	12 Years (2027)

Ratepayer Impact on Future Water Savings

When examining the total elapsed time needed for LADWP to recoup its investment, it is clear that having MWD as a partner is beneficial for the utility, as the combined subsidy from both utilities provides a greater incentive for households to participate without costing ratepayers much money. In essence, increasing LADWP's share in the rebate disbursement burden by one additional dollar, to $2.75, would only delay the utility from making up their investment by two years, even if there was no change in participation rates.

Most importantly, in the long run, the rebate program could potentially save ratepayers money because it could reduce how much Tier 1 and Tier 2 water that LADWP would need to purchase from MWD.[89] Every year, MWD allocates a specific amount of Tier 1 water that LADWP can purchase. In 2011, LADWP's Tier 1 limit was 304,970 AF[90]; any purchase above that amount would mean that LADWP would be charged at the Tier 2 level prices, which are nearly twice as expensive as Tier 1 water.[91] From our analysis, if only five percent of CD3 single-family households participated in the rebate program, LADWP would realize a reduction of 795.5 AF of

[89] Joseph Ramallo, "Mayor Garcetti Announces Increased LADWP Rebate for Residential Turf Removal to Highest Level in Southern California - $3.75," *LADWP News Room*, last modified November 3, 2014, http://goo.gl/3Se3yE
[90] One acre-foot (AF) = 325,851 gallons.
[91] Los Angeles Department of Water and Power. *Urban Water Management Plan* (Los Angeles: LADWP, 2010), accessed March 12, 2015, http://goo.gl/XcWHzl

water each year. If those levels were replicated throughout the city, ratepayers could see a reduction in how much they pay for water, as they would reduce how much Tier 1 water LADWP purchases, and by avoiding the purchase of Tier 2 level water in the long run.

PART VII - POLICY OPTIONS

Based on our research and financial analysis, it is clear that households and ratepayers benefit from investing in the turf replacement rebate program. Therefore, we have put together the following five policy options that our client can use to improve the design of the rebate to improve household accessibility.

1. **Modify the Rebate Level:** This option considers increasing or decreasing the rebate amount to determine how much households would have to bear in out-of-pocket expenses:

    - **$2.75 per square foot:** Decrease the current rebate amount by $1.00. The average participant in CD3 would face $3,606 in out-of-pocket expenses not covered by the rebate, and would see repayment in roughly five years due to savings from reduced water usage.

    - **$3.75 per square foot:** Status Quo option. Based on our conversion cost analysis and conversations with landscape contractors, the current $3.75 per square foot rebate level would cover most costs for the average landscape size in CD3; however, households would face $2,106 in out-of-pocket expenses not covered by the rebate.

    - **$4.75 per square foot:** Increase the total rebate amount by $1.00. Based on the conversion cost analysis, increasing the rebate would result in households with the average landscape size in CD3 facing only $606 in out-of-pocket expenses not covered by the rebate. Increasing the rebate costs could help reduce the economic burden.

2. **Modify the Rebate Tier Structure:** In lieu of not being able to increase the rebate amount, this option considers changing the current tier structure of the rebate. Here, we consider two different tier structures:

    - **Two Tiers:** Status quo option. The current rebate tier structure of $3.75 per square foot for the first 1,500 square feet converted and $2.00 per square foot thereafter.

    - **Increase Tier 1 Cap to 2,000 Ft^2:** Amend the current rebate tier repayment cap from 1,500 square feet to 2,000 square feet. Increasing the tier one cap would provide

households with an extra $1,875 in CD3 to participate in the program, and which potentially would increase the annual participation rate.

3. **Modify the Rebate's Planting Requirements:** This policy option looks at two aspects of the rebate program: (1) modifying the vegetation requirement, where at least 40 percent of the household's project area is to be covered with live native or California-friendly plants; and (2) whether the city should require single-family households to plant native plants over other, alternative drought-resistant plants.

- **Modifying the Vegetation Requirement:** Modifying the Vegetation Requirement: From our research, we learned that a household would have little difficulty meeting the 40 percent minimum requirement, as most households tend to plant more vegetation than is required. Therefore, we believe that no modification is necessary for this vegetation requirement.

- **Require Native Plants: :** Experts familiar with native California plants highly recommend that households install plants that are indigenous to Southern California because of the many benefits to the households, the environment, and the ecosystem (see Appendix I for a full list of these benefits). Moreover, households who plant native plants would not need to rely on drip irrigation since the plants can live off of sparse hand watering. However, there are several issues to consider if the rebate program requires households to use only native plants:

    - **Insufficient supply of native plants in Los Angeles:** There are only several nurseries in Los Angeles that grow native plants. Thus, households would run into a supply problem if they were required to purchase native plants. Currently, native plants are cheaper than the many drought-resistant plants on the market; however, increasing the demand for native plants would likely increase their prices if the supply of native plants did not increase

    - **Lack of education on how to care for native plants:** Even though native plants require less water and maintenance, knowing how to care for native plants is a crucial component, especially when households are in the process of replacing turf. For example, some households may not be aware that some native plants thrive when exposed to the sun while others do not. Knowing how to design a native plant landscape, including where to plant and how wide an area there must be between the plants, are important things that a household should know. Since many are not familiar with native plants, it will take time and resources to educate households how to care for native plants, and thus make the most of their benefits.

Given the issues mentioned above, *requiring* native plants may not be a feasible option at this juncture. When applying the equity criteria, however, native plants are significantly cheaper than other drought-tolerant plants, such as Mediterranean plants. Additionally, native plants are environmentally sustainable because they support the local ecosystem that birds and insects rely on. We have also learned that households could spend as little as $580 to replace a CD3's average landscape size of 1,730 square feet, provided that the city provides the necessary materials, such as mulch and cardboard[92] (see Appendix J for a spreadsheet detailing native plant conversion costs). Despite the benefits and low conversion costs of native plants, Los Angeles does not currently have the supply it would need to meet the demand if the requirement of native plants was in place for the rebate program.

4. **Invest in Public Education:** Public education was one of the most cited barriers to participation in the program.[93] While our analysis does not focus directly on the effective means of public education, we believe that an educational component is crucial for increasing participation rates. The frequently cited issues that experts brought to our attention were the following:

   a) **Aesthetics**: Many households have concerns surrounding the aesthetics of potentially converted lawns. In some cases, households have a misperception that low-water plants are "ugly."[94] We believe that overcoming the issue of aesthetics is possible through more demonstration projects and public-awareness campaigns that can show beautiful alternatives to turf.

   b) **Plant Selection:** Another frequently mentioned challenge was that households have little knowledge of the variety of low-water plants. For example, many households have little understanding of what a California native plant is, and how it is different from Mediterranean plants. We presume that if more households were exposed to the wide variety of plants, they would begin to appreciate them.

   c) **Qualified Landscape Contractors:** We assume that, in most cases, households may not have the time to do their own turf conversion and will, therefore, hire landscape contractors. While there are landscape contractors that perform the turf removal and replacement with low-water plants, the quality of the job will be put in question by certain households. We believe that the LADWP could provide a running list of certified contractors that can offer their services to households interested in converting their

[92] Instead of removing the turf, an alternative would be to start a process that involve covering dried turf with cardboard and mulch for some time before planting Native plants.
[93] Anne Phillips, Phone interview, February 26, 2015.; Falcon.
[94] Ibid.

lawns, thus saving households time and money from searching for the most qualified landscape contractors.

5) Financing Options: Perhaps one of the biggest barriers for residents to participate in the program is the financial component. Currently, the program is structured so that the LADWP reimburses a household *after* it has converted their project area. From our household participant cost test, we noticed that the average cost of conversion is just over $8,000 for 1,730 square feet of landscape. The high up-front costs of participating may be a significant barrier for those who would like to do the conversion, but do not have the savings or credit to pay for it. For example, in 2011 the average household in California had an average $5,785 in their savings accounts.[95] We presume that many households would prefer not to use their savings to pay for the conversion, and thus be left for an extended period without readily available cash for emergencies. Conversely, households may opt for to use their credit cards to pay for the conversion. However, if the process of conversion takes longer than one month, there will be accrued interest and minimum payments that must be paid, which increases the households' participation costs. Given this large financial barrier, LADWP and MWD could partner with low-interest lending organizations to offer households financing options no higher than the rebate amount in order to remove the financial barrier that some households may experience.

[95] Weeks, "Savings Account Balances Decline."

PART VIII - RECOMMENDATIONS

Based on our analysis of our policy options in Part VI, and guided by our aforementioned criteria, we recommend Councilmember Blumenfield advocate for the following policy changes:

1. **Increase the First Tier Cap to 2,000 Square Feet:** From the single-family household financial feasibility analysis, it was estimated that the financial implications for participants under the current tier structure net about $2,000 in out-of-pocket costs. However, since participants must generate the entire conversion costs up-front and wait roughly four to six weeks after the project is complete before getting their rebate, the financial strain for many households is significant. Given this barrier, we suggest increasing the first payment tier from 1,500 square feet to 2,000 square feet to close the financial gap faced by lower-income populations. Increasing the tier level will amount to a $400 reduction in out-of-pocket costs. Additionally, increasing the $3.75 tier cap to 2,000 square feet will act as an added monetary incentive for smaller households in CD3 to convert to xeriscape, without adding as much of a financial burden to LADWP's long-run savings horizon as increasing the total rebate level to $4.75. Here, the impact to ratepayers would be minimal.

2. **Invest in Public Education:** While we did not conduct an analysis of LADWP's current public education campaign, we believe that there are small steps that the agency could make to improve the customer experience for households looking to convert their turf. These small steps are as follows:

    - **Offer more workshops throughout the city**, in different languages, for households looking to learn more about the program and the steps they need to consider for conversion. From our conversations with contractors and native plant specialists, it is clear that residents could save more and do more aesthetically if they were more informed about each step of the conversion process. Currently, a workshops flyer listed on LADWP's Web site shows workshops only in Downtown Los Angeles and in Van Nuys. These locations may be logistically difficult for some city residents to attend, and thus may be a barrier to more effective conservation efforts.

    - **Centralize MWD and LADWP turf rebate Web sites**. Presently, MWD has their "Be Water Wise" Web site, on which they have videos for customers who would like step-by-step guidance on how to convert their turf. In addition, LADWP has their own "California Friendly Landscape" Web site, where they offer garden

designs and plant selections. However, for certain consumers, having more than two Web sites may be confusing and the available information too overwhelming. Centralizing the data and resources could be a useful and an efficient tool for all households.

- **Encourage native plants over California-friendly plants:** Experts familiar with native plants strongly recommend that households install plants that are indigenous to Southern California because of their many benefits to households, the environment, and the ecosystem (see Appendix I for a full list of benefits). Moreover, households that carefully plant native plants not only will use less water but also the plants can eventually become dependent on rainwater alone, thus eliminating the need to hand-water or use drip irrigation. LADWP should consider incorporating the emphasis of planting native plants into their public education campaign to begin to positively changing people's minds about how attractive these plants can be.

3. **Offer Households a Financing Option:** Due to the high up-front costs of participating in the rebate program, the City of Los Angeles should work with relevant company programs, such as the Home Energy Renovation Opportunity (HERO) Property Assessed Clean Energy (PACE)[96] program, which gives low-interest loans to households seeking to purchase water-efficient products. Providing households with the up-front capital to pay for their turf conversion could potentially remove one of the largest household participation barriers.

[96] "Home," PACENow: Financing Energy Efficiency, accessed March 1, 2015, http://www.pacenow.org.

PART IX - CONCLUSION

This report discussed the features and challenges that the turf replacement rebate program faces in the City of Los Angeles, and especially for those households in CD3. While our analysis shows that the current rebate amount covers a large portion of the conversion costs, LADWP has done little to connect households with viable financing options. Fortunately, the Los Angeles County Board of Supervisors recently passed a board motion allowing the PACE financing program to be available for households in Los Angeles.

Inspired by our conversations with local environment experts, ideally, we would require households to plant Native plants when converting their turf, and to switch to watering their lawns with rain barrels or the like so that their plants would only be dependent on rain. Yet, as our initial analysis shows, it is not feasible to require this action at this juncture, and thus we resort to simply encouraging residents to follow this model. Even though shifting the aesthetic value of turf among consumers has been a slow process, LADWP has been encouraged to see more households participating in the rebate program.

The current state of the drought has created the opportune time for policymakers to encourage residents to rid of their lawns for more sustainable options. Ultimately, we believe that the City of Los Angeles can do more in encouraging this shift through its rebate program, as other turf replacement programs have done throughout the country. This can be done by investing more in education, media presence, and community outreach to effectively communicate with the many diverse communities in the city the many financial and environmental benefits of converting turf to more sustainable, ecologically-friendly, native plants.

Appendices

APPENDIX A: Historical Household Rebate Participation Analysis

The historical household rebate participation analysis looks at the years of 2011 to 2014 to analyze the participation rates (in square feet of turf converted each year by community) to estimate how much was paid out in rebates and how much water was saved. This analysis helped us determine average participation levels, however it does not tell us how many homes participated in the rebate.

Step One: Collect the total square feet of turf converted to xeriscape in District 3 from 2011 to 2014.[97]

Turf Conversions by Year (Square Feet)				
	2011	2012	2013	2014
Winnetka (91306)	11,726	6,122	14,577	6,009
Reseda (91335)	2,137	121	18,260	11,481
Woodland Hills (91367) (91364)	24,134	6,400	20,222	39,874
Canoga Park (91303) (91304)	11,507	2,017	23,112	32,724
Tarzana (91356)	7,018	4,361	20,473	32,253
Total:	**56,522**	**19,021**	**96,644**	**122,341**

Step Two: Calculate the total water savings in gallons associated with one square foot of turf removed and replaced with xeriscape. Convert gallons into acre-feet measurement units in order to be able to calculate how much LADWP pays MWD for that amount of water. (1 Acre Foot = 325,851 Gallons)

Water Savings				
	2011	2012	2013	2014
Gallons Saved Due to Conversion (Square Feet x Water Use by Square Feet)	4,333,316	1,458,264	7,409,309	9,379,395
Acre Feet of Water Saved Due to Conversion (Total Gallons Saved/ 325,851 Gallons)	13.3	4.5	22.7	28.8

Step Three: LADWP's share of the Rebate Program is $1 per square foot. We multiplied that amount by the total square feet District 3 converted every year between 2011 and 2014. We then calculated how much LADWP saves by having to import less water. Our results show that in the first year, LADWP pays out more than the amount of money they would save by importing less water.

For example, in 2011, LADWP paid $56,522.00 to residents who participated in the rebate; the agency only realized $9,894.05 in water savings the first year. However, we know that historically LADWP's purchased imported water costs have risen at a steady 6.4%[98] every year. At that rate, LADWP would recuperate their initial investment by 2015 and see savings

[97] Molly Peterson, Denise-Marie Guerra, and Chris Keller. 89.3 KPCC Radio.

[98] Ott, Stephen, Maral Sarkissian, and Evelyn Cortez. "San Fernando Basin Groundwater Remediation & Clean-Up Initiative and Ground Water Replenishment." LADWP SoCal Water Dialogue. October 23, 2013. Accessed February 6, 2015.

every year thereafter. Nevertheless, we calculated their NPV at a 6% interest rate for five years in the future and our results came back positive, resulting in nearly $3,284.89 added value for the utility.

LADWP Investment				
	2011	2012	2013	2014
LADWP Money Paid Out for Rebate ($1/Sqft Rebate)	$56,522.00	$19,021.00	$96,644.00	$122,341.00
Reduced Water Imports in First Year (Acre Feet x MWD Water Rates)	$9,894.05	$3,551.96	$19,259.37	$25,618.03
Net Difference in One Year (Rebate Payout - Reduced Water Demand)	$46,627.95	$15,469.04	$77,384.63	$96,722.97
Net Present Value (5- Year Savings)	$49,912.84	$17,934.41	$96,019.11	$129,618.19

In the table above, it is clear that LADWP's net present value from paying out $1 per square foot is higher than the cost of them paying that amount currently. The figure shows how the higher the water savings the higher the net present value.

Acre Feet (AF) of Water Saved Due to Conversion					
Year	LADWP Price of Water Per Acre Feet (Average Growth Rate 6.4%)	AF 13.3	AF 4.5	AF 22.7	AF 28.8
2011	$744.00	$9,895.20			
2012	$793.69	$10,556.08	$3,571.61		
2013	$847.00	$11,265.10	$3,811.50	$19,226.90	
2014	$890.00	$11,837.00	$4,005.00	$20,203.00	$25,632.00
2015	$946.96	$12,594.57	$4,261.32	$21,495.99	$27,272.45
2016	$1,007.57	$13,400.62	$4,534.04	$22,871.74	$29,017.88
2017	$1,072.05	$14,258.26	$4,824.22	$24,335.53	$30,875.03
2018	$1,140.66	$15,170.79	$5,132.97	$25,893.00	$32,851.03
2019	$1,213.66	$16,141.72	$5,461.48	$27,550.15	$34,953.50
2020	$1,291.34	$17,174.79	$5,811.02	$29,313.36	$37,190.52
2021	$1,373.98	$18,273.98	$6,182.92	$31,189.42	$39,570.71
	Money Saved Due to Conversion:	$140,672.90	$47,596.09	$222,079.09	$257,363.13
	LADWP Total Payout:	$56,522.00	$19,021.00	$96,644.00	$122,341.00

APPENDIX B: Energy Efficient /Water Conservation LADWP Rebate Programs

Program[99]	Rebate Amount	Cost of Participation
ENERGY STAR® Qualified Refrigerator	$65.00 per unit (Limit 1 unit per household)	Medium
High-Efficiency Clothes Washer	$300.00 per unit (Limit 1 rebate application per household)	Medium
ENERGY STAR® Qualified Residential Window	$2 per sq ft	High
Cool Roof	$0.20 to $0.30 per sq ft	High
ENERGY STAR® Qualified Room Air Conditioner	$50 per unit	Medium
Heating Ventilation and Air Conditioning (HVAC) System	Air Conditioner Up to $120 per ton Heat Pump $100 per ton	High
Whole House Fan	$200 per unit	Medium
Weather-Based Irrigation Controllers	$200.00 per unit (<1 acre) $35.00 per station (≥1 acre)	Medium
Soil Moisture Sensor System	$200.00 per unit (<1 acre) $35.00 per station (≥1 acre)	Medium

[99] "Rebates & Programs," *LADWP.com.* Date Accessed February 5, 2015. https://www.ladwp.com/ladwp/faces/ladwp/residential/r-savemoney/r-sm-rebatesandprograms?_afrWindowId=null&_afrLoop=11301845445025&_afrWindowMode=0&_adf.ctrl-state=329roxnlb_4#%40%3F_afrWindowId%3Dnull%26_afrLoop%3D11301845445025%26_afrWindowMode%3D0%26_adf.ctrl-state%3D9cfwc8r4b_4

Rotating Nozzles	$8.00 per nozzle	Low
Turf Replacement	$3.75 per square foot for the first 1,500 square feet, and $2 per square foot thereafter with no cap	High
Variable Speed or Variable Flow Pool Pump and Motor	$500 per unit	Medium
Certified Pool Pump Replacement Program	Up to $1,000	High
The Solar Photovoltaic Incentive Program (SIP)		High
High-Efficiency Toilets	$150 per unit	Low

APPENDIX C: Average Single-Family Household Financial Feasibility & Sensitivity Analysis

Step 1: The Rebate disbursement amount for the average turf rebate participant was calculated at the $2.75, $3.75 (current level), and $4.75 levels.

D3 AVERAGE LANDSCAPE SIZE CONVERTED: 1,730 SQFT		
Rebate: $2.75	$2.75 up to 1,500 sq ft	$4,125.00
	$2.00 thereafter	$460.00
	Total:	**$4,585.00**
Rebate: $3.75	$3.75 up to 1,500 sq ft	$5,625.00
	$2.00 thereafter	$460.00
	Total:	**$6,085.00**
Rebate: $4.75	$4.75 up to 1,500 sq ft	$7,125.00
	$2.00 thereafter	$460.00
	Total:	**$7,585.00**

Step 2: To determine the cost turf conversion, 40% was multiplied by the total amount of convertible turf (1,730) to account for the 40% vegetation requirement. The remaining 60% of convertible turf was then used to calculate the non-vegetation costs of conversion.

COST OF PLANT INSTALLATION:			
	1730 sq ft	Cost	Calculation
40% Vegetation Requirement:	692 sq ft	$2,863.45	Native Plants+ Installation: 7.25 sq ft = $30
60% Mulch:	1,038 sq ft	$1,038.00	Mulch + Installation Cost: $1
Total:	**1,730 sq ft**	**$3,901.45**	

Step 3: To calculate the cost of turf grass removal, the total amount of replaceable landscape was multiplied by $1.92, which represents the cost per square foot.

Cost Of Turf Removal			
Landscape Removal	$1.92 per sq ft	$3,321.60	*Includes Labor
	Total:	**$3,321.60**	

Step 4: The above two figure were summed to arrive at the total cost of conversion. In addition to this figure, the cost of drip irrigation was also

calculated.

Total Cost of Conversion		Drip-Irrigation Installation Costs
Installation	$3,901.45	$967.94
Removal	$3,321.60	
Total	$7,223.05	$8,109.99

Step 5: The net cost of conversion represents to total rebate amount (at different rebate levels) subtracted from the total cost of conversion.

Net Cost at Different Rebate Amounts	
$2.75	$-3,605.99
$3.75	$-2,105.99
$4.75	$-605.99

Step 6: Beginning with the average annual 2014-2015 water rate, a 2% and 6% annual interest rate was applied each year to account for the rising cost of water.

6% Annual Water Rate Increase		2% Annual Water Rate Increase	
2014-15 Water Rate Average	$4.86	2014-15 Water Rate Average	$4.86
2016	$5.15	2016	$4.96
2017	$5.46	2017	$5.06
2018	$5.79	2018	$5.16
2019	$6.14	2019	$5.26
2020	$6.50	2020	$5.37

Step 7: Using the projected water rates calculated above and the amount of annual water savings calculated in "Appendix G," the cost savings for each year were calculated by subtracting the utility cost before turf conversion by the utility cost after turf conversion.

District 3 5/yr. Water Savings (2% Annual Water Rate Increase)	Total Annual HH Water Use (HCF) Before	Total Annual HH Water Use (HCF) After	
	177.32	48.26	
	Before Conversion	After Conversion	Difference
2015	$861.78	$234.54	$627.23
2016	$879.01	$239.23	$639.78

2017	$896.59	$244.02	$652.57
2018	$914.52	$248.90	$665.62
2019	$932.81	$253.88	$678.94
2020	$951.47	$258.96	$692.51
	Net Difference Water Savings		$3,956.65
	Net Present Value		$3,231.81

District 3 5/yr. Water Savings (6% Annual Water Rate Increase)	Total Annual HH Water Use (HCF) Before	Total Annual HH Water Use (HCF) After	
	177.32	48.26	
	Before Conversion	After Conversion	Difference
2015	$861.78	$234.54	$627.23
2016	$913.20	$248.54	$664.66
2017	$968.17	$263.50	$704.67
2018	$1,026.68	$279.43	$747.26
2019	$1,088.74	$296.32	$792.43
2020	$1,152.58	$313.69	$838.89
	Net Difference Water Savings		$4,375.13
	Net Present Value		$3,550.36

APPENDIX D: Landscape Estimate for CD3

	Address	Zip Code	Room/Bath	House Sq ft*	Lot Size**	Estimated Landscape	Landscape Size in Square Feet
Canoga Park							
1	22042 Rayen St	91304	4 bed/4 bath	3,030	11,325	30%	3,398
2	8544 Nevada Ave	91304	4 bed/3 bath	2,022	10,890	35%	3,812
3	8530 Browns Creek Ln	91304	5 bed/3 bath	2,627	7,840	75%	5,880
4	21200 Chase St	91304	3 bed/2 bath	1,008	22,651	30%	6,795
5	8356 Deering Ave	91304	4 bed/3 bath	1,795	5,662	30%	1,699
6	22106 Hackney St	91304	4 bed/3 bath	3,500	9,931	35%	3,476
7	22136 Leadwell S	91304	3 bed/4 bath	1,495	6,747	35%	2,361
8	22637 Kittridge St	91304	3 bed/2 bath	1,828	7,687	40%	3,075
9	22627 Sylvan St	91304	3 bed/2 bath	1,817	11,761	25%	2,940
10	22639 Calvert St	91304	6 bed/5 bath	4,552	43,560	65%	28,314
11	7926 Capistrano Ave	91304	4 bed/2 bath	1,362	7,502	30%	2,251
12	7459 Sausalito Ave	91304	3 bed/2 bath	7,884	1,436	45%	646
13	7108 Variel Ave	91303	2 bed/1 bath	702	5,009	25%	1,252
14	22500 Criswell St	91307	4 bed/2 bath	1,911	7,627	30%	2,288
15	21014 Chase St	91304	4 bed/2 bath	1,678	6,141	20%	1,228
Average for Canoga Park				2481	11051	37%	4,052
Reseda							
1	7811 Vanalden Ave	91335	4 bed/2 bath	1,627	21780	75%	16,335
2	8043 Zelzah Ave	91335	4 bed/2 bath	1,192	6,098	30%	1,829
3	7330 Darby Ave	91335	2 bed/2 bath	1,376	9,657	75%	7,243
4	18143 Welby Way	91335	3 bed/1 bath	1,086	6,099	50%	3,050
5	6700 Bothwell Rd	91335	4 bed/2 bath	1,370	6,098	30%	1,829
6	19500 Blythe St	91335	4 bed/3 bath	1,707	7,518	60%	4,511
7	18314 Saticoy St	91335	2 bed/1 bath	868	5,894	70%	4,126
8	6946 Newcastle Ave	91335	4 bed/2 bath	1,612	6,697	60%	4,018
9	19360 Lemay St	91335	2 bed/1 bath	1,016	6,054	75%	4,541
10	7021 Oakdale Ave	91306	3 bed/2 bath	1,306	8,102	30%	2,431
11	19430 Cohasset St	91335	3 bed/2 bath	1,283	10,062	25%	2,516
12	7007 Sylvia Ave	91335	3 bed/1 bath	972	6,969	20%	1,394
13	6758 Yolanda Ave	91335	3 bed/2 bath	1,640	7,405	15%	1,111
14	18211 Gault St	91335	5 bed/3 bath	1,966	6,316	10%	632
15	18728 Saticoy St	91335	4 bed/2 bath	1,606	6,098	15%	915
Average for Reseda				1375	8056	43%	3,437
Woodland Hills							

1	24301 Hatteras St	91367	4 bed/2 bath	2,016	11,761	60%	7,057
2	23419 Berdon St	91367	3 bed/2 bath	2,063	9,997	40%	3,999
3	22601 Marylee St	91367	4 bed/3 bath	2,552	6,512	35%	2,279
4	4830 Regalo Rd	91367	4 bed/3 bath	2,788	6,534	50%	3,267
5	4623 San Feliciano Dr	91367	4 bed/3 bath	2,360	9,827	25%	2,457
6	21242 Golondrina St	91367	4 bed/4 bath	3,142	8,317	70%	5,822
7	21488 Arcos Dr	91367	4 bed/3 bath	2,980	5,357	30%	1,607
8	4810 Quedo Pl	91367	5 bed/5 bath	5,600	18,730	35%	6,556
9	20520 Oxnard St	91367	3 bed/2 bath	1,404	7,840	45%	3,528
10	4250 Canoga Ave	91367	3 bed/2.5 bath	2,213	7,817	70%	5,472
11	23357 Canzonet St	91367	3 bed/2.5 bath	2,165	10,740	25%	2,685
12	4766 Larkwood Ave	91367	3 bed/2 bath	2,012	9,147	20%	1,829
13	22024 Velicata St	91364	3 bed/2 bath	1,520	6,272	20%	1,254
14	5707 Rawlings Ave	91367	3 bed/2 bath	1,800	16117	30%	4,835
15	5308 Canoga Ave	91364	3 bed/2 bath	1,496	6,226	15%	934
Average for Woodland Hills				**2407**	**9413**	**38%**	**3,577**
Tarzana							
1	19985 Oxnard St	91367	4 bed/3 bath	3,296	16,552	30%	4,966
2	18738 Sylvan St	91335	5 bed/3 bath	2,263	9,021	35%	3,157
3	5210 Bothwell Rd	91356	3 bed/3 bath	2,320	20,037	25%	5,009
4	19246 Casa Pl	91356	4 bed/5 bath	5,000	20,473	75%	15,355
5	4889 La Montana Cir	91356	4 bed/4 bath	3,293	17,859	60%	10,715
6	4404 Vanalden Ave	91356	4 bed/4 bath	3,548	36,590	45%	16,466
7	18549 Saint Moritz Dr	91356	5 bed/4 bath	3,819	43,560	75%	32,670
8	3728 Gleneagles Dr	91356	4 bed/4 bath	3,548	22,651	45%	10,193
9	4237 Ellenita Ave	91356	3 bed/3 bath	2,631	16,988	50%	8,494
10	4944 Palo Dr	91356	4 bed/4 bath	3,700	23,522	55%	12,937
11	5320 Mecca Ave	91356	3 bed/3 bath	2,707	10,036	15%	1,505
12	3859 Winford Dr	91356	5 bed/7 bath	6,399	27,007	70%	18,905
13	4560 Jubilo Dr	91356	4 bed/3 bath	2,564	12,197	15%	1,830
14	5514 Sylvia Ave	91356	5 bed/5 bath	4,273	7,056	30%	2,117
15	6176 Yolanda Ave	91335	3 bed/2 bath	2,400	12,632	25%	3,158
Average for Tarzana				**3451**	**19745**	**43%**	**8,556**
Winnetka							
1	20728 Malden St	91306	4 bed/2 bath	1,870	5,924	20%	1,185
2	8356 Hatillo Ave	91306	2 bed/1 bath	868	9,408	75%	7,056
3	8421 Kelvin Ave	91306	3 bed/2 bath	1,512	4,791	25%	1,198
4	19936 Community St	91306	3 bed/2 bath	1,599	5,488	25%	1,372
5	8076 Mcnulty Ave	91306	3 bed/2 bath	1,407	7,623	20%	1,525
6	20324 Strathern St	91306	4 bed/2.5 bath	3,229	6,534	40%	2,614
7	19748 Blythe St	91306	4 bed/3 bath	2,663	5,227	30%	1,568
8	20640 Runnymede St	91306	3 bed/2 bath	1,226	7,710	50%	3,855
9	6762 Cozycroft Ave	91306	3 bed/1 bath	1,092	7,840	30%	2,352
10	19841 Hamlin St	91306	4 bed/4 bath	1,783	7,405	25%	1,851
1	8015 Limerick Ave	91306	4 bed/2 bath	1,600	7,753	15%	1,163

11							
12	20651 Covello St	91306	3 bed/2 bath	1,216	7,488	25%	1,872
13	8126 Hatillo Ave	91306	3 bed/2 bath	1,372	9,454	50%	4,727
14	20404 Hamlin St	91306	4 bed/2 bath	1,364	7,710	25%	1,928
15	19900 Bryant St	91306	3 bed/2 bath	1,225	8,638	35%	3,023
Average for Winnetka				1,602	7,266	33%	2,486
DISTRICT 3 AVERAGE				2,263	11,106	39%	4,294
	District 3 Estimated Landscape Size (SqFt)		Mean	Median	Q1	Q3	
			4,857	3,023	1,829	4,987	

*LA County Office of the Assessor: http://maps.assessor.lacounty.gov/GVH_2_2/Index.html?configBase=http://maps.assessor.lacounty.gov/Geocortex/Essentials/REST/sites/PAIS/viewers/PAIS_hv/virtualdirectory/Resources/Config/Default

**Zillow

APPEDIX E: Selected District 3 Communities: Single-Family Household Financial Feasibility & Sensitivity Analysis

The same methodology used to develop the average single-family household net cost and long-term water savings was used to develop the net cost and water savings figures for the average single-family households in Winnetka, Canoga Park, and Tarzana. These communities were chosen to represent typical small, medium, and large landscape sizes in CD3.

Water Rate Increases Applied to all Three Neighborhoods

6% Annual Increase		2% Annual Increase	
2014-15	$4.86	2014-15	$4.86
2016	$5.15	2016	$4.96
2017	$5.46	2017	$5.06
2018	$5.79	2018	$5.16
2019	$6.14	2019	$5.26
2020	$6.50	2020	$5.37

Winnetka

COST OF PLANT INSTALLATION:			
40% Vegetation Requirement:	994 sq ft	$4,114.76	Native Plants+ Installation: $7.25 per sq ft = $30
60% Mulch:	1,492 sq ft	$1,491.60	Mulch + Installation Cost: $1 per sq ft
Total:	**2,486 sq ft**	**$5,606.36**	

Cost of Turf Removal			
Landscape Removal	$1.92 sq ft	$4,773.12*	*Includes Labor
	Total:	**$4,773.12**	

Total Cost of Conversion		
Installation	$5,606.36	$1,555.29 *Drip-Irrigation Installation Costs (Homewyse)*
Removal	$4,773.12	
Total	**$10,379.48**	**$11,934.76**

Net Cost at Different Rebate Amounts	
$2.75	$-5,837.76
$3.75	$-4,337.76
$4.75	$-2,837.76

Winnetka 5/yr. Water Savings (2% Annual Water Rate Increase)	**Total Annual HH Water Use (HCF) Before**	**Total Annual HH Water Use (HCF) After**	
	254.79	**69.34**	
	Before Conversion	**After Conversion**	**Difference**
2015	$1,238.28	$336.99	$901.29
2016	$1,263.04	$343.73	$919.31
2017	$1,288.31	$350.61	$937.70
2018	$1,314.07	$357.62	$956.45
2019	$1,340.35	$364.77	$975.58
2020	$1,367.16	$372.07	$995.09
	Net Difference Water Savings		**$5,685.43**
	Net Present Value		**$4,643.88**

Winnetka 5/yr. Water Savings (6% Annual Water Rate Increase)	**Total Annual HH Water Use (HCF) Before**	**Total Annual HH Water Use (HCF) After**	
	254.79	**69.34**	
	Before Conversion	**After Conversion**	**Difference**
2015	$1,238.28	$336.99	$901.29
2016	$1,312.17	$357.10	$955.07
2017	$1,391.15	$378.60	$1,012.56
2018	$1,475.23	$401.48	$1,073.76
2019	$1,564.41	$425.75	$1,138.66
2020	$1,656.14	$450.71	$1,205.43
	Net Difference Water Savings		**$6,286.76**
	Net Present Value		**$5,101.61**

Canoga Park

Average Landscape Size:	**4,052 Sq ft**	
Rebate: **$**2.75	$2.75 up to 1,500 sq ft	$4,125.00
	$2.00 thereafter	$5,104.00
	Total:	**$9,229.00**
Rebate: **$**3.75	$3.75 up to 1,500 sq ft	$5,625.00
	$2.00 thereafter	$5,104.00
	Total:	**$10,729.00**
Rebate: **$**4.75	$4.75 up to 1,500 sq ft	$7,125.00
	$2.00 thereafter	$5,104.00
	Total:	**$12,229.00**

Cost of Plant Installation			
40% Vegetation Requirement:	1,621 sq ft	$6,706.76	Native Plants+ Installation: $7.25 per sq./ft. = $30
60% Mulch:	2,431 sq ft	$2,431.20	Mulch + Installation Cost: $1 per sq./ft.
Total:	**4,052 sq ft**	**$9,137.96**	

COST OF TURF REMOVAL			
Landscape Removal	$1.92 sq ft	$7,779.84	*Includes Labor
	Total:	**$7,779.84**	

Total Cost of Conversion		Drip-Irrigation Installation Costs
Installation	$9,137.96	$2,230.00
Removal	$7,779.84	
Total	**$16,917.80**	**$19,147.80**

Net Cost at Different Rebate Amounts	
$2.75	$-9,918.80
$3.75	$-8,418.80
$4.75	$-6,918.80

Canoga Park 5/yr. Water Savings (2% Annual Water Rate Increase)	Total Annual HH Water Use (HCF) Before	Total Annual HH Water Use (HCF) After	
	415.32	**113.04**	
	Before Conversion	**After Conversion**	**Difference**
2015	$2,018.46	$549.37	$1,469.08
2016	$2,058.82	$560.36	$1,498.46
2017	$2,100.00	$571.57	$1,528.43
2018	$2,142.00	$583.00	$1,559.00
2019	$2,184.84	$594.66	$1,590.18
2020	$2,228.54	$606.55	$1,621.98
	Net Difference Water Savings		**$9,267.14**
	Net Present Value		**$7,569.44**

Canoga Park 5/yr. Water Savings (6% Annual Water Rate Increase)	Total Annual HH Water Use (HCF) Before	Total Annual HH Water Use (HCF) After	
	415.32	**113.04**	
	Before Conversion	**After Conversion**	**Difference**
2015	$2,018.46	$549.37	$1,469.08
2016	$2,138.90	$582.16	$1,556.74
2017	$2,267.65	$617.20	$1,650.45
2018	$2,404.70	$654.50	$1,750.20
2019	$2,550.06	$694.07	$1,856.00
2020	$2,699.58	$734.76	$1,964.82
	Net Difference Water Savings		**$10,247.29**
	Net Present Value		**$8,315.52**

Tarzana

Average Landscape Size:	**8,556 sq ft**	
Rebate: **$**2.75	$2.75 up to 1,500 sq ft	$4,125.00
	$2.00 thereafter	$1,972.00
	Total:	**$6,097.00**
Rebate: **$**3.75	$3.75 up to 1,500 sq ft	$5,625.00
	$2.00 thereafter	$1,972.00
	Total:	**$7,597.00**
Rebate: **$**4.75	$4.75 up to 1,500 sq ft	$7,125.00
	$2.00 thereafter	$1,972.00
	Total:	**$9,097.00**

Cost of Plant Installation			
40% Vegetation Requirement:	3,422 sq ft	$14,161.66	Native Plants+ Installation: $7.25 per sq ft = $30
60% Mulch:	5,134 sq ft	$5,133.60	Mulch + Installation Cost: $1 per sq ft
Total:	**8,556 sq ft**	**$19,295.26**	

Cost of Turf Removal			
Landscape Removal	$1.92 per Sq ft	$16,427.52	*Includes Labor
	Total:	**$16,427.52**	

Total Cost of Conversion		Drip-Irrigation Installation Costs (Homewyse)
Installation	$19,295.26	$12,344.00
Removal	$16,427.52	
Total	**$35,722.78**	**$48,066.78**

Net Cost at Different Rebate Amounts	
$2.75	$-41,969.78
$3.75	$-40,469.78
$4.75	$-38,969.78

Tarzana 5/yr. Water Savings (2% Annual Water Rate Increase)	Total Annual HH Water Use (HCF) Before	Total Annual HH Water Use (HCF) After	
	876.98	**238.69**	
	Before Conversion	**After Conversion**	**Difference**
2015	$4,262.12	$1,160.03	$3,102.09
2016	$4,347.37	$1,183.23	$3,164.13
2017	$4,434.31	$1,206.90	$3,227.41
2018	$4,523.00	$1,231.04	$3,291.96
2019	$4,613.46	$1,255.66	$3,357.80
2020	$4,705.73	$1,280.77	$3,424.96
	Net Difference Water Savings		**$19,568.36**
	Net Present Value		**$15,983.51**

Tarzana 5/yr. Water Savings (6% Annual Water Rate Increase)	Total Annual HH Water Use (HCF) Before	Total Annual HH Water Use (HCF) After	
	876.98	**238.69**	
	Before Conversion	**After Conversion**	**Difference**
2015	$4,262.12	$1,160.03	$3,102.09
2016	$4,516.45	$1,229.25	$3,287.19
2017	$4,788.31	$1,303.25	$3,485.06
2018	$5,077.71	$1,382.02	$3,695.70
2019	$5,384.66	$1,465.56	$3,919.10
2020	$5,700.37	$1,551.49	$4,148.89
	Net Difference Water Savings		**$21,638.03**
	Net Present Value		**$17,558.94**

APPENDIX F: Household Water Savings Horizon Calculations

This model allowed for an evaluation of each timeframe incidence of water spending for households that have and have not converted their turf over a five-year period. Each period was developed using these inputs, respectively:

1) Household Water Consumption Costs Prior to Conversion

- *Existing utility cost prior to conversion:* The product of the average annual water usage for a single-family household in hundred cubic feet (HFC) multiplied by the average landscape size in square feet. The annual water use figure was adjusted to account for over watering.[100]
- *LADWP average annual water rate:* The price of water, $4.86 per HFC, was used for the first year and adjusted using a 2% and 6% annual increase thereafter for five years.

2) Household Water Consumption Costs After Conversion

- Based on a previous xeriscape study findings, we applied a *73% annual water savings* to annual outdoor water usage rates. This will determine the reduction in water use, thereby revealing the amount of cost savings, by single-family households due to turf conversion. The same water rates calculated in the previous period will be used.

[100] This is an estimate based off of the California Homebuilders Foundation's report: *Water Use in the California Residential Home* (Stockton, CA: ConSol, 2010), 9, accessed January 15, 2015, http://goo.gl/Yk4oA7

APPENDIX G: Rising Cost of Purchasing Imported Water from MWD

Price of MWD Water, Per Acre Feet (Average Growth Rate 6.4%)[101]	
Year	Price
2011	$744.00
2012	$793.69
2013	$847.00
2014	$890.00
2015	$946.96
2016	$1,007.57
2017	$1,072.05
2018	$1,140.66
2019	$1,213.66
2020	$1,291.34
2021	$1,373.98
2022	$1,461.92
2023	$1,555.48
2024	$1,655.03
2025	$1,760.95
2026	$1,873.65
2027	$1,993.57
2028	$2,121.16
2029	$2,256.91
2030	$2,401.35
2031	$2,555.04
2032	$2,718.56
2033	$2,892.55
2034	$3,077.67
2035	$3,274.64

[101] Ott, Stephen, Maral Sarkissian, and Evelyn Cortez. "San Fernando Basin Groundwater Remediation & Clean-Up Initiative and Ground Water Replenishment." LADWP SoCal Water Dialogue. October 23, 2013. Accessed February 6, 2015.

APPENDIX H: Water Consumption Equations

	Equation Used:
Annual Outdoor Water Use (including overwatering):	**Annual Outdoor Water Use Estimate:** 54.3 inches[102] x 0.6233 x Area in Square Feet[103] 54.3 = is the reference for evapotranspiration (ET) for District 3 which is the total amount of water, in inches, per year that turf grass requires in a specific climate; i.e. climate-based water requirements for turf. 0.6233 = conversion factor needed for the equation to output number of water in gallons Area = square feet of landscaping **Overwatering Estimate:** 43 gallons x Area[104] **Total Household Water Consumption = Annual Outdoor Water Use + Annual Overwatering Estimate**
Annual Water Savings Due to Conversion:	55.8 gallons x Square Feet of Turf[105]
Gallons to Acre Feet:	1 Acre Feet = 325, 851 Gallons

[102] "Home," *LandscapeResource.com,* accessed March 15, 2015, http://landscaperesource.com/.
[103] "Home," Alliance for Water Efficiency, last modified 2011, http://www.home-water-works.org/.
[104] "*Water Use in the California Residential Home*," California Homebuilding Association. June 2010
[105] Sovocool, *Xeriscape Conversion Study.*

APPENDIX I: Benefits of California Native Plants on Environment

Saves Water	Once established, many native plants need minimal irrigation beyond normal rainfall.
Low Maintenance	Low maintenance landscaping methods are a natural fit with native plants that are already adapted to the local environment. Look forward to using less water, little to no fertilizer, little to no pesticides, less pruning, and less of your time.
Pesticide Freedom	Native plants have developed their own defenses against many pests and diseases. Since most pesticides kill indiscriminately, beneficial insects become secondary targets in the fight against pests. Reducing or eliminating pesticide use lets natural pest control take over and keeps garden toxins out of our creeks and watersheds.
Wildlife Viewing	Native plants, birds, butterflies, beneficial insects, and interesting critters are "made for each other." Research shows that native wildlife prefers native plants.
Support Local Ecology	As development replaces natural habitats, planting gardens, parks, and roadsides with California natives can provide a "bridge" to nearby remaining wildlands.

Source: California Native Plant Society - http://www.cnps.org/cnps/grownative/benefits.php

Native Plants Conversion Cost

Landscape Size: 1,730 Sq Ft (CD3 Avg.)

REBATE:	Rebate Tier Structure	Square feet	Total Amt.
	$3.75 up to 1,500	1,500 sq ft	$5,625.00
	$2.00 thereafter	230 sq ft	$460.00
	Total:	**1,730 sq ft**	**$6,085.00**

COST OF PLANT INSTALLATION:	Size of Native Plants	Cost Per Plant	# of Plants	Total Amt.	Square Feet Covered
40% Vegetation Coverage Requirement (~692 sq ft)	Small native plants (avg. 3x3 feet, to cover ~1/8 of yard)	$7.25	27	$195.75	243
	Medium native plants (avg. 10x15 feet, to cover ~1/3 of yard)	$8.00	3	$24.00	450
			Total Cost of Plant Installation:	**$219.75**	
				Vegetation requirement fulfilled at:	693
				Total square feet left to cover:	1,037

COST OF MULCH INSTALLATION:	Coverage Description	Cost	Total Cubic Ft Needed	Total Amt.	Square Feet Covered
60% Mulch (~1,038 sq feet)	Needs to be covered 3 inches deep	[illegible] feet	3,114	$10,899.00	1,038
Cardboard (price per square foot: $0.49*)	Placed on top of turf, below mulch	$0.49 per sq ft	1,038	$508.62	1,038
Labor (~ 6 hours, 2 people, $30/hour)		$30 per hour		$360.00	
			Total Cost of Mulch Installation:	**$11,767.62**	
*Lowe's			**Cost with Free Mulch and Cardboard from City:**	**$360.00**	

COST WITH ADDITIONAL PLANT INSTALLATION:	Size of Native Plants	Cost Per Plant	# of Plants	Total Amt.	Square Feet Covered
	Tall native plants (i.e. trees, covers an avg. 25x25 feet)	$7.25	1	$7.25	625
	Native shrubs (covers an avg. 5x5 feet)	$8.00	16	$128.00	400
			Total Cost of Plant Installation:	**$355.00**	
				Total square feet covered:	1,718
				Total square feet left:	13

	Total Amount	Net Difference with Rebate
Total Cost of Plant & Mulch Installation:	$11,987.37	-4390.37
Total Cost of Plant & Mulch Installation with Free Mulch and Cardboard:	$579.75	7017.25
Total Cost with Additional Plant Installation:	$12,342.37	-4745.37
Total Cost with Additional Plant Installation with Free Mulch and Cardboard:	$934.75	6662.25

APPENDIX K: Financial Effects of Increasing Tier Cap to 2,000 on LADWP

Rebate Payout for 5% of SFH in CD3 for Varying Rebate Levels						
Rebate Structure	Total SFH Units	1% of SFH	Average Landscape Size (sq ft)	Available SFH Landscape for Conversion (sq ft)	Payout for One SFH Turf Conversion	Total Rebate Payout for 5% of SFH
$2.75 - *up to 1,500 sq ft* $2.00 - *thereafter*	53,652	537	1,730	929,010	$4,585	$12,299,720
$3.75 - *up to 1,500 sq ft* $2.00 - thereafter	53,652	537	1,730	929,010	$6,085	$16,338,225
$4.75 - *up to 1,500 sq ft* $2.00 - *thereafter*	53,652	537	1,730	929,010	$7,585	$20,365,725

APPENDIX L: Water Reduction if 1% of SFH in CD3 Participated in the Rebate Program

Average Water Consumption for 1% of SFH in CD3			
Total SFH Landscape Eligible for Conversion (sqft)	Pre-Conversion Outdoor Water Use (Acre Feet) Including Over Water Use[106]	Post-Conversion Outdoor Water Use (Acre Feet)	Net Water Savings (Acre Feet)
929,010	218.6	59.5	159.1

Cost of Importing Water, Assuming Price of Water Increases at 6.4% Each Year for 5% Single-Family Household Increase in CD3 Participation			
Year	Cost of Importing Water Pre-Conversion	Cost of Importing Water Post-Conversion	Net Savings Due to Conversion
2015	$206,983.52	$56,334.20	$150,649.32
2016	$220,253.81	$60,050.90	$160,202.90
2017	$234,350.05	$63,786.95	$170,563.10
2018	$249,348.45	$67,869.32	$181,479.13
2019	$265,306.75	$72,212.95	$193,093.80

[106] See Appendix G for water equation.

APPENDIX M: LADWP Water Savings over Time from 5% Increase in Single-Family Household Participation in CD3

		MWD & LADWP Combined Rebate			LADWP's Rebate Portion		
Year	**Annual Water Savings***	**$4.75 Level**	**$3.75 Level**	**$2.75 Level**	**$0.75 Level**	**$1.75 Level**	**$2.75 Level**
2015	$150,661.34	$150,661.34	$150,661.34	$150,661.34	$150,661.34	$150,661.34	$150,661.34
2016	$310,965.00	$310,965.00	$310,965.00	$310,965.00	$310,965.00	$310,965.00	$310,965.00
2017	$481,528.10	$481,528.10	$481,528.10	$481,528.10	$481,528.10	$481,528.10	$481,528.10
2018	$663,007.20	$663,007.20	$663,007.20	$663,007.20	$663,007.20	$663,007.20	$663,007.20
2019	$856,101.00	$856,101.00	$856,101.00	$856,101.00	$856,101.00	$856,101.00	$856,101.00
2020	$1,061,552.00	$1,061,552.00	$1,061,552.00	$1,061,552.00	$1,061,552.00	$1,061,552.00	$1,061,552.00
2021	$1,280,152.72	$1,280,152.72	$1,280,152.72	$1,280,152.72	**$3,523,815.39**	$1,280,152.72	$1,280,152.72
2022	$1,512,743.88	$1,512,743.88	$1,512,743.88	$1,512,743.88		$1,512,743.88	$1,512,743.88
2023	$1,760,220.88	$1,760,220.88	$1,760,220.88	$1,760,220.88		$1,760,220.88	$1,760,220.88
2024	$2,023,536.41	$2,023,536.41	$2,023,536.41	$2,023,536.41		**$8,076,933.87**	$2,023,536.41
2025	$2,303,704.13	$2,303,704.13	$2,303,704.13	$2,303,704.13			$2,303,704.13
2026	$2,601,802.58	$2,601,802.58	$2,601,802.58	**$12,404,172.66**			**$12,404,175.41**
2027	$2,918,979.33	$2,918,979.33	$2,918,979.33				
2028	$3,256,455.40	$3,256,455.40	**$17,924,954.57**				
2029	$3,615,529.93	**$21,181,409.97**					
2030	$3,997,585.23						

*Each year's water savings due to an increase in CD3 households participating in the rebate program multiplied by LADWP's projected price of purchasing water (incorporating a 6.4% increase) from MWD that year. Between 2015-2020 there is a one percent increase in participation, every year thereafter there is compounded water savings from a 5% increase in participation rates.

APPENDIX N: List of Professional Interviews

1. Penny Falcon, Manager of Water Conservation Policy, Legislation, and Grants for LADWP
2. Mark Gentili, Water Conservation Supervisor, at LADWP
3. Kristen Holdsworth, Project Manager at the California Center for Sustainable Communities at UCLA
4. David Jacot, P.E., is the Director of Energy Efficiency for LADWP
5. Céline Kuklowsky, Senior Research Associate, Gaps Analysis of PIER Funded Research at California Center for Sustainable Communities at UCLA
6. Caroline Mini, Hydrology and Water Resources, PhD
7. Lisa Novick, Director of Outreach and K-12 Education at the Theodore Payne Foundation
8. Anne Phillips, CEO, Go Green Gardeners
9. David Rahimian, Senior Project Coordinator, LADWP
10. Lyn Shaw, Lyn Shaw, District Director, Office of Councilmember Bob Blumenfield
11. Melanie Winter, Director of WaterLA and Founder of The River Project