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Understanding the Equity Implications of Residential Green Infrastructure Incentive Programs

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Understanding the Equity Implications of Residential Green Infrastructure Incentive Programs

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Report

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Master of Science in Community and Regional Planning

The University of Texas at Austin

August 2021

Acknowledgements

I would like to thank the many individuals in Austin, Philadelphia, San Antonio, Seattle, and Washington, D.C., that helped to inform the research and valuable recommendations offered in this report. I would like to thank Miriam Solis and Bjorn Sletto for providing so many helpful insights and much needed guidance, and for being incredible mentors whom I look up to immensely. Last, but not least, I would like to thank my friends and family who have always provided me with the greatest love and support!

Abstract

Understanding the Equity Implications of Residential Green Infrastructure Incentive Programs

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The University of Texas at Austin, 2021

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Stormwater issues are becoming more prevalent in the US as the country deals with ageing infrastructure, increasing urbanization, and climate change. Many cities have begun to explore and adopt more sustainable strategies to manage stormwater, such as green infrastructure (GI), which mimics natural systems to collect and treat rainwater and stormwater at their sources. City governments are exploring options to implement GI on both public and private properties by encouraging private adoption through residential incentive programs. The City of Austin, TX is in the process of implementing the Rain Catcher Pilot Program (RCPP) to achieve stormwater management objectives by integrating the city's existing green infrastructure programs and resources.

Residential GI has the potential to provide social and environmental benefits and can thus advance environmental justice or reinforce inequality. Historically marginalized communities have suffered disproportionately from stormwater problems like flooding and pollution, and they have also experienced displacement as a result of green gentrification. Therefore, it is critical that city governments consider the equity

implications of their programs, including disparities in program participation, barriers to program participation, and how their programs intersect with patterns of social and economic disparities. In doing so, they help ensure that these programs and practices do not continue to cause adverse effects for historically marginalized communities.

By conducting a review of Austin's RCPP, environmental incentive programs within the City of Austin, and residential GI incentive programs in other US cities through content analysis and interviews with city staff, this study aims to answer the questions: What are the racial and social equity implications of residential GI incentive program structures and their implementation? What lessons can be gleaned from residential environmental incentive programs in US cities? The study finds that there are many structural barriers and inequities embedded in these incentive programs, but there are also innovative approaches that reduce barriers for low-income communities of color. The study concludes with recommendations on how to improve equity in residential GI incentive programs so that city governments can move from causing harm to advancing equity.

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INTRODUCTION

Stormwater issues are becoming more prevalent in the US as the country deals with ageing infrastructure, increasing urbanization, and climate change. These stormwater issues will likely bring with them environmental injustices, posing major risks for marginalized communities that have already suffered disproportionately from stormwater problems like flooding and pollution. Many US cities, shaped by historic patterns of government-backed racial segregation, continue to be segregated spaces today where communities of color and low-income communities are forced to live in underinvested and flood prone areas. These patterns of spatial separation have become especially prominent in cities that are experiencing gentrification and displacement. Urban development and economic investment in predominantly non-white neighborhoods that marginalized communities fought to improve environmentally are now being transformed to whiter, more affluent neighborhoods. The intersecting of these two injustices makes the situation dire for marginalized communities.

These challenges have led many cities to explore and adopt more sustainable policies and practices. Water resources management and stormwater management are of particular importance for cities that are prone to natural hazard events including drought and flooding, which have been exacerbated by climate change. Planning for the future requires more creative and integrated solutions that can serve multiple purposes. The concepts of low impact development (LID) and green infrastructure (GI) or green stormwater infrastructure (GSI) have emerged as alternatives to “gray” or traditional stormwater infrastructure. GI is smaller and decentralized, typically implemented at the site scale (Lim 2018), and mimics natural systems to collect and treat rainwater and

stormwater at their sources. Additionally, GI can provide ecosystem and community benefits such as reducing erosion, reducing localized flooding, and improving human health (US EPA 2020).

While many cities have begun to implement green infrastructure projects on public property, they are looking for ways to increase GI adoption on residential private properties because this land use makes up such a large percentage of land use in cities—more than 50%, in some cases (Lim 2018). Several cities are finding ways to encourage residents to adopt GI through incentive programs. The City of Austin, Texas has been looking at residential GI and its potential to achieve stormwater management and water conservation objectives through their Rain Catcher Pilot Program (RCPP), which is "a comprehensive effort to integrate and leverage the City's existing Green Stormwater Infrastructure (GSI) programs and resources" (City of Austin 2020).[1]

Residential GI has the potential to provide many benefits to residents, and it also has important environmental justice implications. As city governments explore these GI opportunities, it is important for them to consider racial and social equity in terms of who their programs are reaching, whether disparities exist in program participation, and how their programs may be potentially biased toward certain demographic or socioeconomic groups. It is also important for city governments to recognize which groups have been historically marginalized, what past or current environmental injustices exist, and make sure that these programs and practices do not continue to cause adverse effects for historically marginalized communities. In fact, city governments should prioritize utilizing these programs to advance environmental justice.

[1] GI is sometimes also referred to as GSI or LID. In this report, I use GI instead of GSI or LID due to the fact GI was used more frequently in the literature I reviewed.

By conducting a review of the RCPP, environmental incentive programs within the City of Austin, and residential GI incentive programs in other US cities, this study aims to answer the central research question: What are the racial and social equity implications of residential GI incentive program structures and their implementation? And: what lessons can be gleaned from residential environmental incentive programs in US cities? To answer these questions, I examine residential environmental incentive program structures and their equity implications to understand the major barriers to creating equitable programs, as well as to identify innovative strategies policymakers are employing to ensure equity in their programs. Finally, I make recommendations to the City of Austin on how they can improve equity in their residential GI programs moving forward, building on the RCPP. This report can serve as a supplemental resource to WPD's current RCPP efforts, including its citywide market study to understand opportunities, barriers, motivations, and knowledge from the Austin community.

METHODS

I used a mixed methods approach, relying primarily on qualitative methods which included content analysis and interviews to learn about the equity implications of residential scale, environmental incentive programs. I grouped my analysis and findings into three sections: green infrastructure in Austin with a review of Austin's Rain Catcher Pilot Program, City of Austin residential environmental incentive programs, and residential green infrastructure incentive programs in four other US cities – Philadelphia, PA, San Antonio, TX, Seattle, WA, and Washington, D.C.

Content analysis consisted of reviewing academic literature, reports produced by governmental and non-profit organizations, and online resources for incentive programs.

I reviewed program goals and objectives, incentive amounts, application processes, and eligibility requirements.

Ten semi-structured interviews lasting about 45 minutes to an hour were conducted with City of Austin staff, non-profit staff, and city staff from select municipalities with GI incentive programs (see table 1). Interviews with WPD staff and Urban Patchwork staff allowed me to learn more about the RCPP residential incentive program and its equity implications as the pilot program continues to evolve. Interviews with other City of Austin departments allowed me to learn about existing incentive programs within Austin and how Austin Water, Austin Energy, and Austin Resource Recovery have considered equity in program design and implementation. They would also allow me to learn about any Austin-specific challenges for incentive programs and utility-specific challenges. Interviews with peer cities allowed me to learn about other green infrastructure incentive programs and their goals and challenges as well as how they have considered and dealt with equity concerns in the evolution of their programs.

Table 1. List of interviews conducted (program staff names will be kept anonymous for privacy purposes). Table by author.

Interviewee	**Incentive Program**	**City**
WPD Staff	Rain Catcher Pilot Program	Austin, TX
Urban Patchwork Staff	Rain Catcher Pilot Program	Austin, TX
Austin Water Staff	Water Conservation Rebates	Austin, TX
Austin Energy Staff	Home Improvement Rebates	Austin, TX
Austin Energy Staff	Solar Photovoltaic Rebate Program	Austin, TX
Austin Resource Recovery Staff	Home Rebate Program	Austin, TX
Philadelphia Water Staff	RainCheck Program	Philadelphia, PA
San Antonio Water System Staff	WaterSmart Coupons	San Antonio, TX
Seattle Public Utilities Staff	RainWise Program	Seattle, WA
Department of Energy and Environment Staff	RiverSmart Homes Program	Washington D.C

My interviews with City of Austin staff were enabled by my past and current experience working with the Watershed Protection Department. Since June of 2020, I have been an intern working for the Planning Division. In the summer of 2021, I conducted preliminary research for the Behavioral Study for Raincatcher Program, a project led by the design firm Asakura Robinson and for which the University of Texas is a subcontractor. These roles helped inform my project. However, I was not financially compensated for this project, and I conducted the analysis and generated my findings independently.

Chapter 2: Literature Review

ENVIRONMENTAL JUSTICE

The environmental justice movement emerged in the US in the 1980s as a result of grassroots activism and organizing amongst communities of color to fight against the unequal distribution of solid and hazardous waste sites (Agyeman, Bullard, and Evans 2002; Holifield, Chakraborty, and Walker 2017). In 1987, the United Church of Christ Commission for Racial Justice released a report titled *Toxic Wastes and Race in the United States: A National Report on the Racial and Socio-Economic Characteristics of Communities with Hazardous Waste Sites* that was "the first national report to comprehensively document the presence of hazardous wastes in racial and ethnic communities throughout the United States" (p. ix). The report found race to be the most significant variable, more so than both household income and housing value, associated with the location of hazardous waste facilities across the US (Holifield, Chakraborty, and Walker 2017; United Church of Christ 1987).

Since the movement began, countless studies have found that people of color have been disproportionately affected by environmental harms that have negatively affected their health, safety, and quality of life (Agyeman, Bullard, and Evans 2002). Additionally, many studies have found that people of color have less access to environmental benefits such as clean water or urban greenspaces (Byrne 2017). Environmental justice proponents argue that these distributive injustices are a direct result of procedural and institutional justice—that is, the lack of access to decision making and policy processes, and they are "(re)produced through institutionalized processes and historically constituted social relations" (Agyeman, Bullard, and Evans 2002; Perreault, Wraight, and Perreault 2012, 487).

While grassroots activism and organizing remain the critical drivers of the EJ movement, the US government has created an Office of Environmental Justice and has developed programs, policies, and strategies to support the movement's goals. The US EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (US EPA 2014). Furthermore, environmental justice "will be achieved when everyone enjoys: the same degree of protection from environmental and health hazards, and equal access to the decision-making process to have a healthy environment in which to live, learn, and work" (US EPA 2014). One policy action the EPA has taken is requiring federal agencies to consider environmental justice in their activities under the National Environmental Policy Act (NEPA) (US EPA 2014). The EPA offers resources like the EJScreen environmental justice screening and mapping tool as well as guidance on how federal agencies should evaluate environmental justice in their actions and how their actions impact communities of color, low-income populations, and/or indigenous communities (US EPA 2014). The EPA also offers several grant programs and funding opportunities to support environmental justice projects (US EPA 2014). Despite these measures, low-income communities of color continue to experience hazardous and unhealthy urban environments.

Environmental Justice and Green Infrastructure

Environmental justice scholars and researchers have identified several racial equity implications of green infrastructure and their potential benefits. These include environmental justice in the context of water resources, environmental justice in the

context of flooding and natural hazards, and environmental justice in the context of greenspace.

Environmental Justice, Water, and Flooding

Over the past two decades, the environmental justice implications of flooding and other natural events have become better understood. Much of the research on the topic has been prompted by the destruction and harm caused by Hurricane Katrina which primarily affected Black and low-income residents in New Orleans, LA (Chakraborty, Collins, and Grineski 2018). Many studies have shown that low-income communities of color are disproportionately impacted by flood events and "are at increased risk of experiencing debilitating damage, uncompensated loss, and long-term suffering" (Collins and Grineski 2017, 351). These communities often experience greater exposure to flooding and have less access to protective resources such as flood insurance, flood mitigation infrastructure, and post-flood assistance (Collins and Grineski 2017). This is directly related to longstanding patterns of racial segregation and disinvestment in communities of color as well as their exclusion from decision-making processes (Tretter 2013). Racial segregation in cities resulting from zoning and redlining practices have forced communities of color and low-income communities into undesirable residential areas that lack proper infrastructure, including water and stormwater infrastructure, and that do not receive economic investment (Love and Vey 2019; Norwood 2021). These areas often intersect with flood-prone areas which typically have lower property values because of flood-risk. In Austin, TX, for example, residents in the predominantly Latino/a/x neighborhood of Dove Springs have faced flooding issues for years because of inadequate stormwater infrastructure. They have experienced and lived through inundation and shared their stories and memories of those experiences time and time

again (Barragan 2018; Diaz 2014a; 2014b; McGlinchy 2015). Community leaders have been fighting for drainage infrastructure improvements for years, but the City of Austin has failed to prioritize the neighborhood for drainage upgrades (Huber 2019; 2020). The city relies on very technical methods, including hydrologic models to prioritize infrastructure investments that may not always identify local drainage problems, so Dove Springs' residents have been left to continue dealing with flooding. Climate change will only exacerbate the frequency and severity of natural events including major drought, storm, and flood events, compounding these water related environmental justice issues.

Green infrastructure has the potential to improve some of the flooding injustices that marginalized communities face. Garcia-Cuerva, Berglund, and Rivers (2018) conducted a study in the Walnut Creek watershed in Raleigh, North Carolina to understand how GI on private and public property may address water-related environmental justice issues in a neighborhood that experienced repeated flooding and problems with faulty stormwater infrastructure. The authors note that marginalized communities are often excluded from environmental decision making processes and it is important that GI programs engage these communities (Garcia-Cuerva, Berglund, and Rivers 2018). They point out that while many studies have looked at the potential benefits residential GI technologies can provide for communities, none have selected marginalized communities to implement those technologies. Thus, they identified preferred locations, "those located in socioeconomically underprivileged or marginalized communities within the watershed" that were also high impact locations, "areas in which elevated foot traffic facilitates exposure to GI so that the public becomes more familiar with these practices" for the placement of GI (Garcia-Cuerva, Berglund, and Rivers 2018, 650). Ultimately, they determined that marginalized communities can benefit from implementation of GI due to reduced flooding and water conservation measures (Garcia-

Cuerva, Berglund, and Rivers 2018). Baptiste, Foley, and Smardon (2015) found that if GI was provided for free or provided with the potential of savings being accrued, low-income communities would be very willing to adopt GI on private property. Their knowledge and understanding of stormwater management problems, likely gained through lived experience of past experiences such as adverse effects of flooding, is a strong predictor of willingness to implement GI on their properties (Baptiste 2014; Baptiste, Foley, and Smardon 2015).

Environmental Justice, Urban Green Space, and Green Gentrification

While the previous section discusses some of the ways that GI may help to improve environmental disparities, GI may also aggravate disparities. Access to environmental benefits provided via urban greenspace is another environmental justice issue that has become widely studied. Greenspaces comprise "a wide variety of natural and human-modified areas including remnant landscapes (e.g. forests, national parks), as well as parklands (e.g. urban parks, botanic gardens, cemeteries and commons) and green infrastructure (e.g. street trees, green alleys, green roofs and green walls etc.)" (Byrne 2017, 437). A growing number of studies have found that greenspaces are unequally distributed among urban populations, particularly that marginalized communities (low-income, communities of color) have less access to greenspaces, and whiter, more affluent communities have greater access (Byrne 2017; Wolch, Byrne, and Newell 2014). Further, where access is distributed equitably, there are disparities in the quality of greenspaces (Byrne 2017).

As communities have fought to improve access to and quality of green spaces, improving overall environmental conditions in their neighborhoods, their advancements have brought some undesirable consequences. "Green gentrification" or "environmental

gentrification" describes the phenomenon in which improvements in community greenspaces or overall environmental conditions lead to harmful effects and new injustices such as increased property values or expensive development projects that end up displacing the residents that fought for those improvements (Anguelovski et al. 2017; Byrne 2017). This environmental paradox or tension that arises from urban greening has presented a significant challenge for these communities. The concept of utilizing urban greening strategies that are 'just green enough' to ensure the advancement of environmental justice while preventing negative effects like gentrification will be critical for marginalized communities moving forward (Wolch, Byrne, and Newell 2014). Wolch, Byrne, and Newell (2014) suggested that small-scale, scattered interventions may be more effective in being 'just green enough'; this could prove promising for residential green infrastructure.

LOW IMPACT DEVELOPMENT AND GREEN INFRASTRUCTURE

Rapid urban development and associated increases in impervious cover coupled with climate change have led to increased volumes of urban stormwater runoff in many cities across the United States. Current stormwater infrastructure systems in place, referred to as traditional or conventional stormwater management systems, are large centralized systems that consist of extensive networks of "gray infrastructure" including storm drains and underground pipes that collect and discharge water rapidly away from buildings and infrastructure and directly into waterways (Bedan and Clausen 2009; Chini et al. 2017; Dechak 2019; Dhakal and Chevalier 2016). These infrastructure systems are becoming overwhelmed and will require significant investment – hundreds of billions of dollars – for repairs and maintenance (Dechak 2019; Steffen et al. 2013) or expansion to handle increased volumes of stormwater runoff (McPhillips and Matsler 2018).

The combination of increased impervious cover and stormwater runoff and the lack of capacity of stormwater infrastructure systems in the US have resulted in many adverse effects on the environment, including hydrological disruption, groundwater depletion, flooding, erosion, pollution, water quality degradation, and ecosystem damage or habitat loss (Coleman et al. 2018; Dhakal and Chevalier 2016). Municipalities have looked to alternative stormwater management strategies in their efforts to mitigate and combat these pressing stormwater management challenges and issues.

Low impact development (LID) has emerged as an alternative approach to stormwater management. In contrast to traditional stormwater management systems, LID is a decentralized approach that aims to capture and treat stormwater on-site or at its source using smaller scale, green infrastructure (GI) systems (Bedan and Clausen 2009; Dhakal and Chevalier 2016; Steffen et al. 2013). The United States Environmental Protection Agency defines LID as the “systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat.” (US EPA 2015). Green infrastructure is defined as "the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters" (US EPA 2020). There are many types of green infrastructure measures as outlined in table 2 (US EPA 2020). LID and green infrastructure are often used interchangeably. This alternative LID approach boasts a variety of important environmental, social, and economic benefits (McGarity et al. 2015). LID represents an alternative paradigm to large, centralized gray stormwater infrastructure systems that often serve single-purpose functions toward smaller,

decentralized green infrastructure systems that serve multi-purpose functions (McPhillips and Matsler 2018; Steffen et al. 2013).

Table 2. Types of GI measures as defined by the US EPA. Data from US EPA (2020).

GI Measure	**Description**
Downspout disconnection	Disconnects and reroutes rooftop drainage from the storm sewer to rain barrels or permeable areas
Rainwater harvesting	Collects and stores rainwater in barrels or cisterns
Rain gardens (bioretention or bioinfiltration cells)	Collect and absorb runoff from rooftops, sidewalks, and streets by mimicking natural landscapes
Bioswales	Use vegetation or mulch to slow and filter stormwater flows
Permeable pavements	Infiltrates, treats, and stores rainwater where it falls
Green roofs	Roofs covered with growing vegetation that enables rainfall infiltration and evapotranspiration of stored water
Urban tree canopy	Absorbs stormwater

Benefits of Green Infrastructure

Green infrastructure serves the primary purpose of slowing and reducing urban stormwater runoff. By mimicking permeable natural landscapes, GI will soak up or retain water rather than repelling it (Dechak 2019). By reducing stormwater volumes and peak flows, GI can mitigate flooding and erosion (US EPA 2020). Urban stormwater runoff is a major source of pollution that degrades water quality by bringing nutrients, bacteria, and toxic metals into waterways. GI also serves the purpose of improving water quality or decreasing pollution by capturing and naturally filtering stormwater at its source (Dechak 2019; Chini et al. 2017). Some aspects of GI that cannot be easily achieved by most gray stormwater technologies include this capture and increased infiltration of stormwater which can complement the existing water supply and reduce existing demand for municipal water supplies by aiding in groundwater recharge (Dechak 2019; Tackett

2012). Harvested rainwater can also be used directly for non-potable water uses such as outdoor irrigation or indoor uses like flushing toilets (US EPA 2020).

GI systems have several other secondary or co-benefits. Installing GI systems can provide cost savings because GI is often less expensive than gray stormwater infrastructure (Chini et al. 2017; Dechak 2019; US EPA 2020). GI alternatives often have lower capital costs and lower maintenance costs as well as longer life expectancy which can help to reduce public expenditures on stormwater infrastructure (Dechak 2019; US EPA 2020). Some social benefits include providing green spaces that can serve community purposes, improving aesthetics, creating green jobs (Chini et al. 2017; McGarity et al. 2015; Tackett 2012). Public health benefits can be gained by reductions in air temperatures and urban heat island mitigation as well as improvements in air quality through increased vegetation (Dechak 2019; McPhillips and Matsler 2018; US EPA 2020). These can reduce heat-related and respiratory illnesses (Dechak 2019). Ecological benefits through increases in vegetation and decreases in erosion include habitat provision, improvement, and connectivity, and increased biodiversity (McGarity et al. 2015; McPhillips and Matsler 2018; US EPA 2020). These co-benefits will contribute to cities' climate resilience and support sustainability agendas (Chini et al. 2017).

Residential Rainwater Harvesting

Rainwater harvesting (RWH), which includes rain cisterns and rain gardens, is a type of GI measure that can be implemented at the residential scale. Rainwater harvesting is the practice of capturing stormwater runoff, typically by intercepting rooftop runoff, and storing it in a cistern, barrel, or tank for future use or diverting it to a vegetated area for infiltration purposes (Jones and Hunt 2010; Steffen et al. 2013; Walsh, Pomeroy, and

Burian 2014). RWH was originally used in areas with limited water supply due to climate or lack of infrastructure, however, it has expanded to other areas for conservation purposes due to drought or increased water demands, for stormwater purposes to decrease runoff, and for sustainability and green building purposes (Walsh, Pomeroy, and Burian 2014). Captured runoff can help to meet water supply needs entirely or supplement existing water supply needs (Steffen et al. 2013; Walsh, Pomeroy, and Burian 2014). This can translate to potential savings on water bills (Walsh, Pomeroy, and Burian 2014). Diverting and storing water can help with flood control and stormwater pollution management (Steffen et al. 2013).

While there are several benefits of residential RWH, effectiveness of residential RWH systems can vary. RWH goals including reducing stormwater runoff, providing a water supply, and minimizing costs, can be conflicting, so designing or selecting a system to balance these goals, while still proving effective, can be difficult (Jones and Hunt 2010). Therefore, studies have been conducted to understand the effectiveness of and challenges to residential rainwater harvesting systems. Monitoring studies and simulations have been conducted to evaluate the performance of different systems. In their study of RWH systems performance in South Carolina, Jones and Hunt (2010) found that smaller cisterns could be used to supplement water supply, but larger cisterns were needed to reduce stormwater. Similarly, in their study of a watershed-scale residential RWH program in San Diego, CA, Walsh et. al. (2014) found a linear relationship between runoff reductions and RWH capacity in which the highest capacity cisterns provided the greatest reductions in runoff. On the contrary, they found that smaller rain barrels in comparison to larger cisterns had the highest cost-effectiveness (Walsh, Pomeroy, and Burian 2014). Smaller barrels also provided “the fastest drain

times, the smallest footprint, and the greatest ease when it comes to implementation and operations and maintenance by homeowners" (Walsh, Pomeroy, and Burian 2014, 251).

In their study of RWH in 23 cities across the US, Steffen et al. (2013) concluded that RWH has potential for both water supply benefits and stormwater management, but is dependent on factors such as precipitation, cistern size, and water usage pattern. Steffen et al. (2013) also concluded that these two objectives are conflicting (because saving more water leads to a reduction in stormwater benefits) and the operation of the RWH system needs to be different depending on whether water supply or stormwater management is the overriding objective. At the neighborhood scale, "semiarid regions have modest stormwater management potential" and more precipitous regions have a lower stormwater potential (Steffen et al. 2013, 822-823). Walsh et al (2014) suggested that while a decentralized residential RWH program may not be able to reduce large quantities of runoff and flooding on its own, using this type of program to complement a centralized stormwater system as a larger integrated system would be beneficial for stormwater control.

Public Perceptions and Behaviors Relating to Residential Green Infrastructure Implementation

In addition to technological GI systems challenges like designing an effective RWH system to meet performance goals, there are perceptual challenges to GI (Baptiste, Foley, and Smardon 2015). As decentralized green infrastructure becomes more appealing to cities as a stormwater management strategy, policymakers need to understand what factors influence the public's willingness to adopt GI on their properties (Baptiste, Foley, and Smardon 2015). Several behavioral studies have been conducted to understand residential adoption of RWH systems. Baptiste et al. (2015) conducted a study

of two socio-economically distinct neighborhoods in Syracuse, NY to understand "what factors affect urban residents' perceptions and decisions about green infrastructure implementation" (2). Residents were surveyed on their willingness to implement green infrastructure given two hypothetical scenarios: free provision of GI or savings accrual due to GI implementation (Baptiste, Foley, and Smardon 2015). They were also surveyed about general and specific stormwater management and GI knowledge, influence factors affecting GI implementation, and demographic characteristics (Baptiste, Foley, and Smardon 2015). The authors found that residents who responded to the survey had a moderate to high willingness to adopt GI if provided free or if a savings was accrued, and residents from the working-class, ethnically diverse neighborhood were more willing to implement given the latter scenario. Residents from both neighborhoods had a high level of knowledge regarding stormwater management and GI which may likely be attributed to lived experience with stormwater problems. Additionally, there was a high level of personal efficacy – belief in one's ability to take action – to address stormwater problems, particularly amongst Hispanic/Latino residents, which may suggest willingness to implement GI on personal property (Baptiste, Foley, and Smardon 2015). Overall, Baptiste, Foley, and Smardon (2015) found that factors such as aesthetics, cost, and levels of environmental knowledge influenced willingness to implement GI. The authors suggest that perhaps certain groups or neighborhoods, such as low-income communities, could be identified as ideal candidates for GI programs. However, barriers to implementation must also be identified and reduced or removed. Program success is dependent on gaining a comprehensive understanding of the physical and social attributes of the community, understanding lived experiences relating to stormwater problems, and providing information, incentives, and inclusive participation (Baptiste, Foley, and Smardon 2015).

Brown et al. (2016) sought to learn about residential participation in GI programs by conducting a case study of the Little Stringybark Creek (LSC) Project in Melbourne, Australia. The LSC Project was an integrated stormwater management project which utilized strategies to retain and harvest stormwater on both public land and private properties "through a household engagement programme that combine[d] public education with financial incentives" (80). The educational component of the program was intended to address a common barrier identified in environmental behavior research which is residents' lack of awareness of the benefits that can be gained from a behavior (Brown et al. 2016). The economic incentive was "adopted on the assumption that the desired behaviour was likely unaffordable to households and that a financial incentive was therefore required" (Brown et al. 2016, 80). Like the Baptiste et al. study, Brown et al. (2016) used surveys to understand residents' participation. Some of the positive perceptions survey respondents had included "reduces household utility bills" and "provides independence from water restrictions" (Brown et al. 2016, 84). Some of the negative perceptions survey respondents had included "distrust of formal registration of ownership" and "disruption to the property during installation" (Brown et al. 2016, 84).

Brown et al. (2016) concluded that the positive perceptions of rainwater tanks "constituted tangible personal benefits to the resident" like financial savings, while rain gardens had fewer positive perceptions and were believed to have fewer tangible and direct personal benefits for the residents (85). The authors found that most residents were motivated to participate in the program because of the financial incentive offered over other reasons such as broader environmental benefits, which "demonstrates that economic incentives are an effective means of securing public engagement in projects that aim to foster pro-environmental behaviour" (Brown et al. 2016, 93). Personal

benefits such as future savings on water bills and independence from water use restrictions were also a strong motivator of participation (Brown et al. 2016).

Brown et al. (2016) found several barriers to participation, some of which have been identified in previous environmental behavior research. One barrier was household income or lack of money. Funding offered for LSC project participation did not cover the full cost of GI installation. Khastagir and Jayasuriya (2011) investigated the financial viability of installing RWH tanks because the financial investment in a RWH system is an important consideration for municipalities if they aim to encourage residential GI installations. There are three main financial components for installing a rainwater tank: the capital investment (tank cost), the installation expenditure (accessories cost), and the operation and maintenance costs, and these costs can vary based on the type and design of the tank (Khastagir and Jayasuriya 2011).

The initial investment on a RWH system can be substantial and payback periods can vary – in this study, anywhere from 14-40 years (Khastagir and Jayasuriya 2011). Thus, if residents do not have the means to provide a large upfront investment to install a system, cost remains a significant barrier to implementation (Brown et al. 2016; Khastagir and Jayasuriya 2011). Other barriers included the lack of space or inadequate size for a rain tank or rain garden on a residential property, the application process because it was complicated and lengthy, time availability due to higher priority of other responsibilities compounded by the funding process, and homeownership (Brown et al. 2016).

The barriers identified in these studies have important racial equity implications. They indicate that demographics, such as income or racial identity, are not strong determinants for willingness to adopt green infrastructure. Rather, these studies point to prohibitive characteristics of residential GI incentive programs that hinder adoption

across the board. Factors like cost, property size and availability of space, time availability, and others matter. However, demographics do intersect with these factors, heightening the potential barriers low-income communities of color face. Therefore, program success is not a matter of residents' willingness to implement but rather on understanding barriers specific to historically marginalized communities and finding ways to reduce or remove them.

ENVIRONMENTAL INCENTIVE PROGRAMS

Incentives are policy instruments that have been used to encourage positive environmental actions such as the reduction of energy or water consumption or the implementation of green infrastructure measures on private property (Radonic 2019; Rana et al. 2021; US EPA 2009). There are both non-financial and financial incentives, but the latter are often intended to remove financial barriers (Clements et al. 2018; Rana et al. 2021). As financial incentives pertain to GI, Lim (2018) claims "the logic of economic incentive strategies is based on an assumption of economic rationality where property owners will invest in GI construction if they can achieve long-term cost savings on stormwater fees" (Lim 2018, 1365).

The US EPA has identified the following primary incentive mechanisms that are being used by cities across the US: stormwater fee discounts, development incentives, grants, rebate and installation financing, and awards and recognition, described in table 3 (2009).

Table 3. Primary Incentive Mechanisms as defined by the US EPA. Data from US EPA (2009).

Incentive Mechanism	**Definition**
Stormwater Fee Discount	Require a stormwater fee that is based on impervious surface area. If property owners reduce need for service by reducing impervious area and the volume of runoff discharged from the property, the municipality reduces the fee.
Development Incentives	Offered to developers during the process of applying for development permits. Examples include: zoning upgrades, expedited permitting, reduced stormwater requirements and increases in floor area ratios.
Grants	Provide direct funding to property owners and/or community groups for implementing a range of green infrastructure projects and practices.
Rebates & Installation Financing	Provide funding, tax credits or reimbursements to property owners who install specific practices. Often focused on practices needed in certain areas or neighborhoods.
Awards & Recognition Programs	Provide marketing opportunities and public outreach for exemplary projects. May include monetary awards.

Rebate programs have been used to incentivize rainwater harvesting systems on residential properties (Brown et al. 2016; Radonic 2019). In their study of a hypothetical cost-share rebate program for the adoption of rain gardens, Newburn and Alberini (2016) found that "the expected adoption rate more than tripled when comparing no rebate versus a government rebate set at one-third of the installation cost, indicating that economic incentives matter" (1345).

While incentive programs have been promoted as a strategy to increase GI implementation, there has been little research done on their implications for equity. Research that looks at how incentive programs may be inequitable in the energy sector may provide some clues, however. Looking to reduce greenhouse gas emissions from energy consumption, several state and local governments and utilities have looked to implement market-based incentives to encourage adoption of renewable energy systems,

more efficient appliances, and others (Fournier et al. 2020). These incentives are attractive to governments and utilities because they are "simple to implement, do not complicate utility operations, and do not otherwise limit absolute levels of consumption" (Fournier et al. 2020, 3). Unfortunately, incentive programs in the energy sector have been found to disproportionately benefit wealthier individuals (Fournier et al. 2020; Guo and Kontou 2021). Fournier et al. (2020) conducted a study on the participation of disadvantaged communities (DAC) in Los Angeles County in the energy transition toward improved household energy efficiency, renewable energy generation, etc. by mapping energy consumption and renewable technology adoption by DAC-status. They found participation amongst DAC communities to differ significantly from other communities and attribute this to "the failure of market-based programs to adequately address the equity dimensions of the energy transition" (Fournier et al. 2020, 8). Because market-based programs focus on measures of volume (e.g., energy savings accrued or gallons of water conserved) and often come at a cost, they favor affluent residents and households that consume more. Therefore, marginalized residents and households do not receive the benefits, such as new energy or water technology, awarded by program participation.

As cities consider adopting and expanding GI programs to residential areas, they must consider the role of existing disparities in the distribution of this urban amenity. Which residential areas these programs are implemented in, as well as how these programs are structured, provide critical insights on how GI affects historically marginalized communities. In what follows, I examine several environmental incentive programs to identify existing structural barriers to program participation and potential solutions to achieve more equitable program distribution.

Chapter 3: Green Infrastructure in Austin, Texas

AUSTIN ENVIRONMENTAL AND SOCIAL CONTEXT

The City of Austin is no stranger to stormwater challenges. Austin lies in the heart of "Flash Flood Alley" which follows the curve of the Balcones Escarpment through Texas' central region from Waco to Uvalde (L. Lee 2016). The Balcones Escarpment is "a region of steeply sloped terrain that separates the mainly limestone formations of the Edwards Plateau (i.e., the Texas Hill Country) from the flat clay- and sand-based coastal plain" (Nielsen, Schumacher, and Keclik 2016). This Central Texas region is unique in its landscape and weather patterns i.e., its hilly and rocky topography and its high rainfall intensities due to warm air masses from the Gulf colliding with cool air masses from the north, making it one of the most flood-prone regions in North America (L. Lee 2016). These pre-existing natural conditions combined with development and increasing amounts of impervious cover cause high and powerful volumes of runoff that lead to flooding, erosion, and degraded water quality which pose major risks for Austin residents. The City of Austin (COA) Watershed Protection Department (WPD) manages both creek flooding, defined as the problems associated with the primary drainage system (major creeks and their tributaries), and localized flooding, defined as the problems associated with secondary, or "local" drainage system (composed of pipes, curb inlets, manholes, minor channels, roadside ditches, and culverts) (Watershed Protection Department 2015). Over the years, Austin has recorded many devastating floods from large storms and has spent millions of dollars to implement large flood mitigation projects to address creek flooding, but Austin's growth will exacerbate both creek flooding and localized flooding even generated through smaller storms (Caterine 2017).

While many Austinites have experienced creek and localized flooding, Austin's marginalized residents have been hit hardest. This disparity dates back to the 1920s. Tretter and Adams (2012) explain that "periodic flooding played a substantial role in shaping the racial geographies of Austin" (190). Because of Austin's planned segregation and housing restrictions (racially restrictive covenants), African American and Latino/a/x residents were relegated to live in the most flood-prone areas of the city with the lowest land values, namely East Austin (Tretter and Adams 2012). The flood of 1935 (the largest flood in recorded history), decimated East Austin, leaving up to 3,000 residents homeless and their possessions destroyed (Tretter and Adams 2012). Still today, Austin's communities of color and low-income communities continue to live in East Austin and often live in flood-prone areas because of historic racial divisions and lower property values in floodplains (Long 2016; D. Lee and Jung 2014). The Halloween floods of 2013 and 2015 devastated homes and residents living near Onion Creek in Southeast Austin, which is a predominantly Latino/a/x area (Price 2016; City of Austin 2016). Residents in Dove Springs, also in Southeast Austin, have been fighting for an improved drainage system for years, but lower-income neighborhoods which are disproportionately non-white in Austin have not been prioritized for infrastructure investments. When residents living in flood-prone and underserved neighborhoods like Dove Springs that have been excluded from COA decision-making processes do not receive upgraded drainage systems, they may be forced to leave their homes. This displacement by flooding can be considered another form of gentrification (Caterine 2017).

Compounding the stormwater issues that Austin's marginalized communities have faced and continue to face is the city's sustainability agenda that emerged in the 1990s. Austin has gained a reputation as an environmentally friendly, "green city" using sustainability initiatives to promote growth while protecting the environment (Tretter

2013). However, what constitutes an environmental concern has often been decided by the former of two competing environmentalisms: the "environmental" vision which focuses primarily on the "costs of human modifications to the natural world," and the "just sustainability" vision which focuses on "linking ecological concerns with social problems," making environmentalism a social justice issue (Tretter 2013, 301). This can be explained by the fact that the SMART growth platform which promoted economic prosperity, ecological preservation, and social equality, brought together two of Austin's primary competing political factions – environmentalists and developers – in support of the platform. The SMART growth platform divided the city into three development zones: a drinking-water zone, an urban desired-development zone, and a desired-development zone. The third zone "turned out to be almost the entirety of East Austin close to downtown" which led to the rapid gentrification of East Austin at a time when "just sustainability" groups like People Organized In Defense of Earth and Her Resources (PODER) were fighting to improve environmental conditions for residents living in the area (Tretter 2013, 306). PODER argued that the decision to promote East Austin as a desired-development zone while protecting other parts of the city was based on environmental principles that excluded communities of color, reinforcing unequal power relations of the past that shaped Austin's growth (Tretter 2013). Though the platform was abandoned in 2003, SMART growth initiatives continued, leading to more development, gentrification, and displacement in East Austin, placing an undue burden on the communities of color in East Austin.

RAIN CATCHER PILOT PROGRAM

The City of Austin Watershed Protection Department's (WPD) mission is "to protect lives, property, and the environment of our community by reducing the impact of

flooding, erosion, and water pollution" (Watershed Protection Department 2015). In the past, the city has used structural stormwater control measures to address the problems of flooding, erosion, and water quality, but these approaches, including concrete levees and floodwalls, like the 5,700-foot long Crystalbrook drainage and floodwall system built to alleviate flooding from Walnut Creek, are difficult to build in dense urban areas. Additionally, goals set forth by Imagine Austin, the City of Austin's comprehensive plan, call for the use green infrastructure to enhance environmentally sensitive areas and integrate nature into the city (Glick et al. 2016). Therefore, the WPD is working toward implementing integrated stormwater management practices and small-scale distributed stormwater control measures (SCMs) that serve the dual purpose of stormwater management and water conservation.

WPD is currently implementing a small-scale study to test the effects of these distributed SCMs via the Rain Catcher Pilot Program (RCPP). The department conducted a proof-of-concept modeling exercise for the program in which they generated the hypothesis that "dense, distributed stormwater control measures, on both public and private property, can significantly buffer the negative effects of legacy urban development on stream hydrology" (Glick et al. 2016, 1). The program aims to create an integrated stormwater infrastructure system that utilizes existing COA green infrastructure programs and resources including WPD, Austin Water, and the Development Services Department discounts, rebates, capital funding, and educational programs to achieve stormwater management and water conservation objectives (City of Austin 2020). The program focuses on increasing the prevalence of rain gardens and cisterns to achieve these objectives.

The RCPP is located in the Upper Waller Watershed at the headwaters of Waller Creek in the Highland Neighborhood. The study area is 1.08 square miles (2.8 square

kilometers) with approximately 46% of the area classified as impervious cover (City of Austin 2020). City of Austin land use data from 2012 showed that residential land uses including single family, duplex, and multifamily comprised about 40% of the area while commercial, office, and industrial land uses comprised less than 20% of the area (Glick et al. 2016). The proportion of developed land in the study area has increased since 2012 primarily attributed to an increase in single family residential development.

The study area was selected via a hydrologic modeling exercise and has characteristics that make it a suitable pilot site. Because much of the development in this area was completed prior to drainage criteria adoption in 1977, 82% of the stormwater drainage infrastructure in the Waller Creek watershed is outdated (City of Austin Watershed Protection 2016). Additionally, newer developments in the area lack stormwater control measures and there are limited options for implementing traditional stormwater control measures. In 2017, Johnston explained that the study area was:

> ranked #7 of the worst twenty watersheds in terms of water quality and erosion and has therefore been prioritized for capital improvement projects, only 3.45% of total area remains undeveloped, therefore net changes in impervious cover are unlikely, [and] it was determined that the effects of SCMs could be detected given the relatively small drainage area that makes up the pilot area. (37)

Lastly, a USGS gage is located at the bottom of the pilot site (downstream of the GI projects) for collection of ongoing water quality and quantity monitoring data and WPD has access to historic stormwater monitoring or flow data from the area so changes in the system can be easily identified (City of Austin 2020).

The pilot program consists of a combination of public and private projects. WPD began implementation of the projects in 2018. There are ten demonstration project sites on public land including the Reilly Elementary School Demonstration Project, the Skyview Neighborhood Partnering Program Project, the Meadowview Traffic Triangle

Rain Garden, the Reznicek Field Water Quality Retrofit Project, and rain gardens installed in right-of-ways (see figure 1) (City of Austin 2020).

Figure 1. RCPP public demonstration projects. *Source*: City of Austin. n.d. "Rain Catcher Pilot Program" Watershed Protection. Accessed July 3, 2021. https://www.austintexas.gov/department/rain-catcher-pilot-program

The Reilly Elementary School Demonstration Project which included the installation of twelve cisterns and five rain gardens to capture rain from the school's roofs and parking lots was completed in late 2020. The rain gardens and cisterns are designed to catch and slowly release stormwater to reduce erosion, flooding, and water quality problems at the school and the creek. Reilly Elementary School is now partnering with the non-profit Partners for Education, Agriculture and Sustainability (PEAS) to create an outdoor learning program centered around these GI installations (Austin Watershed Protection Department 2020).

The Skyview Neighborhood Partnering Program project on West Skyview Road is a joint effort between the Skyview Neighborhood Association and the city's Neighborhood Partnering Program (NPP). Through the NPP, the city provides assistance for funding, developing, and constructing community projects and community groups are responsible for cost-sharing (via cash, donated materials, labor, or volunteer hours) and project maintenance (City of Austin n.d.). This project consisted of removing pavement on a dead-end street to restore the area to a more natural state. Pavement removal was completed in 2018 and 2019. The remainder of the project includes planting native plants and installing benches and a picnic table to be completed in fall of 2021 (City of Austin 2020).

Residential Green Infrastructure

Prior to the rollout of the RCPP, Johnston (2017) conducted a case study of the Upper Waller Watershed at the headwaters of Waller Creek to explore how residential GI was perceived and to identify the potential barriers and opportunities for meeting WPD's objectives of the pilot program by conducting a survey of residents in the area. The survey results indicated that few respondents had already adopted residential GI, but most

respondents indicated a willingness to adopt GI. Further, many respondents did not fully understand GI. Johnston (2017) found that the primary obstacles for residents to greater GI adoption were cost, maintenance, and help with installation. Money, time, and knowledge were also presented as challenges. Johnston (2017) suggested that WPD could do the following to encourage the greater adoption of GI:

1. Tailor GI to have greater relative advantage (i.e. by lessening yard management costs or maintenance needs)…
2. Reduce the complexity of these systems (either in how they are perceived or in terms of providing assistance in their installation, for example)…
3. Enable greater compatibility for GI, in terms of cultural and social norms… [by] simplifying these systems but also promoting yard management practices that are more eco-centric…
4. Provide more trialability and observability opportunities of rain gardens and cisterns. (vii)

WPD utilized this study to inform the RCPP program design, particularly the residential incentive component. RCPP projects on private (residential) land are referred to as the "Home Incentive Pilot Program" in which WPD is working with residential property owners to install rain gardens and cisterns. WPD is partnering with COA's water utility, Austin Water (AW), and the Development Services Department (DSD) as well as two non-profits: Urban Patchwork and the Nature Conservancy to provide financial assistance to private property owners, to help with outreach and messaging for the program, and to streamline GI installation (Austin Watershed Protection Department 2019, 1).

The RCPP combines three separate rebate and discount programs to create a stacked incentive: the Rainwater Harvesting rebates (for rainwater cisterns and rain gardens) from AW, an additional $1 per gallon of rainwater captured from WPD, and

$1000 per street tree through the Urban Forestry program in DSD (City of Austin 2020; Diringer et al. 2020). It also offers residents free site assessments, contractor connection, and assistance with the rebate process help make the program easier for participants. By participating in the program, residents can gain several benefits as outlined in figure 2. Overall, the RCPP is "designed to maximize community participation and raise public awareness about the value and benefits of healthy streams and stormwater stewardship" (Johnston 2017, 5).

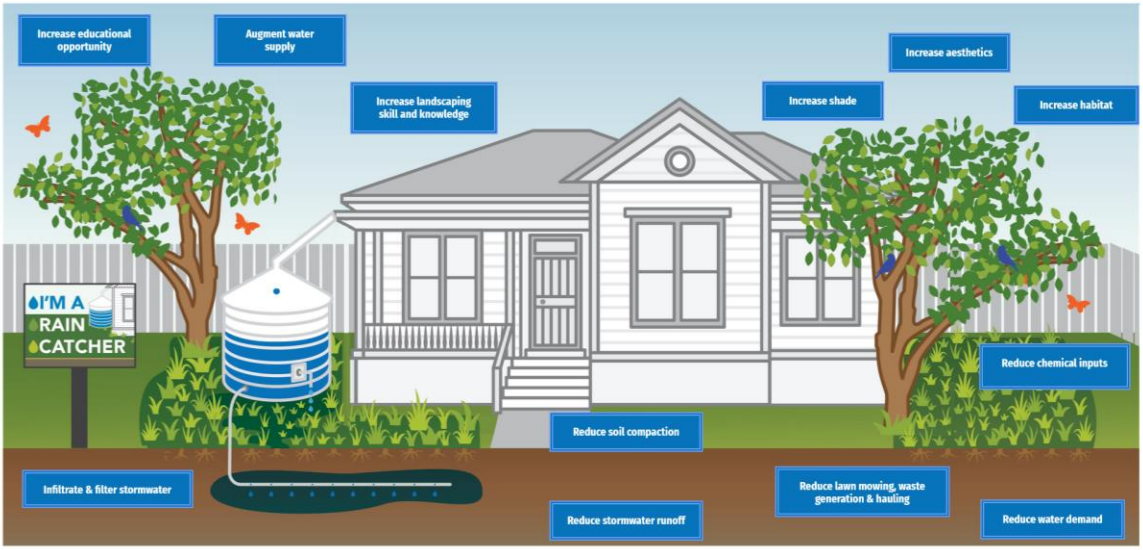

Figure 2. Benefits of the RCPP. *Source*: City of Austin Watershed Protection Department. n.d. "Home." Rain Catcher Pilot Program. Accessed July 3, 2021. https://raincatcheraustin.org/

The RCPP consists of five phases. In Phase 1, 2018, the program was offered to a small subset of 25 pre-selected homes. Following Phase 1, from 2020-2024, the pilot project will be implemented via a phased approach. In each phase, the program is offered to a different section within the study area "to facilitate both incremental development of the pilot as well as experimental components that take advantage of spatial separation"

(Austin Watershed Protection Department 2019). In each of the following three phases (Phases 2-4), the program will be offered to about 450 additional properties per phase. In the final phase (Phase 5) the program will be offered to any eligible homes in the entire WLR3 catchment that have not participated yet. At the end of each phase, WPD will analyze results and report findings.

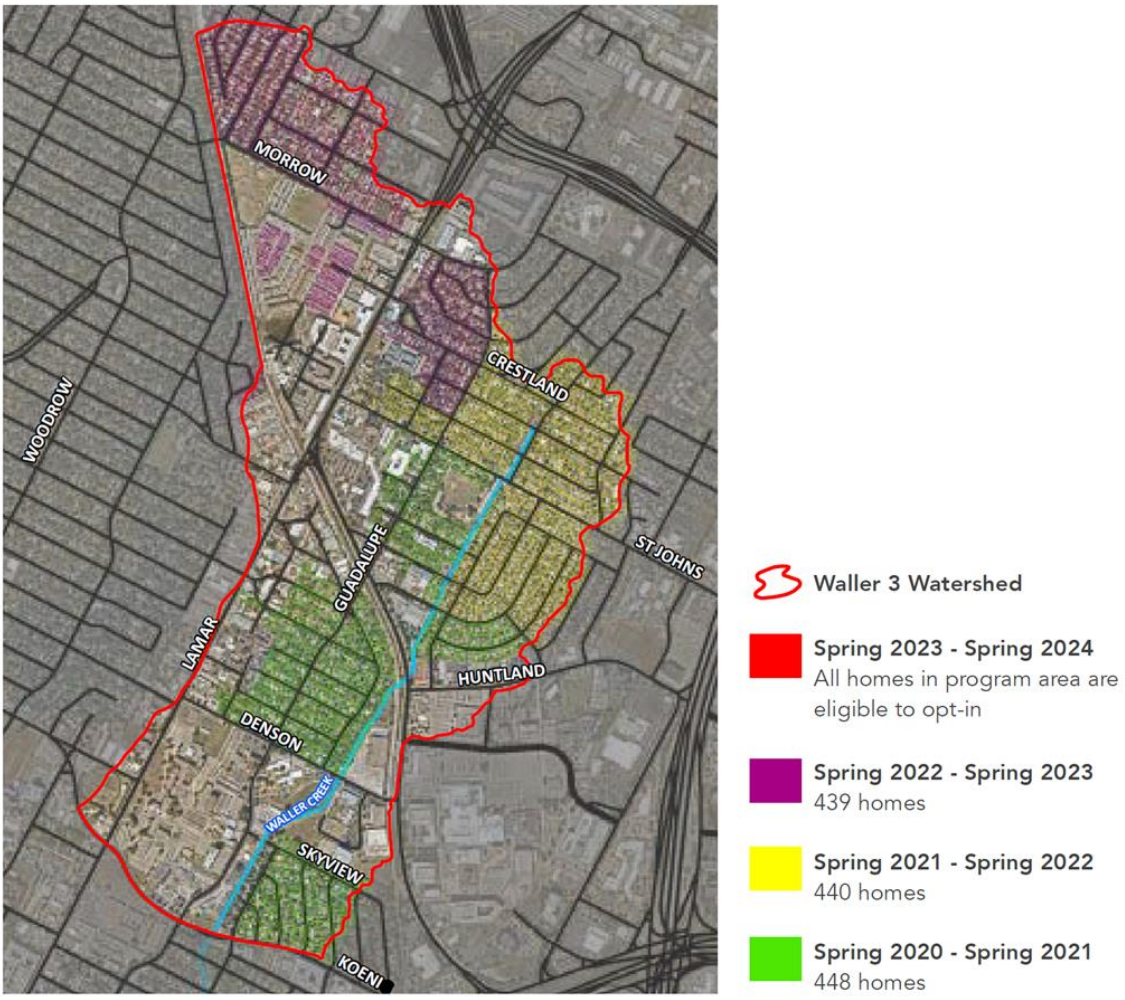

Figure 3. RCPP Phased Eligibility Map. *Source*: Austin Watershed Protection Department (2019).

Eligible properties must be located in the study area as outlined in figure 3 (above). If a property is eligible, the property owner can then schedule a free site assessment with a "city Ambassador" to generate a Site Assessment Report that determines the amount of rainwater that can be collected on the property. The city Ambassador also works with the property owner to identify drainage problems and other site details that are passed on to a landscape designer to inform where and what type of rainwater features would work for the site. The resident needs to commit to collecting at least 75% of the potential capture to qualify for the program. Site Assessment reports will include next steps on how to schedule a free site visit with a landscape designer who will meet with residents by phone, video or in-person to "learn how [they] like to use [their] space, discuss some rainwater catchment system designs, and possible solutions to address other issues through low impact landscaping changes" (City of Austin 2020).

EQUITY IMPLICATIONS

While a WPD staff member explained that equity was not a consideration in the original design of the pilot program, WPD staff and Urban Patchwork staff have gained valuable insights from the first two phases of the pilot program (Austin Watershed Protection Department Staff 2021). WPD is also in the early stages of city-wide market study that was initiated in 2021 to "identify opportunities, barriers, motivations, and knowledge from different demographic groups in the Austin community" and to identify best practices for maximizing residential adoption of green infrastructure (Austin Watershed Protection Department 2019, 10).

Outreach, Engagement, and Education

An Urban Patchwork staff member recognized the problem of residents' distrust in the government while implementing the Rain Catcher Pilot Program (2021). The non-profit serves as the face of the program to help bridge this barrier between residents and the city (Urban Patchwork Staff 2021). There can also be risk associated with participating in incentive programs, and it is important that program administrators educate and help residents understand the entire process and the incentives from the beginning (Urban Patchwork Staff 2021). An Urban Patchwork staff member explained that it has been challenging to figure out the best way to educate residents about the program; it has taken time to understand how residents were interpreting the program and to adjust education initiatives accordingly (Urban Patchwork Staff 2021). A strategy to help overcome the trust factor as well as the education factor or "intimidation factor" with GI concepts is an initial site consultation in which a city ambassador and an Urban Patchwork representative meet with the homeowner for about an hour and explain the program in person (Austin Watershed Protection Department Staff 2021). A more visible strategy that has been utilized to educate residents about the program are the public demonstration projects that WPD has installed. For example, WPD worked with AISD to install a large demonstration project at Reilly Elementary School so that the community could interact with and familiarize themselves with a GI installation.

Eligibility

Property requirements have been identified as a barrier for the RCPP. Residents are only eligible for the WPD additional dollar per gallon of stormwater captured rebate if they are able to capture a minimum threshold of water because WPD is trying to encourage residents to capture more than what has been captured with existing Austin

Water GI rebate programs (Urban Patchwork Staff 2021). This minimum threshold is dependent on the size of the structure on the property as well as the size and capacity of the GI system installed, which will exclude certain homeowners. WPD has also thought about home repairs that may be necessary so properties or structures can handle the GI installations (2021). For example, a roof and gutters may need to be repaired or replaced so they can divert water to a cistern properly (Austin Watershed Protection Department Staff 2021; Diringer and Shimabuku 2021). Getting residents to the point where their homes can support GI installations is a challenge to be addressed. WPD is exploring establishing partnerships with nonprofit or community groups that have home repair programs that may be able to provide further assistance to those who need it (Austin Watershed Protection Department Staff 2021).

Location requirements constitute a barrier to participation for marginalized communities. In the case of the RCPP, only properties in the upper Waller Creek Watershed are eligible to participate in the program. While this area was chosen for hydrologic reasons, a WPD staff member made the point that the neighborhood is not a racially or socio-economically diverse neighborhood (Austin Watershed Protection Department Staff 2021). In fact, the pilot program area is predominantly white and affluent. This has the potential to reinforce inequality because it brings investment to areas that already benefit from high levels of public and private investment. Given the history of flooding in Austin's low-income communities of color, the location of future initiatives should consider how spatial eligibility could take a more equitable approach.

Administration

Application

The application process for the RCPP is long and requires a lot of paperwork. Because there are three different rebates associated with the program, paperwork needs to be done for each one. This has been recognized as a barrier which is one of the reasons WPD has partnered with Urban Patchwork. Urban Patchwork works with residents and contractors and is responsible for filling out all of the applications for the program. This is an important service that the RCPP provides to streamline the application process and remove this barrier for program participants (Urban Patchwork Staff 2021).

Time

An Urban Patchwork staff member explained that the process for the RCPP is slow. This played a role in losing residents that were originally interested in participating in the program, but then dropped out of the program because the process was taking too long and they did not want to keep spending time on it (Urban Patchwork Staff 2021). One of the reasons for the long process is there have been issues with contractor retention and new contractor onboarding because there is a shortage of available contractors. Additionally, the contractors that are working with the RCPP have been taking a long time to get designs out to homeowners because they have many other projects going on. This has deterred participation because homeowners have had undesirable experiences having to work with multiple contractors who are taking too long to complete their tasks (Urban Patchwork Staff 2021).

Cost

The reasoning behind the RCPP's stacked incentive was to lower the financial barrier for residents, however, WPD recognizes that even with the stacked rebates, the cost of participating in the RCPP is still too high for many residents. An Urban Patchwork staff member explained that the price on the estimate for a GI installation is still much higher than what the rebates will cover and the difference between the two is too much for most homeowners (Urban Patchwork Staff 2021). WPD is hoping to be able to get the cost for residents down to 10% of the total costs (Austin Watershed Protection Department Staff 2021). An option WPD is exploring is to offer a mini GI package, for example a cistern irrigation system that feeds a single street tree rather than the entire lot, for residents who cannot afford a larger system that is required for participation in the RCPP (Austin Watershed Protection Department Staff 2021). WPD has also thought about acquiring other funding sources such as federal funds or partnering with nonprofits to provide additional funding for residents.

Chapter 4: City of Austin Residential Environmental Incentive Programs

Drawing from content analysis and interviews with city staff, this section discusses the goals, descriptions, and eligibility requirements as well as the equity implications of Austin Water's, Austin Energy's, and Austin Resource Recovery's various residential environmental incentive programs. These three departments were chosen because they all have existing incentive programs to encourage residential adoption of different types of pro-environmental measures and can offer Austin-specific equity insights.

AUSTIN WATER INCENTIVE PROGRAMS

The Austin Water (AW) residential incentive programs, described in table 4, have an overarching water conservation goal to reduce water demand and consumption. The first program started in the late 1990s to address the utility's concerns about exceeding the water treatment systems' capacity due to rapid population growth (Austin Water Staff 2021). Reducing outdoor water use was and continues to be the primary focus because the utility saw highest usage during the summer months, when residents were turning on irrigation systems and watering their yards (Austin Water Staff 2021). Since then, the utility has built additional treatment facilities and increased treatment capacity, so now a major concern is purchasing additional water rights from the Lower Colorado River Authority (LCRA) to meet the demand (Austin Water Staff 2021). Funding the residential rebate programs to encourage residents to install water saving equipment is justified by the savings accrued from not having to purchase additional water rights from LCRA (Austin Water Staff 2021).

Table 4. Austin Water residential incentive program descriptions. Data from Austin Water (Austin Water, n.d.).

Program	**Program Description**	**Maximum Incentive**
Landscape Survival Tools Rebate	Customers can get a rebate for using a combination of mulch, compost and core aeration on their lawns, to ensure that water stays on their yards, reducing the need for supplemental irrigation.	Compost: $50 Mulch: $40 Core aeration service: $30 Total: $120
WaterWise Landscape Rebate	Customers can get a rebate to decrease outdoor irrigation by replacing healthy turf grass with native plant beds which can reduce or eliminate the need for supplemental watering.	$1750
WaterWise Rainscape Rebate	Customers can get a rebate for installing landscape features (berms, terraces, swales, rain gardens, porous pavement, etc.) to keep and beneficially use rainwater on the property.	$0.30 for every square foot converted, up to $500
Irrigation Upgrade Rebate	Customers can get a rebate for making improvements to their existing irrigation systems to increase water efficiency. New irrigation systems and expansions to existing systems are not eligible.	$1000
Laundry to Landscape Rebate	Customers can get a rebate on equipment purchased to reuse laundry graywater to water their landscapes, reusing anywhere from10 to 40 gallons of water per load.	$150
Rainwater Harvesting Rebate	Customers can get a rebate on rainwater harvesting systems. The rebate is $0.50 per gallon capacity for non-pressurized systems or $1.00 per gallon capacity for pressurized systems.	$5,000 or 50% of the equipment cost, whichever is less
Pressure Reduction Valve Rebate	Customers can get a rebate for a pressure reduction valve to lower water pressure and keep water efficiency high.	$150
Water Timer Rebate	Customers can get a rebate for a watering timer that gives more control over hose-end watering.	$40
Showerheads and Faucet Aerators	Customers can get a free efficient showerhead and faucet aerators to increase home water savings.	Free

Austin Water incentive program eligibility requirements can be found in Appendix A.

AUSTIN ENERGY INCENTIVE PROGRAMS

The main objective of the Austin Energy (AE) residential incentive programs, described in table 5, are to help reach the goals set forth by the *Austin Energy Resource, Generation, and Climate Protection Plan to 2030* and the Austin Community Climate Plan to reach net-zero greenhouse gas emissions by 2040 (Austin Energy 2020). Specific goals include "achieving 100% carbon-free electricity generation by 2035, saving 1,200 megawatts through energy efficiency and demand response by 2030, acquiring 375 MW of local solar generation by 2030," and others (Austin Energy 2020). In addition to reducing energy use and curbing demand, Austin Energy wants to help customers save money on their energy bills and improve air quality conditions in their homes for a healthier and more comfortable living environment. Improving energy efficiency and incorporating more renewable energy on the grid will help create a more stable grid for all AE customers (Austin Energy Staff 2021a).

Table 5. Austin Energy residential incentive program descriptions. Data from Austin Energy (Austin Energy 2021).

Program	**Program Description**	**Maximum Incentive**
Heat Pump Water Heaters	Customers can get a rebate to help them purchase and install a new qualifying ENERGY STAR® hybrid/heat pump water heater for their home which can deliver nearly twice the heat of conventional electric water heaters.	$800
Air Conditioning	Customers can get a rebate to replace their air conditioner with a qualifying energy-efficient air conditioner or heat pump, if they work with a participating contractor.	Average $350
Power Partner Thermostats	Customers can get a rebate to help them purchase eligible, smart thermostats. Each eligible thermostat they enroll in the Power Partner program, where Austin Energy adjusts	$25 rebate and $130 bill credit per thermostat

	their thermostat on a handful of high energy use days, gets an additional bill credit.	
Window Air Conditioners	Customers can get a rebate to help them purchase a new qualifying ENERGY STAR window air conditioner which use up to 15% less energy than conventional models.	$50
Home Performance with ENERGY STAR	Customers can get a rebate by making whole-house energy efficiency improvements (such as AC/heating system retrofits, attic insulation, and others) to their home to save money on your monthly bill and improve your home's indoor air quality.	Variable averaging $1,800
Weatherization Assistance	Qualifying customers can get free home energy improvements (such as attic insulation, solar screens, high-efficiency LED lighting, and others) to improve energy efficiency to save them money on monthly electric bills, improve indoor air quality, and make their home healthier and more comfortable.	FREE for low to moderate income customers up to $7,500
Solar Photovoltaic (PV)	Customers can get a rebate to install solar PV systems that are clean, quiet, and efficient ways of generating renewable energy at their home.	$2,500
Community Solar	Customers who are renters or do not meet the property requirements to participate in the Solar PV program can participate in the Community Solar program which provides residential customers access to locally generated solar energy. Half of the capacity of the program is allocated to AE Customer Assistance Program (low-income) customers.	Normal rate: 4.27¢/kWh Eligible CAP customers receive a discounted rate of 2.77¢/kWh

Austin Energy incentive program eligibility requirements can be found in Appendix A.

AUSTIN RESOURCE RECOVERY HOME REBATE PROGRAM

Austin Resource Recovery's (ARR) Home Rebate Program was designed to get residents involved and contributing to the City of Austin's zero waste goal. They are working to divert 90% of materials (food waste) going to the landfill by 2040 (Austin Resource Recovery Staff 2021). The program provides a rebate of up to $75 to Austin

residents that pay the Clean Community Fee on their utility bills for either a home composting system and accessories or a chicken coop for their home. The department requests that residents allow a minimum of eight weeks for processing of the application.

ARR offers the option of applying for a $75 coupon rather than a rebate for a home composting system. They request a minimum of two weeks for processing and will mail the coupon for participants to purchase a home composting system at a local participating retailer. Participating retailers include Exaco Trading Co., The Great Outdoors and The Natural Gardener. ARR also offers an online self-guided home composting or chicken keeping class or a virtual class with an instructor.

EQUITY IMPLICATIONS

There are many important findings about equity as it pertains to residential incentive programs from the three City of Austin departments. Both Austin Water and Austin Energy staff members explained that they view their incentive programs as a suite of programs in which not every program is suitable for every Austin resident, but there is at least one program suitable for every Austin resident. Five themes were identified as major barriers to equitable program structure: outreach and education, eligibility, application, time, and costs.

Outreach, Engagement, and Education

A major challenge to getting underserved communities to participate in utility programs as identified by an Austin Energy staff member is that there is a lot of mistrust amongst low-income residents, especially with utilities, because utilities have the ability to and will cut essential services like energy or water if bills are not paid (2021). Residents' lack of trust deters them from participation. However, local government

entities can work to build trust within those communities by engaging with them to understand their concerns and needs. AE recently (about two years ago) realized that they were not reaching very many residents with their Weatherization Assistance Program, which is geared toward low-income customers (Austin Energy Staff 2021a). They conducted focus groups with their customers, specifically low-income customers that had not participated in the program to understand why they were not participating. AE also had equity concerns brought to their attention through community engagement efforts and were told that incentive dollars were going to Austin's affluent residents, which is what spurred the creation of the Community Solar Program (Austin Energy Staff 2021b).

Going directly to communities that have lower participation and conducting outreach in those communities is an important strategy for Austin Energy's programs. AE found that in person meetups and neighborhood canvassing have proven to be much more successful strategies than mail and direct advertising for reaching lower-income customers for their Community Solar Program (Austin Energy Staff 2021b). AE has also made it a point to meet customers where they are by coordinating with local groups and attending existing community events like Food Bank events, church events, health department events, etc. (Austin Energy Staff 2021a).

Education is also a critical piece of community outreach. AE staff interviewees have found that residents do not necessarily understand the benefits and cost savings they can gain by participating in the programs. AE requires customers to take an education course before participation in the rebate program to make sure they understand the different solar program offerings and have the information to make decisions that will suit their needs best (Austin Energy Staff 2021b). An ARR staff member pointed out that their educational materials are only offered in English and Spanish, so they created an

online class on YouTube which allows residents to choose a translation in any language (Austin Resource Recovery Staff 2021).

Eligibility

Eligibility requirements can prevent customers, especially low-income customers from participating in incentive programs. AE identified homeownership as a barrier to their Solar Photovoltaic rebate program because "you need your own rooftop to participate in the rebate program" (Austin Energy Staff 2021b). Similarly, Austin Water customers need to have their own yards if they would like to utilize some of the landscape or irrigation rebates. In 2014, ARR's Home Rebate program was expanded to all residents who pay the Clean Community Fee which includes residents of apartments and condos in addition to single family homes, reducing an important barrier (Austin Resource Recovery Staff 2021).

Property requirements can prevent participation as well. An Austin Energy staff member explained that their Solar PV rebate program has specific roof requirements that can hinder participation. For example, customers need a to have a rooftop that is not shaded and about 40% of Austin energy customers likely have shaded rooftops (Austin Energy Staff 2021b). There are also orientation requirements to implement rooftop solar equipment (Austin Energy Staff 2021b).

Programs that are designed for low-income residents have income requirements or home value requirements. An Austin Energy staff member noted this as a barrier. They found their Weatherization Assistance program had income requirements that were too stringent and not reflective of Austin's cost of living. Before they revamped the program, the income requirement was 200% of the federal poverty level (or $53,000 for a family of four). However, they raised the income requirement to 80% of the median family income

level as defined by the City of Austin's Housing and Planning Department ($79,100 for a family of four) to reflect the actual cost of living in Austin (Austin Energy Staff 2021a). This allowed more people to qualify for the program. Further, they got rid of the income documentation that was required of residents because it was identified as a major barrier in the focus groups that AE conducted.

Administration

Application

An AW staff member identified the application process as their biggest barrier other than cost (Austin Water Staff 2021). The process can be very lengthy because the paperwork is difficult and confusing. There is often a lot of legalese and technical language used in the program description and application documents (Austin Energy Staff 2021a). An AE staff member found that residents were not submitting applications because they did not understand the program (2021). To add to complication, an AW staff member explained that their applications are only available in English; they are hoping to provide applications in Spanish and other languages soon (2021).

Another barrier in the application process can be locating the application online. An Austin Energy staff member explained that before AE updated their application process, it was complicated to navigate the AE website and find the application. Residents needed to call somebody or submit a lead through the website to get an application (Austin Energy Staff 2021a). In person outreach has been particularly effective in reducing the application time barrier for AE's solar programs because they can help customers sign up on-the-spot which eliminates the time required to navigate to the website to sign up for the program (Austin Energy Staff 2021b).

Some programs are still only accepting mail-in, paper applications and do not have options to submit program applications via online portals or through their mobile phones. This can slow down the process significantly. AE updated their Weatherization Assistance program application by making it mobile phone compatible and it is now a simple five-minute application that interested customers can fill out and send in online or through their mobile phones. This application process update has made a "huge difference" and AE has seen a large boost in participation numbers (Austin Energy Staff 2021a). This has boosted participation rates so much that AE has no longer had challenges finding customers to participate in the program.

Time

The time commitment for some of these programs can be significant. There are several reasons why the timeline for the entire process of a program can be quite lengthy including customers' lack of understanding of processes, staffing issues within the administerial department, or process decay due to employee turnover (Austin Energy Staff 2021b). Not everyone has the time availability that may be required for participation in these programs. Low-income customers are likely to have priorities higher than joining a renewable energy program (Austin Energy Staff 2021b). Another time challenge is that programs require participants to be home for equipment installations and this requires people to take time off from their jobs, which may not be possible for some people (Austin Energy Staff 2021a).

Cost

Cost has shown to be a determinant of who can participate in certain programs. Austin Water's Irrigation Upgrade Rebate is inherently inequitable because typically only

affluent residents can afford automatic irrigation systems (Austin Water Staff 2021). Austin Energy's Solar PV rebate program mostly captures affluent residents because solar installation is an expensive endeavor and customers need to have access to capital to participate and the payback period is about ten years (Austin Energy Staff 2021b). For certain rebate programs, costs can get very high because there are costs to account for in addition to the cost of the equipment. For example, for Austin Water's Pressure Reduction Valve Rebate, the costs of installation can set the total cost of implementation between $600 to $1000 because the equipment must be installed by a master plumber and the city code requires a permit which adds an additional cost that the plumber includes in the installation fee (Austin Water Staff 2021). Many programs require residents to work with contractors and there have been problems in the past with predatory contractors (Austin Energy Staff 2021b). AE staff explained that these contractors will exaggerate the benefits of solar and convince customers to adopt at a high cost and residents do not end up getting the return on investment they were promised (2021).

For rebate programs that do cover a significant portion of the costs or even all the costs, residents still need to pay the costs upfront before later being reimbursed by the program. An AW staff member identified this as one of their biggest barriers because customers have to wait six to eight weeks to get the rebate check (Austin Water Staff 2021).

COA departments have looked for ways to work around cost barriers. Austin Energy created the Weatherization Assistance program to provide free home energy improvements for qualifying low-income residents. Austin Water contributes funding to the City of Austin Neighborhood Housing and Community Development's GoRepair program to fund plumbing repairs which are offered to qualifying low-income customers at no charge. Austin Resource Recovery's home compost rebate program allows residents

to request a coupon rather than a rebate to provide financial assistance upfront to alleviate financial burden for residents.

Chapter 5: Residential Green Infrastructure Incentive Programs in Four US Cities

Drawing from content analysis and interviews with city staff, this section discusses the goals, descriptions, and eligibility requirements as well as the equity implications of Philadephia's Rain Check program, San Antonio's WaterSaver program, Seattle's RainWise program, and Washington, D.C.'s RiverSmart Homes prorgam. These programs were chosen because they are incentive programs that were developed to encourage residential adoption of green infrastructure and can offer equity insights as they pertain to residential green infrastructure.

PHILADELPHIA WATER DEPARTMENT RAIN CHECK PROGRAM

The Philadelphia Water Department (PWD) created the Green City, Clean Waters, 25-year plan to reduce stormwater entering the combined sewer system by implementing green infrastructure projects throughout the city (Philadelphia Water Department n.d.). As part of this initiative, the Philadelphia Rain Check program encourages individuals to help manage stormwater runoff at the residential level (Philadelphia Water Department Staff 2021). The Rain Check program provides funding for residents to improve their landscaping and help protect Philadelphia's rivers and streams by preventing pollution from entering Philadelphia's waterways (Philadelphia Water Department n.d.).

Rain Check offers a variety of green infrastructure for residents to install on their properties including rain barrels, metal downspout planters, rain gardens, and permeable pavers and covers a portion of the costs for residents. The average costs for participants is shown in table 6 (Philadelphia Water Department n.d.). PWDs goal is "to keep as much stormwater as possible out of the sewer system, so the amount PWD pays is generally

based on the amount of water managed by these tools" (Philadelphia Water Department n.d.).

Table 6. Average costs for each type of green infrastructure installation for PWD Rain Check. Data from Philadelphia Water Department (Philadelphia Water Department n.d.).

Green Infrastructure	**Approximate Total Cost**	**PWD Pays**	**Cost to Participant**
Rain Barrel	About $150	About $150	Free
Metal Downspout Planter	$1000	$900	$100
Rain Gardens	About $17-$25/sq. ft.	$16/sq. ft. up to a maximum of $1,500	Participant pays the remainder
Permeable Pavers	About $30-$50/sq. ft. (Depending on site conditions)	$15/sq. ft. up to a maximum of $1,500	Participant pays the remainder

Note: PWD Rain Check program eligibility requirements were not found online.

SAN ANTONIO WATER SYSTEM WATERSAVER INCENTIVE PROGRAMS

The San Antonio Water System (SAWS) has a long-term integrated water resource plan in which water conservation is a major priority. SAWS wants to ensure that in all scenarios moving forward, factoring in challenges of drought and population growth, among others, that they will have ample water resources for their community (San Antonio Water System Staff 2021). To meet this goal, SAWS is implementing programs, policies, and strategies to reduce per capita demand, with the objective of securing at least one billion gallons of water savings annually (San Antonio Water System Staff 2021). A variety of conservation investments have helped keep water costs lower while reducing the need for additional water supplies (San Antonio Water System 2021). Specifically, SAWS has employed a wide range of education initiatives,

incentives, and regulations to encourage residents to help achieve conservation goals and objectives (San Antonio Water System Staff 2021). While the primary objective of SAWS residential incentive programs is conservation, the WaterSaver programs can also serve the dual purpose of green infrastructure. SAWS WaterSaver Coupon programs are described in table 7 (San Antonio Water System n.d.).

SAWS considers it important to have programs that work for everybody in their community so they make sure to design programs that reach different groups socio-economically and geographically across San Antonio (San Antonio Water System Staff 2021). In addition to their WaterSaver programs, SAWS has an affordability program for low-income customers called Plumbers to People. Plumbers to People provides free plumbing repairs for water leaks including leaking faucets, leaking toilets or broken pipes in owner-occupied households that qualify at 125% of the federal poverty level (San Antonio Water System Staff 2021).

Table 7. San Antonio Water System WaterSaver incentive programs. Data from San Antonio Water System (San Antonio Water System n.d.)

Program	**Program Description**	**Maximum Incentive**
WaterSaver Landscape Coupon	Customers can get a coupon to remove grass (and any irrigation or sprinkler systems) and replace with plants to transform their landscape saving water and money. (Customers have the option to choose rain garden plants for increased water infiltration).	$100 per 200 sq. ft. (up to $800 or 8 coupons)
WaterSaver Patioscape Coupon	Customers can get a coupon to convert grass (and irrigation) to a pervious outdoor living space of flagstone, pavers or stepping stones to create a contiguous, pervious patioscape.	$100 per 200 sq. ft.

SAWS WaterSaver program eligibility requirements can be found in Appendix A.

SEATTLE PUBLIC UTILITIES RAINWISE PROGRAM

Seattle Public Utilities (SPU) and King County Wastewater Treatment Division are working together to manage stormwater naturally. They are utilizing green infrastructure to reduce and clean runoff before it arrives in their wastewater system and waterways. The goal is to use GI to manage 700 million gallons of polluted water each year by 2025 (Seattle Public Utilities and King County Wastewater Treatment Division n.d.). RainWise was designed to help SPU to mitigate its combined sewer overflow issues by encouraging and incentivizing property owners to manage stormwater by installing cisterns and/or rain gardens on private property (Seattle Public Utilities Staff 2021). These GI installations prevent flooding, add attractive landscaping, and can provide water for summer irrigation (Seattle Public Utilities and King County Wastewater Treatment Division n.d.).

The RainWise Program provides rebates that cover most or all of the cost (on average 85 percent of the cost) of installing cisterns and/or rain gardens on eligible residents' properties (Seattle Public Utilities Staff 2021). The rebate can be up to $4.00 per square foot of rooftop runoff controlled. To receive a rebate, residents must be in an eligible combined sewer overflow basin and work with a RainWise-trained contractor (Seattle Public Utilities and King County Wastewater Treatment Division n.d.). Contractors will work with residents to design an installation for their properties making sure to maximize the rebate. SPU also partners with the nonprofit, Stewardship Partners to offer the RainWise Access Grant which provides up to an additional $1,000 for RainWise eligible homeowners "to bridge the gap between rebate amount and actual project costs for income limited and underserved communities" (Seattle Public Utilities and King County Wastewater Treatment Division n.d.). SPU RainWise program eligibility requirements can be found in Appendix A.

WASHINGTON D.C. DEPARTMENT OF ENERGY AND ENVIRONMENT RAINSMART HOMES PROGRAM

The main objective of the RiverSmart Homes program is to educate homeowners about green infrastructure and stormwater problems in the District and to encourage them to install green infrastructure on their private properties to help mitigate stormwater runoff that ends up in the District's waterways (Washington, D.C. Department of Energy and Environment Staff 2021). Ultimately, this will reduce pollution and improve the water quality of the Anacostia and Potomac Rivers and the Chesapeake Bay. DOEE has specific goals and metrics to including the number of best management practices (BMPs) they aim to install as well as the number of homeowners to educate and properties they would like to audit for program participation each year (Washington, D.C. Department of Energy and Environment Staff 2021).

RiverSmart Homes is a District-wide program that offers a variety of incentives to homeowners to reduce stormwater runoff on their properties. Homeowners receive a free stormwater audit, which determines their eligibility for financial and technical assistance to install rain barrels, shade trees, rain gardens, BayScaping (native planting), permeable pavers, and impervious surface removal (Washington D.C. Department of Energy and Environment n.d.). For most installations, DOEE partners homeowners with non-profits and contractors to install the project and homeowners contribute a copayment which is about 10% of the total cost of each GI type (see table 8) (Washington, D.C. Department of Energy and Environment Staff 2021).

Table 8. Copayment amount for Washington, D.C. DOEE RiverSmart Homes green infrastructure measures. Data from Washington, D.C. DOEE (Washington D.C. Department of Energy and Environment n.d.).

GI Measure	**Copayment**
Rain Barrels	$50 or $70 copayment per rain barrel (limit two rain barrels per property)
Rain Gardens	$75 per 50 square foot rain garden (limit two per property)
BayScaping (native plant garden)	$100 copayment per 120 square foot BayScape (limit two per property)
Permeable Pavers and/or Re-Vegetation (conversion of impervious surfaces)	$10 per square foot rebate for permeable pavers $5 per square foot rebate for vegetation
Shade Tree Planting	Free (there is no copayment and no limit on # of trees per property)

Note: Washington, D.C. RiverSmart Homes program eligibility requirements were not found online.

EQUITY IMPLICATIONS

All four of these programs offer important insights about the challenges and opportunities associated with equity and residential GI incentive programs. The same five themes as the COA environmental incentive programs were identified as major barriers to equitable program structure with some nuances: outreach and education, eligibility, application, time, and costs.

Outreach, Engagement, and Education

Although none of these programs necessarily started out with specific goals to reach marginalized communities, they have evolved to have more of an equity lens and are actively looking for ways to better reach and to improve participation in underserved communities. One way the Washington D.C. Department of Energy and Environment (DOEE) did this was by funding a study to look at their communities east of the river,

where most of their marginalized communities are, and figure out where there were gaps in the program and what about the program deterred participation in these communities (Washington, D.C. Department of Energy and Environment Staff 2021). They are currently exploring ways to implement the recommendations offered by the study.

Lack of trust in government has been recognized as a challenge for participation. A Washington, D.C. DOEE staff member explained that historically marginalized communities are more comfortable taking advice to participate in programs from fellow neighbors or trusted community leaders rather than from government staff (2021). Washington, D.C. DOEE staff are working on developing an ambassador program with residents who have already participated in the RiverSmart Homes Program to educate neighbors and friends about the program and its benefits (2021). Establishing and maintaining a physical presence in marginalized communities using strategies like going out in person, meeting homeowners where they are, putting eyes on properties, and walking residents through the process are important ways that local government staff can built trust and relationships with communities (Washington, D.C. Department of Energy and Environment Staff 2021).

In efforts to improve their engagement strategies and participation with underserved communities, Washington, D.C. DOEE staff has been conducting listening sessions in marginalized neighborhoods that have low program participation to solicit concerns and determine strategies and approaches on how to further engage residents and tackle barriers for program participation (2021). Reaching out directly to understand these customers' needs was and continues to be an important step in improving their programs and reducing barriers for these residents.

Tailored marketing has been an important outreach strategy to reach low-income residents for SAWS. SAWS sends out WaterSmart Home Reports that are tailored

specifically to customers enrolled in their affordability programs (about 35,000 customers) so that residents can see which programs are appropriate for them, rather than seeing program offerings for pool rebates or irrigation system rebates. They also focus on advertising the Plumbers to People leak repair program over the WaterSaver Landscape Coupon program because a leak repair will help reduce their water bills more than the landscape coupons (San Antonio Water System Staff 2021).

SAWS staff identified education as a major barrier explaining that customers do not always have experience or knowledge about what they are installing (2021). SAWS developed a website (gardenstylesanantonio.com) to host educational materials about landscaping and maintenance to provide customers with the information they need to successfully install and maintain their landscapes. They have also hosted live webinars for educational purposes. Seattle Public Utilities (SPU) shifted to conducting live webinars to educate residents about the RainWise program because of the Covid-19 pandemic and found that they have reached many more customers and have gotten a lot more participation online, likely because certain barriers like transportation, time, and childcare that often hinder in-person event attendance are eliminated (Seattle Public Utilities Staff 2021).

SPU and Washington, D.C. DOEE staff noted the importance of having potential program participants look at GI demonstration projects or prior GI installation sites. Demonstration sites have the potential to address government distrust as well as education barriers. SPU and Washington D.C. DOEE have engaged with their respective school districts to install demonstration projects. SPU staff explained this strategy is important for underserved communities because they can see the installations in their communities and become more comfortable with the GI rather than having a bureaucrat or contractor try to sell it to them (Seattle Public Utilities Staff 2021). SPU staff have also

asked RainWise program participants to host “info-boxes” in their front yards which hold educational information about the program and also include a walking tour so that residents can see prior installations in their neighborhoods (2021). Another outreach and education strategy SPU has found effective, especially for communities of color, is “living room meetings” in which residents who have had RainWise installations invite their neighbors to their homes to talk story, eat, and participate in a communal learning experience (Seattle Public Utilities Staff 2021).

Eligibility

Homeownership was a big barrier identified for GI incentive programs. Philadelphia Water Department (PWD) staff identified homeownership as a barrier to participation in the Rain Check Program because even though renters are eligible to participate in the program, they are required to get written permission from their landlords (Philadelphia Water Department Staff 2021). It is unlikely that residents would want to get permission from and convince their landlords to participate in the program especially if the investment may only provide a longer-term benefit. The homeownership barrier is exacerbated by the fact that programs require participants to own either single-family detached homes or properties with fewer than four units. Both SPU and PWD staff identified this as a barrier to participation. In their report “Black workers face two of the most lethal preexisting conditions for coronavirus—racism and economic inequality” Gould and Wilson found that “54.5% of African American households live in single-unit structures, compared with 74.2% of white households. On the other hand, 29.2% of African American households live in structures that include five or more units—more than double the rate of white households” (Gould and Wilson 2020, 9-10). SPU staff explained that a large majority of the person of color (POC) community in Seattle live in

multifamily housing and do not own the housing that they reside in (Seattle Public Utilities Staff 2021). Therefore to get more POC involved in the program, they have to find ways to connect with owners, educate them about the program, and convince them to do an installation (Seattle Public Utilities Staff 2021).

Location eligibility requirements have been a major challenge for the SPU RainWise program. RainWise was created and designed for technical engineering purposes to mitigate combined sewer overflow. Thus, SPU only allows residents to participate who live in areas of the city where the combined sewer system exists and this excludes many of the most diverse areas of the city (Seattle Public Utilities Staff 2021). Using an equity lens, SPU staff are looking for ways to expand the program to areas outside of the combined sewer system. They are having technical conversations and building justifications for ratepayers to show that even if they implement residential GI outside of the combined sewer areas, there are water quality or quantity benefits to be gained (Seattle Public Utilities Staff 2021).

Administration

Application

The application for GI incentive programs can be difficult for residents just like the application for other environmental incentive programs. An SPU staff member noted that because installation of a RWH system requires working with a contractor, the program application requires contractors and homeowners to fill out different parts of the same application and this adds to confusion for both parties (2021). Some programs are still only accepting mail-in, paper applications and do not have options to submit program applications via online portals or through their mobile phones. This can slow down the process significantly. SPU started accepting electronic applications following the Covid-

19 pandemic and this significantly sped up rebate processing time (Seattle Public Utilities Staff 2021). A Washington, D.C. DOEE staff member explained that the RiverSmart Homes program application is very quick and simple, taking only minutes to complete, and because of this, they have received more applications than they can process in a timely manner (2021).

Time

The timeline for GI incentive programs can be very long. The RiverSmart Homes program is a complicated and long process from start to finish that can take between nine months and one and a half years, sometimes even longer (Washington, D.C. Department of Energy and Environment Staff 2021). Wait time from application submission to getting contacted by the department administering the program is a big barrier, particularly for high-demand programs. The wait time for RiverSmart Homes is between three to five months because there is not enough staff to process the large quantity of applications they receive in a timely manner (Washington, D.C. Department of Energy and Environment Staff 2021). SAWS recently implemented a robust program management platform, the Salesforce Customer Relation Management (CRM) Platform Solution, that allows them to administratively manage application volume very efficiently (San Antonio Water System Staff 2021). The platform makes the process more efficient by providing the following benefits:

> Integrated data: Customer account data, property appraisal data and historical program participation in one place.
>
> Program management: Each program has business intelligence processes and dashboards reflecting real-time progress.
>
> Enhanced customer communications: Templates for email and printed letters enable fast, personalized communications with customers.

> Easy application management: Posting applications online takes minutes and data feeds directly into CRM account records and program processing lists.
>
> Digital coupons: In 2018, we began using digital coupons for several programs. These are redeemed on the phone and reconciled to the correct vendor on the platform within minutes. In our survey, over 80 percent of customers like them and find them easy to use. (San Antonio Water System 2019, 16)

Application processing is not the only time challenge. Many of the programs require residents to work with multiple entities throughout the process such as staff from the city departments that run the program, contractors that install the equipment, and potential third-party entities like nonprofits that help to streamline the program processes. Coordination with these different entities can also draw out the timeline.

In addition to being an educational challenge, maintenance was found to be a time challenge as well. SAWS WaterSaver programs are do-it-yourself programs, so time to install and to maintain landscapes can be significant (San Antonio Water System Staff 2021). A Washington, D.C. DOEE staff member noted that maintenance can be a barrier because residents do not always have the energy to maintain their green infrastructure systems (2021). Washington, D.C. DOEE is thinking about ways that they may be able to provide free maintenance or highly subsidized maintenance for residents (Washington, D.C. Department of Energy and Environment Staff 2021).

Cost

All program staff members interviewed recognized cost as a barrier to participation for their programs. A SAWS staff member recognized that the WaterSaver Patioscape Coupon was not as accessible to residents because the coupon is $100 for a 200 sq. ft. grass removal which typically costs about $325 (2021). They found the WaterSaver Landscape Coupon to have much higher participation because the coupon is also $100 for a 200 sq. ft. grass removal which usually costs only about $125-130 and

can be less than $100 depending on plant choice (San Antonio Water System Staff 2021). A Philadelphia Water Department staff member explained that the reason why the Rain Check program offers residents free rain barrels and installation for customers is because they know that cost is a barrier (2021). The RiverSmart Homes program currently does not cover the full cost of GI equipment and installation – residents pay a co-pay of about 10 percent of total costs – however, RiverSmart program staff are exploring ways to provide a co-pay waiver for residents who need it (Washington, D.C. Department of Energy and Environment Staff 2021). SPU also partners with a nonprofit, Stewardship Partners, to provide additional grant funding (RainWise Access Grant) for low-income, RainWise eligible residents to help cover costs that are not covered by the RainWise rebate and to reduce the barrier for underserved communities. Funding for the RainWise Access Grant is currently provided by King County, however, SPU is looking into adding their own funds to the program (Seattle Public Utilities Staff 2021).

Even though the SPU RainWise program typically covers 85 percent of the GI equipment and installation costs, and sometimes covers 100 percent of the costs, it also has a rebate return period of about four to six weeks (Seattle Public Utilities Staff 2021). Residents who are unable to afford the upfront costs are not able to participate in these program. A SAWS staff member explained that when they changed their WaterSaver landscape rebate to a coupon (instant rebate), they increased participation rates by about ten times (from about 150 households per year to 1,500 households per year) (San Antonio Water System Staff 2021).

SPU faces an additional financial challenge because the rebate is considered income by the government and program participants are taxed on the rebate. This may be especially hard on and cause concern for customers of color as they may already be struggling with income and tax classification (Seattle Public Utilities Staff 2021).

Chapter 6: Findings and Discussion

Drawing from academic literature, incentive program content, and interviews with incentive program staff, this study offers important findings for residential green infrastructure incentive programs and their racial and social equity implications.

The governmental department and utility staff members interviewed expressed the evolving nature of their programs. Program staff members have been considering their incentive programs as they pertain to racial and social equity and are continuously thinking about how the programs can be improved and made more accessible to all residents.

Multiple departments made it clear that their residential incentive programs are designed as a suite of programs considered as a whole, and the suite is designed to provide something for different people with different circumstances (Austin Energy Staff 2021a). While specific programs only reach certain residents, the suite of programs is designed to reach all residents with different socio-economic statuses (Austin Water Staff 2021).

Some programs are inherently inequitable, for example automatic irrigation system rebate programs, because more affluent residents are the ones who can afford to have these systems and are typically higher water consumers. Overall, rebate programs are often distributed in higher-income areas of cities and low-income assistance programs tend to be distributed in low-income areas of cities (Austin Energy Staff 2021a; Austin Water Staff 2021; San Antonio Water System Staff 2021). Instant rebate programs or rebate programs that covered the full cost of equipment installation tended to be more evenly distributed throughout the city (Austin Resource Recovery Staff 2021; San Antonio Water System Staff 2021).

Three factors were identified as the main barriers to an equitable incentive program: outreach and engagement, eligibility, and administration. The following section describes common barriers and recommends potential solutions for overcoming these barriers.

OUTREACH, ENGAGEMENT, AND EDUCATION

Outreach and engagement, especially with marginalized communities, is an important component of incentive programs that can be challenging to conduct successfully. Lower income, communities of color are often excluded or not typically served by environmental programs and thus site specific engagement with these communities is essential for program planning and implementation (Mason, Ellis, and Hathaway 2019). Previous research has identified skepticism and distrust of environmental communications and information for environmental programs as well as distrust of the governmental agencies that are implementing these programs, particularly for incentive-based programs (Brown et al. 2016). Interviews with program staff in this study only bolstered the idea that there is a prevalence of distrust toward local government agencies, especially utilities.

Outreach and engagement can help program staff or policymakers understand the groups that they are trying to reach and build trust within those communities. In person meetups and meeting customers where they are have been effective outreach strategies as well as tailored marketing for specific groups of residents, for example marketing assistance programs to lower-income customers rather than rebate programs. For engagement, program staff can actively reach out to communities by conducting focus groups with residents that have not been reached or have not participated in the program to understand their reasons for not participating. Community engagement efforts provide

opportunities for residents to voice equity concerns and suggest possible strategies and solutions that may not otherwise be identified by government agencies. Reaching out directly to understand these customers' needs has been and will continue to be an important step in improving incentive programs and reducing barriers for underserved residents.

Learning from residents about barriers to program participation is an important part of the program, as well as working to educate residents about the program's process and benefits. Several program staff members have found that residents do not necessarily understand the benefits and cost savings they can gain by participating in the programs. There can be risk associated with participating in incentive programs, and it is important that program administrators help residents fully understand the process, the incentives, and the benefits at the get go. Education courses about equipment and installations, online resources such as guides for maintenance, and live webinars have been strategies used to help educate residents about programs.

Demonstration projects or sites have been a particularly important outreach and education strategy for green infrastructure programs because they have the potential to address government distrust as well as education barriers. This strategy is helpful for reaching underserved communities because they can see the installations in their communities and become more comfortable with the green infrastructure and how it works rather than having a city representative or contractor try to sell it to them on paper. Another strategy that may prove effective in reaching communities of color is having residents who have already installed green infrastructure on their properties host small events with their neighbors to share related conversations, experiences, and knowledge.

ELIGIBILITY

Program eligibility can be a barrier to participation for a variety of different reasons. The major barriers identified in this study included homeownership, property requirements, location, and income requirements. Homeowners are the ultimate decision-makers for implementing green infrastructure and installing other energy or water conservation equipment or materials on private properties. This is an inherent inequity because there are homeownership disparities between white families and families of color as well as low-income families and affluent families (Herbert et al. 2005; Urban Institute 2019). A study conducted by Ando and Freitas (2011) in Chicago found that census tracts with a higher percentage of rental properties had lower levels of adoption for rain barrels (Newburn and Alberini 2016). Multiple program staff members interviewed identified homeownership as a barrier to participation because of its innate inequities. Even programs that allow rental properties to participate require written permission from landlords, which is a burdensome task to complete. The homeownership barrier is exacerbated by the fact that programs require participants to own either single-family detached homes or properties with fewer than four units. In their report "Black workers face two of the most lethal preexisting conditions for coronavirus—racism and economic inequality" Gould and Wilson found that "54.5% of African American households live in single-unit structures, compared with 74.2% of white households. On the other hand, 29.2% of African American households live in structures that include five or more units—more than double the rate of white households" (Gould and Wilson 2020, 9-10).

Property requirements can make programs inequitable. In the Little Stringybark Creek project described previously (see Chapter 2), some residents found the project to be unfair because it "implicitly discriminated against smaller properties" which did not have enough space for larger equipment (Brown et al. 2016). Size requirements, roof

requirements, and other structural requirements that deem a property sufficient to handle a GI installation is a challenge to be addressed. Some programs are exploring ways to assist residents in getting their homes up to par to support GI installations by establishing partnerships with non-profit or community groups that have home repair programs that may be able to provide further assistance to residents who need it.

Oftentimes, programs, particularly pilot programs, are only offered to residents living in certain areas of the city. This location eligibility was identified as a barrier specific to GI incentive programs. GI programs that have the primary goal of reducing stormwater choose program areas for hydrologic or technical engineering reasons without necessarily taking into account the racial or socio-economic characteristics of those areas. Using an equity lens, some local government departments are exploring ways to expand programs to new locations so that they are reaching lower-income, communities or color. They are having technical conversations to show that installing GI in other areas of the city can still provide water quality and quantity benefits to their ratepayers.

Programs that are geared toward lower income residents, which were specific to the utility programs examined in this study, have income requirements or home value requirements. Income requirements are often based on the federal poverty level which take a national average. These income requirements may prove too stringent and are not always reflective of a city's cost of living. Raising income requirements or using income level requirements that are generated from city-specific data can allow more people to qualify for a program. Removing requirements for income documentation can also help to increase participation because residents can be deterred by this process.

ADMINISTRATION

Application

Challenges associated with incentive program application processes was a theme common to all types of programs reviewed. The application process to participate in GI incentive programs has been identified as a barrier in environmental behavioral literature. Brown et al. noted that "some residents thought the application process was too complicated and others thought there was too much paperwork required" (2016, 87-88). The process can be very lengthy because the paperwork is difficult and confusing. There is often a lot of legalese and technical language used in the program description and application documents. Programs that require working with a contractor can make applications lengthier and confusing because both the contractor and the homeowner need to fill out different parts of the same application. Difficulty with the application can be greater if a potential participant does not speak English as their primary language or have the resources to get a translation. Program applications are not always offered in languages other than English limiting who can apply.

Some programs are still only accepting mail-in, paper applications and do not have options to submit program applications via online portals or through their mobile phones. Further, some program websites are complicated to navigate and applications may not be easy to find. This can slow down the process significantly. Programs that recently updated their applications to online platforms or to be mobile phone compatible have seen increases in participation numbers. Programs that had very quick and simple applications had no difficulties in getting applicants, in fact some received more than they could process in a timely manner. Having staff members that help residents fill out

complicated applications can help to streamline the application process and remove this barrier for program participants.

Time

The timeline for GI or water or energy conservation equipment incentive programs can be very long – from months to over a year. There are several reasons why the timeline can be quite lengthy including customers' lack of understanding of processes, staffing issues within the administerial department, or process decay due to employee turnover. Application processing can take months if there are not enough staff to handle processing. Many of the programs require residents to work with multiple entities throughout the process such as staff from the city departments that run the program, contractors that install the equipment, and potential third-party entities like nonprofits that help to streamline the program processes, which can also draw out the timeline.

Lastly, not everyone has the time availability that may be required for participation in these programs. Low-income customers are likely to have priorities higher than implementing green infrastructure on their properties or joining a renewable energy program. Several programs require participants to be home for equipment installations and this requires people to take time off from their jobs, which may not be possible for some people. GI systems also require time for maintenance, and this may be another task added to an already full schedule.

Cost

While incentive programs are intended to reduce the financial burden on homeowners to retrofit their homes, they typically do not cover the full costs of retrofit

projects. Residential green infrastructure can have high installation and maintenance costs, and affluence is an important determinant of program participation (Brown et al. 2016; Ureta et al. 2021). Some programs mostly capture affluent residents because participants need to have access to capital. Program costs can get very high because there are costs to account for such as labor or installation costs and permit fees, in addition to the cost of the equipment. Even when rebates do cover a significant portion of the costs or even all the costs, residents still need to pay the costs upfront before later being reimbursed by the program. Rebates can take anywhere from four to eight weeks to be processed. Residents who are unable to afford the upfront costs are not able to participate in these programs.

Chapter 7: Recommendations and Conclusion

As cities look for solutions to curb stormwater problems, they have begun to implement voluntary residential GI programs as they are "a potentially very cost-effective means for cities to manage stormwater runoff, especially after ecosystem services co-benefits are factored in" (Lim 2018, 1364). GI offers a viable and sustainable alternative to conventional stormwater infrastructure and management while potentially providing many environmental and social benefits. Further, GI approaches have the ability to help address some environmental injustices like flooding, that marginalized communities face (Garcia-Cuerva, Berglund, and Rivers 2018).

Incentive programs are a strategy being utilized by many municipalities across the United States and other countries to help them meet various energy, water resources, or stormwater management goals. While extensive research has been conducted on environmental behavior and the public's willingness to adopt GI, and several studies have suggested that incentive programs may increase intention to adopt GI, few studies have looked at GI incentive programs and their implications for marginalized communities. After reviewing a select group of incentive programs in Austin, TX and four other large US cities (Philadelphia, PA, San Antonio, TX, Seattle, WA, and Washington, D.C.), using an environmental justice lens, I have concluded that there are many racial and social inequities embedded in environmental incentive programs. While much of the academic literature published about incentive programs uses a behavioral lens to explain reasons for lack of participation in environmental programs, I find that the lack of participation is due to structural barriers, rather than behavioral reasons.

Rebate programs appear to be the primary type of incentive program being used in the cities reviewed in this study, and these rebate programs seem to have higher

participation rates among white and higher-income residents. Certain rebate programs, like those that have a primary goal of water conservation, for example, that exist to target high water users which are often higher income residents, are inherently inequitable because they are targeting a specific subset of the population, but other rebate programs like those that have a primary goal of stormwater reduction, for example, that are not implemented to target a specific subset of the population can still be inequitable because of the barriers discussed in Chapter 6.

If municipalities are serious about implementing residential GI as a stormwater management strategy in an equitable manner, in which they are reaching underserved and marginalized communities, they will need to consider programs other than rebate programs that do not have the structural barriers embedded in many rebate programs. Drawing from the structural barriers identified in this report, I recommend below some programs and strategies that may serve low-income, communities of color more effectively than rebate programs.

I would first like to emphasize that for any type of incentive program, it is critical that cities take into account existing segregation, socioeconomic disparities, environmental injustices, and gentrification and displacement to identify where to implement these programs and to create intersecting strategies that can simultaneously improve problems that marginalized communities are faced with.

A broad and overarching strategy should involve planning both green and gray infrastructure in ways that do not reinforce existing inequalities. This would reduce some communities' susceptibility to harmful floods and other water-related hazards. In addition, there are specific steps cities can take with regard to their residential GI programs. These include:

I. Work in and with residents of neighborhoods that are more vulnerable to the consequences of extreme wet weather events, including flooding. The environmental challenges experienced by communities are well-documented. These concerted efforts can be implemented in tandem or as part of other initiatives that respond to community priorities and concerns, such as anti-displacement measures.

II. Utilize assistance programs which are typically designed with the purpose of reaching and are more effective in reaching lower-income communities. They provide a free product or service for qualifying low-income residents. Many of the departments interviewed had one or more assistance programs available for customers to participate in.

III. Utilize grant or mini-grant programs which are similar to assistance programs in that they cover a large portion of costs for a product or service, but funding may come from sources outside of the city, like federal grants. Unlike assistance programs, not all grant programs have income requirements. Grant programs that aren't specifically designed for low-income customers and don't cover the full cost of a product or service can further reduce the burden for low-income residents by offering a co-pay waiver for residents who need it. Grant programs typically partner with non-profit organizations to help administer grants, provide products or services, or provide additional funding for residents that need it.

IV. Utilize instant rebate or coupon programs that are those in which financial assistance is provided upfront, so the resident does not need to pay for equipment or services out of pocket and then wait for reimbursement. This alleviates financial burden and encourages participation.

There are challenges and limitations to implementing these programs; they are not perfect. Developing these programs can require more work i.e. time, resources, staff capacity, etc., require a greater amount of funding to cover costs, and require management systems or platforms that allow for efficient processing of high volumes of applications, among others. Even though the types of programs mentioned above are important for reducing financial barriers, it is necessary to employ strategies for reducing other barriers (discussed in Chapters 3-6) to supplement these programs. Actively investing in marginalized communities, especially those that can stand to benefit most from stormwater reduction measures, by spending time and resources, building relationships and trust, prioritizing outreach and project installations in their neighborhoods, taking measures to streamline processes, and many other strategies will lead to a more equitable future in which everyone can access and reap the benefits of green infrastructure.

Appendix A: Incentive Program Eligibility

AUSTIN WATER RESIDENTIAL INCENTIVE PROGRAM ELIGIBILITY

The following eligibility requirements were gathered from Austin Water's website: https://www.austintexas.gov/department/rebates-tools-programs

Landscape Survival Tools Rebate

- Must be a residential customer of Austin Water or a qualifying water provider
- Must be the property owner or utility account holder
- Materials purchased from fundraising events are not eligible
- Have not already received the Landscape Survival Tools rebate in the past 36 months (3 years)
- Allow Austin Water to monitor yard and future water use for rebate program effectiveness

WaterWise Landscape Rebate

Applicant:

- Be a residential customer of Austin Water or a qualifying water provider
- Apply for pre-approval from Dec 1 - Mar 31 (for spring rebate) and/or Jun 1 – Sept 30 (for fall rebate)
    - One application accepted per pre-approval period
    - May apply in other periods for more areas until the $1,750 limit is reached
    - Must have property owner's permission to apply (if not the owner)
- Agree to pre- and post-installation inspections by Austin Water
- Willing to let Austin Water track your water use and refer to the project in outreach materials

Conversion Area:

- Must convert at least 500 sq. ft.
    - 75% of area must have healthy turf grass at the time of application
- Must use native/adapted plants from the Grow Green Plant Guide (Austin Water must approve any substitutions)
    - Cannot replace turf grass with another type of turf grass
- Must have at least 50% plant cover (at plant maturity)
    - Must install plants from Mar 15 – May 15 (for spring rebate) and Sept 15-Nov15 (for fall rebate)
- Plant beds must be top dressed with at least 2-3 inches of organic mulch
- Existing irrigation systems must be capped off or changed to drip or low-use bubblers
- No new permanent irrigation system may be installed in the conversion area
- Gravel paths may not be over 3 feet wide

- Gravel patios may not be over 200 square feet in area
- No gravel between sidewalk and street
- No water features allowed
- It is the responsibility of the homeowner to comply with any applicable homeowner association (HOA) requirements. A conflict between these guidelines and HOA requirements may result in the denial of a rebate application

WaterWise Rainscape Rebate

Applicant:

- Be a residential or school customer of Austin Water or a qualifying water provider
    - Property must already be developed (new construction does not qualify)
- Apply for pre-approval from Dec 1 - Mar 31 (for spring rebate) and/or Jun 1 – Sept 30(for fall rebate)
    - One application accepted per pre-approval period (may apply in additional periods for more areas until reaching the $500 limit)
    - Must have property owner's permission to apply (if not the owner)
- Austin Watershed Protection Department requests rainscapes be registered with the city. Register the rainscape
- Agree to pre- and post-installation inspections by Austin Water
- Willing to let Austin Water track your water use and refer to the project in outreach materials

Rainscape:

- Must cover at least 100 square feet
    - Gravel or rock rainscapes may not be more than 3 feet wide
- Must install any plants from Mar 15 – May 15 (for spring rebate) and Sept 15-Nov 15(for fall rebate)
- Must meet all homeowners association requirements (if applicable)
- Must not need a site plan submission or other authorization under the City's Land Development Code (schools only)
- If site is over the Edwards Aquifer Recharge or Contributing Zones, contact the Texas Commission for Environmental Quality at 512-339-2929 for any additional requirements
- For rainwater collection tanks/cisterns, use the Rainwater Harvesting Rebate

Irrigation Upgrade Rebate

Applicant:

- Must be a single-family customer of Austin Water or a qualifying water provider
- Must be the property owner or utility account holder
- May not have applied in the past 12 months or reached the $1,000 limit for the site

    - Rain sensor or soil moisture sensor and irrigation system pressure regulating valve rebate task items are limited to once per site for the lifetime of the property
- Agrees to any needed post-installation inspections by Austin Water

Irrigation System:

- Upgrades must be to improve an existing system. New systems and/or expansions of existing systems do not qualify
- The homeowner or a licensed irrigator must do the irrigation work (Texas Administrative Code Chapter 344)
- You must convert an entire station if you are:
    - Installing pressure compensating heads
    - Converting from spray to multi-stream, multi-trajectory rotor nozzles
- If you convert a station to drip, you must include the pressure regulation and filter method noted on the invoice
- If you cap a station, you must remove the station valve and keep it for final inspection
    - Cap must remain visible until final inspection is complete
- Must have an appropriate backflow prevention device

Laundry to Landscape Rebate

Applicant:

- Be an Austin Water residential customer or qualifying water provider
- Must be the property owner or utility account holder
- Agrees to keep the laundry-to-landscape system installed in the Austin Water service area
- Agrees to any needed post-installation inspections by Austin Water
- Willing to let Austin Water reference the project in outreach materials

Graywater system:

- System may only use laundry graywater from residential washing machines
- Must be a new system; may not be replacing an existing laundry-to-landscape system
- Must be a gravity-fed system
- Graywater must not be stored, runoff into streets and waterways, and not pond on or pool on the soil surface
- System must meet all City of Austin permit requirements, including Cross Connection Protection, Plumbing Code, and Watershed Protection requirements, as well as all other regulations as applicable (contact Development Assistance Center at 512-978-4000)
- System may not be in the Edwards Aquifer Recharge Zone or any other area deemed to be environmentally sensitive (contact Watershed Protection at 512-974-2550)

Rainwater Harvesting Rebate

Applicant:

- Must be a customer of Austin Water or a qualifying water provider
- Must be the property owner or utility account holder
- May not have applied in the past 12 months or reached the $5,000 limit for the site
- Must intend to keep a system 500 gallons or less in service for five years and a system greater than 500 gallons in service for ten years
- Agrees to any needed pre- and post-installation inspections by Austin Water
- Willing to let Austin Water reference the project in outreach materials

Rainwater Harvesting System:

- Must be a new system or an expansion of an existing system
- Must meet City subdivision and zoning requirements, including setback and impervious cover limits (contact Development Assistance Center at 512-978-4000) and any homeowners association regulations
- Systems with a pump and greater than 500 gallons of capacity (including combined capacity if multiple tanks are connected) must meet auxiliary water requirements, including cross connection testing, backflow prevention, and permits prior to rebate approval. (contact Special Services at 512-972-1060)
- Austin Watershed Protection Department requests rainwater harvesting systems be registered with the city. Register your system
- Equipment must be new and intended for rainwater harvesting
- Metal tanks must be lined. Transparent tanks/pipe must be painted or enclosed
- Tanks that are greater than 500 gallons must have a first-flush diversion system and a level base made of gravel, sand, or concrete

Pressure Regulating Valve Rebate

Applicant:

- Be an Austin Water customer at a property with no more than four units
    - Properties with five or more units must use the Multi-Family PRV Rebate
- Must be the property owner or utility account holder
- Have water pressure of 80 pounds per square inch (psi) or higher without a PRV
- May not be replacing an existing PRV
- Must consider the possible impacts of reducing the water pressure and understand that Austin Water is not responsible for any problems that might occur
- Must take care of any future repairs or replacement of the PRV

Pressure Regulating Valve:

- Must be installed by a licensed plumber and set between 35 psi and 65 psi
- Must be an International Association of Plumbing and Mechanical Officials (IAPMO) approved model
- All permitting requirements must be met prior to rebate approval
- Must be installed in a sleeve or meter box that is easily accessible for maintenance

Water Timer Rebate

Applicant:

- Be an Austin Water residential customer
- Have not already received the Watering Timer Rebate at this address
- Agree to keep the watering timer(s) installed in the Austin Water service area
- Willing to take part in a survey about your watering timer use

Watering Timer:

- Any brand or style is eligible
- Hose-end vacuum breakers must be used with watering timers (Local Amendments to the Plumbing Code-Table 603.2)
    - You may buy a timer with built-in vacuum breakers or buy the vacuum breakers separately
    - Because vacuum breakers are required, Austin Water cannot rebate their cost

AUSTIN ENERGY RESIDENTIAL INCENTIVE PROGRAM ELIGIBILITY

Heat Pump Water Heaters

(Source: https://savings.austinenergy.com/rebates/residential/offerings/appliances-and-equipment/hp-water-heater)

Prerequisites

- The heat pump water heater must be installed at a residence that receives electricity from Austin Energy.
- The heat pump water heater must be installed in a home that has had permanent electric service from Austin Energy for more than one year. Rebates are not available for new construction.
- New equipment is not eligible for rebates if the existing equipment received rebates within the last 10 years.
- All existing heat pump water heaters being replaced must be 10 years old or older.
- You must purchase a qualifying ENERGY STAR® hybrid/heat pump water heater.
- You must use electricity to heat your water.
- You must submit your application within 90 days of purchase. Applications submitted beyond this time frame will not be approved.
- You must adhere to all applicable permitting requirements.

Requirements

- The heat pump water heater you purchase must:
- Be labeled an ENERGY STAR® hybrid electric water heater, also referred to as a heat pump water heater, and have an Energy Factor of 2.0 or better
- Store a minimum of 40 gallons of water
- Be installed new (not used)

- Be installed meeting all applicable codes and adhering to all applicable building permit processes for proper installation
- Be permanently installed at the structure
- Have minimum required clearances and free area as determined by the manufacturer
- Carry a minimum six-year warranty on major components supplied by manufacturer
- If required, you must agree to a post-installation inspection by Austin Energy.

Rebate Recipient Eligibility Requirements

- Property owners or electric account holders that purchased and installed the equipment are eligible to receive the rebates.
- By default, the rebate payment is directed to the customer listed on the Austin Energy electric account. The rebate may also be directed to one of the below parties if all requirements are met.
    - The property owner, verified using county tax records.
    - A tenant at the property, when the property owner submits a signed Letter of Authorization to issue the rebate to the tenant.
    - A property manager, when the property owner submits a signed Letter of Authorization to issue the rebate to the property manager.
    - If you need a Letter of Authorization, please email Austin Energy Customer Energy Solutions or call us at 512-482-5342.
- Participating contractors are not eligible to receive the water heater rebates.
- Gas water heaters and tankless gas water heaters are not eligible for this rebate (Austin Energy 2021).

Air Conditioning

(Source: https://savings.austinenergy.com/rebates/residential/offerings/cooling-and-heating/ac)

Prerequisites

- You must receive electricity from Austin Energy.
- You must use an Austin Energy participating contractor.
- All existing systems being replaced must be 10 years old or older.
- Rebates are available only for the replacement of existing equipment.
- New equipment is not eligible for rebates if the existing equipment received rebates within the last 10 years.
- Your home must be 10 years old or older.
- Your participating contractor must submit your rebate application within 90 days of installation. Applications submitted beyond this time frame will not be approved.
- Participating contractors must comply with all program requirements and conduct business in an honest, professional, and ethical manner. All participating

contractors must abide by the Austin Energy Code of Conduct and Ethical Requirements (pdf).

Requirements

- All installations must reduce peak demand for electricity.
- All required City of Austin permits must be in place. Refer to Permitting Requirement for Property Owners and Occupants (pdf) for details.
- All work must meet manufacturers' standards and local, state, and national codes.
- Your new air conditioner must meet the efficiency guidelines in the rebate tables.
- All components of the system (condenser, furnace/air handler, and evaporative coil) must be replaced in order for the new system to be eligible for rebates.
- Your installer must size equipment to an approved ACCA Manual J methodology or Austin Energy's Air Conditioning Sizing Guidance (pdf).
- You must attach proof that your equipment meets the sizing requirement (Manual J or Austin Energy's Air Conditioning Sizing Guidance (pdf).
- You must agree to a post-installation inspection by Austin Energy.

Exclusions

- Air conditioning systems with electric resistance heating elements do not qualify.

Rebate Recipient Eligibility Requirements

- Property owners or electric account holders that purchased and installed the equipment are eligible to receive the rebates.
- By default, the rebate payment is directed to the customer listed on the Austin Energy electric account. The rebate may also be directed to one of the below parties if all requirements are met.
    - The property owner, verified using county tax records.
    - A tenant at the property, when the property owner submits a signed Letter of Authorization to issue the rebate to the tenant.
    - A property manager, when the property owner submits a signed Letter of Authorization to issue the rebate to the property manager.
    - If you need a Letter of Authorization, please email Austin Energy Customer Energy Solutions or call us at 512-482-5342.
- Participating contractors are not eligible to receive the air conditioner rebates.

Power Partner Thermostats

(Source: https://savings.austinenergy.com/rebates/residential/offerings/cooling-and-heating/pp-thermostat)

Prerequisites

- You must have an eligible thermostat.
- You must be an Austin Energy customer with a unique account number. Co-op and master-metered accounts are not eligible at this time.
- Simply replacing an already enrolled smart thermostat with a new smart thermostat in the same household is not eligible for an additional incentive.

Requirements

- You must agree to a post-installation inspection by Austin Energy, if necessary.
- Existing equipment must be connected and operational.
- You must have a standard air conditioning system (split system, package unit, or heat pump).
- The heater component may be gas or electric.
- Your air conditioning equipment must be in good mechanical condition and controlled by an approved, communicating thermostat device.
- Homeowners and renters are eligible to receive the Power Partner program participation bill credit. Homeowners and renters may also receive the purchase and installation rebate if they purchased and installed the thermostat.
- Landlords are only eligible for the purchase and installation rebate and are not eligible to receive the Power Partner program bill credit.
- Applicants are limited to five (5) thermostats.
- You must use an eligible thermostat from the list below.

Window Air Conditioners
(Source: https://savings.austinenergy.com/rebates/residential/offerings/cooling-and-heating/window-ac)
Prerequisites

- You must receive electricity from Austin Energy.
- You must purchase a new qualifying ENERGY STAR window air conditioning unit.
- You must submit your application within 90 days of purchase. Applications submitted beyond this time frame will not be approved.

Rebate Recipient Eligibility Requirements

- Property owners or electric account holders that purchased and installed the equipment are eligible to receive the rebates.
- By default, the rebate payment is directed to the customer listed on the Austin Energy electric account. The rebate may also be directed to one of the below parties if all requirements are met.
    - The property owner, verified using county tax records.
    - A tenant at the property if the tenant purchased the unit.

Home Performance with ENERGY STAR
(Source: https://savings.austinenergy.com/rebates/residential/offerings/home-improvements/hpwes-rebate)
Prerequisites

- Your home or building must receive electric service from Austin Energy at residential rates.
- Only owners of single-family homes, condominiums, town homes, duplexes, triplexes, fourplexes, and rental properties are eligible.
- Your residence cannot be a mobile or manufactured home.

- A participating contractor must perform the no-cost energy assessment and make all energy efficiency improvements.

Requirements

- You must qualify for at least $100 in rebates to participate.
- Your home or building must be 10 years old or older.
- Buildings where asbestos is found in the heating, ventilation, and air conditioning system are not eligible.
- Buildings where remodeling is imminent or concurrent with the proposed installations are not eligible.
- New AC units or heat pumps must be sized to service at least 600 sq ft or 12,000 BTU adjusted performance per ton, or the participating contractor must perform a Manual J load calculation to determine the size of the AC unit.
- To qualify for an AC Tune Up, the system must be out of the manufacturer's warranty and less than 15 years old.
- New AC unit must meet the minimum SEER/EER requirements.
- All components of the system (condenser, furnace/air handler, and evaporator coil) must be replaced in order for the new system to be eligible for rebates.
- Renters must provide written permission from the property owner to participate.
- You are not eligible for a loan (or rebate) covering any energy efficiency measure for which you received a rebate or loan within the past 10 years.

Weatherization Assistance

(Source: https://savings.austinenergy.com/rebates/residential/offerings/home-improvements/weatherization)

Prerequisites:

- You must be an Austin Energy customer.
- Eligible households must have an annual income that is no greater than 80% Median Family Income (defined by Austin Department of Housing).

Requirements:

- You must live in the house you want weatherized.
- You must live in a single-family home, duplex, triplex, fourplex, or mobile home.
- Your home's appraised value is $300,000 or less (excluding land value).
- Your home must be 2,500 square feet or smaller.
- Your home must be more than 10 years old.
- The home must have not received comprehensive weatherization improvements with an Austin Energy program within the last 10 years.
- Both owners and renters can apply. If you rent, your landlord must sign the Landlord Permission Form

Solar Photovoltaic

(Source: https://austinenergy.com/ae/green-power/solar-solutions/for-your-home/solar-photovoltaic-rebates-incentives)
Prerequisites:

- You must have an Austin Energy residential electric utility account.
- The solar PV system must be connected to an Austin Energy residential electric account where the PV system will be installed.

Requirements:

- You must complete the Austin Energy Solar Education Course prior to applying for a rebate.
- You must use an Austin Energy Participating Contractor to install your solar PV system - see the Find a Contractor tab.
- The solar PV system must be 3kW (AC) or larger, and mostly free of shading.
- You must apply for and receive a Letter of Intent (LOI) prior to system installation in order to be eligible for Austin Energy rebates and incentives.

Exclusions:

- Third-party solar Power Purchase Agreements (PPAs) are not allowed in the Austin Energy service territory.
- Homes with existing solar PV systems are not eligible to participate in this program.
- Leased solar PV systems are not eligible to participate in this program.

Community Solar
(Source: https://austinenergy.com/ae/green-power/solar-solutions/for-your-home/community-solar)
Must be an Austin Energy Customer Assistance Program (CAP) customer to receive the discounted rate.

SAN ANTONIO

(Source: https://www.gardenstylesanantonio.com/watersaver-landscape-coupon/)

Steps

1. Take photos of where you plan to remove grass and install your new garden bed.
2. Apply online for the $100 Coupon and attach the photo you took of the location of your future garden bed.
3. Remove at least 200 square feet of grass per coupon and any sprinklers. No permanent irrigation is allowed in the new beds. If you have irrigation, take pictures of any sprinkler heads, valves, drip lines or other irrigation components you have removed to comply with the program requirements.
4. Redeem your plant coupon at a participating vendor by Nov. 15. Select 15 plants in any combination. Then plant them to create a contiguous 200-square-foot garden bed. After you redeem your coupon, you will receive an email with a link to submit photos for inspection. Save that email.

5. Once you've completed your beds, take photos and find the email we sent you when you redeemed your coupon. Open the inspection form in the email and attach your photos to that form and send it to SAWS. Do not attach to the email.
6. Photos will be reviewed against program criteria. Participants not meeting the criteria for success will be contacted via email with ideas on how to make them successful. Until then they are ineligible for additional programs.

Coupon covers only a portion of the costs at participating vendors.

- You must purchase 15 plants from the approved WaterSaver Coupon list (no substitutions). Small plants must be purchased in 1 gallon containers and small trees in 5 gallon containers.

Landscape Coupon Photo Inspection

- Bed size must be at least 200 square feet per landscape coupon redeemed.
- Is there organic or inorganic mulch in the bed?
- Does the bed appear to be new?
- Are sprinkler heads absent from planting area?
- Are plants from the package planted in the bed?
- Are the plants in good condition?

Patioscape Coupon Photo Inspection

- Patioscape size (minimum 200 square feet per coupon).
- Is there any plant material in the patioscape?
- Does the patioscape appear to be new?
- Is the patio permeable (lets water through)?
- Are spray heads/rotors or drip lines absent in the new patioscape area?

SEATTLE

(Source: https://700milliongallons.org/rainwise/eligibility/)

Eligibility

1. Combined Sewer Overflow (CSO) Basins
   Properties eligible for RainWise rebates are located within eligible CSO basins. By becoming RainWise, these properties will reduce water flowing to the sewer pipes. Most parcels within a CSO basin are eligible for a RainWise cistern. For rain gardens, there are a few other things to consider:
   a. Land Stability
      Rain gardens cannot be within 300 feet of a steep slope or a landslide prone area. Infiltrating water can destabilize slopes.
   b. Sufficient Distance
      Rain gardens must be at least 100 feet away from contaminated sites, landfills, and underground storage tanks. Otherwise, the percolating water could mobilize and spread contaminants from these sites.

c. Adequate Drainage
Of course, rain garden eligible parcels must have soils that drain quickly so that water infiltrates (soaks in). By combining these factors, we determine which sites are eligible for rain gardens, cisterns, or both.

Why am I not eligible?
Even though you live in an eligible basin, your property may have some disqualifying criteria. If your home is relatively new, it already complies with current stormwater code.

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