Modeling Residential Rainwater Harvesting Potential in the USA

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Modeling Residential Rainwater Harvesting Potential in the USA

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Abstract

Water scarcity and issues with water quality have made constant headlines during the last decade. For example, consider the crisis in Flint, MI and the attention that water as a commodity has gotten from top investment banks (Goldman Sachs, n.d.). Scarcity has been driven by a depletion of freshwater resources, which are also increasingly at risk of pollution across the continental US (Lerner, 2018). These issues are reflected in the constant escalation of water utility prices during that same time period (Water and Wastewater, 2017; Walton & Lafond, 2018). If those catalysts aren't enough to continue driving water prices at a rate that handily outpaces inflation, then the impending investment of $1T USD needed to replace a majority of the underground water infrastructure over the next 25 years should be enough of a catalyst to extend this trend deep into the future (Buckley, Gunnion, & Sarni, 2016; Deloitte, 2016).

Rain falls on roofs every year and is not collected, which puts pressure on public water infrastructure in the form of stormwater runoff. Rainwater harvesting (RWH) is a method used throughout history to take advantage of rain to provide water at the household level. Some municipalities have begun to subsidize RWH systems, but it is not prevalent. The main questions I addressed in this thesis were: Can RWH prove to be economically viable investments for households over the next 20 years in terms of return on investment (ROI)? Can RWH provide enough of a public benefit, in terms of reduced pressure on public water infrastructure, to entice local governments to provide incentives for households to adopt such systems?

My main objective was to conduct a cost benefit analysis (CBA) to evaluate the conditions under which RWH is a viable investment at the household level. The foundational data sets of this model include aggregated water pricing data for 30-cities across the US and 30-year precipitation averages compiled by NOAA. The tiered structure of the water pricing data set allowed me to shift my focus to aggregate consumption rather than specific end uses. I also showed how one can gauge reliability of RWH systems through a sensitivity analysis, adjusting key variables such as water prices, precipitation, system costs, and roof size.

The results indicated that in potable scenarios there were only two cities that featured positive NPVs, ranging from $952 to $13,586 depending on usage, out of the 30-city sample size. In contrast, there were nine such instances in the non-potable analysis, with NPVs ranging from $287 to $18,869. IRRs ranged from 2.6% to 9% and 2.3% to 12% for potable and non-potable, respectively, within the set of cities which produced positive NPVs. Furthermore, when considering potable potential with a subsidy equivalent to the existing legislation in Austin, TX, there were nine occurrences of positive NPVs. When adjusting parameter values for key variables I found that the most influential variables on profitability, in order, were water price escalation rates, roof size and precipitation, and system cost. Ongoing maintenance and electricity costs were the least influential.

This type of model is generalizable to RWH systems anywhere, substituting parameter values. This holds implications for policy makers in their decision-making with respect to water infrastructure planning. Determining the effectiveness of subsidies is one of the outputs of this model, which can prove to be a catalyst for RWH adoption.

Acknowledgements

I would like to thank everyone I have met throughout this program. I am eternally grateful for all the time and effort each of you have volunteered to me. These exchanges have yielded far more value than I could have predicted.

Currently acting as my thesis director, Dr. Mark Leighton has been part of my learning journey from its humble beginnings in this program. His vast experience base from which he draws to communicate valuable concepts as well as thought provoking catalysts have not only been invaluable along the journey, and specifically this project, but predictably for the many more I encounter in the near and distant future.

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Chapter I

Introduction

The current initiatives in the USA to roll back protections for waterways, put in place by the Obama administration through the gutting of the Clean Water Act, puts freshwater resources in a precarious position. The future of our most valuable natural resource is in peril, as an estimated 50% of the nation's waterways already have claimed the "impaired" title when considering EPA guidelines (Lerner, 2018). In addition, the current infrastructure in place to deliver and consume water, across the continental United States, is heading towards the end of its useful life (Buckley, Gunnion, & Sarni, 2016). Utilities have begun to prepare for this impending capital expenditure, estimated to be $1 trillion over the next 25 years, by steadily increasing water rates (Buckley et al., 2016; Water and Wastewater, 2017). Improvements to infrastructure are not the only factor putting pressure on utilities as scarcity, water treatment costs, a reduction in water use through efficiency improvements, and reduced industrial activity all can put pressure on the price of water (Buckley et al., 2016). Supporting these notions, the price of water has handily beaten inflation when looking at the national averages over the years (Amadeo, 2018; Walton & Lafond, 2018). When considering these catalysts and previous price movements, the growth in water prices across the country show no signs of slowing down. Although residential water prices are currently a small proportion of household expenses, the effect that compounding has on constant price increases can leave people unprepared. The velocity that the increase in water prices are experiencing can put households at financial risk.

Climate change poses further risk to freshwater availability. Weather events are trending in the direction of more extreme outcomes, leaving us with the possibility of prolonged wet and dry seasons (Walsh & Wuebbles, 2014). This is especially important as we are heavily reliant on groundwater resources which are projected to experience higher variance in their recharge cycles (UN Water, 2010). Although water availability might be compromised, national annual rainfall is expected to increase in the US with a rise in temperature. We have already seen this over the past few decades as most regions have experienced an increase in total precipitation, while the southwest and southeast regions have experienced reductions in total rainfall (Walsh et al., 2014). Higher variability in water resources means that the predictability of available water supplies will become increasingly elusive. Water quality can also incur climate related damages as cases of extreme flooding and drought can lead to higher rates of pollution.

Rainwater Harvesting Systems

A possible solution to this dilemma is to install a rainwater harvesting system (RWH) which would supplement tap water use through the collection of rain. The storage of water for drier times can prove to be an important asset with such uncertainty in the future. This resource is something that can be leveraged in the short term as well to generate cost savings akin to how solar panels leverage sunlight. This is a passive solution to an active problem as water quality issues can also be mitigated through the filtration of rainwater for potable use.

Residential RWH systems can be installed to provide water for several end uses. Main uses of collected primary filtered non-potable water are toilet flushing, laundry, irrigation, and swimming pools (Kloss, 2008). If potable water is required, further filtration is added to the RWH system. Filtered rainwater using a charcoal and reverse osmosis and/or ultraviolet filtration systems can provide quality potable water (Sistek, 2008; Thomas et al., 2014). This adds to the cost, which leads to a reduction in ROI (return on investment) for homeowners. This added cost would be justified if an adequate supply of high-quality tap water is at risk, or to mitigate risks of future quality issues.

RWH systems work by using a roof as a catchment area to divert water through a gutter system into a tank which sits on or below ground. The tank then stores the water until it is subsequently pumped into the home for use. Another method uses for the roof itself, if it is flat and deep enough, to serve as the catchment and storage area (Figure 1) (Vargas-Parra, Gabarrell, & Villalba, 2019). This allows the system to be gravity fed, rather than require a pump system, eliminating electricity and maintenance costs associated with the pump. This method is rarely implemented, but worth broader consideration.

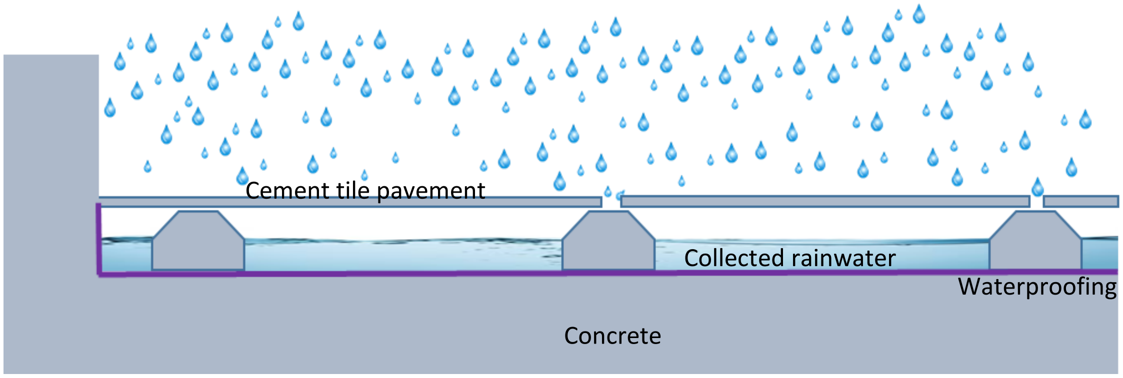


Figure 1. A visual representation of a gravity fed RWH system using the roof as the catchment area.

There are two main methods of deployment associated with the systems which use tanks: individual and clustered deployments. In the individual setting, every household incurs the costs for their RWH system alone. In the clustered method a certain number of households pool their resources in order to achieve cost savings and create a shared tank system. This clustered system can achieve drastically shorter payback periods (Vargas-Parra et al., 2019). The most common type of RWH system in the USA for households has been an above ground polyethylene tank system primarily used for irrigation (Thomas, Kirisits, Lye, & Kinney, 2014). A survey conducted by polling members of the American Rainwater Catchment Systems Association (ARCSA) found that 32% of household implementations use harvested rain for drinking, with 43% using harvest rain for non-potable indoor use, and 90% using the water for irrigation. Other types of cisterns in use include galvanized metal, fiberglass, and concrete, making up 10%, 3%, and 10% of respondents, respectfully. A majority of implementations have used a primary filtration method to filter out debris, with 75% of potable water using inline ultraviolet (UV) treatment (Thomas et al., 2014).

The adoption of RWH hinges on the costs and potential benefits which can only be estimated once future water prices are considered. The current literature pays little to no attention to future water prices in their economic models. This proposed research will hinge on filling this gap.

Research Significance and Objectives

Using cost benefit analysis (CBA), an economic model was constructed to evaluate the cost savings potential of potable and non-potable retrofitted RWH systems in a residential setting. A generalized model of this nature should assist others in their modeling of RWH systems in the future. The model was constructed using a 30-city sample spread across various regions throughout the continental US. I considered historical water prices, in conjunction with prudent statistical assumptions, to identify possible price movements over a 20-year time period. This analysis fills a gap in the currently available models and research. My research objectives were:

- To show conditions under which RWH is a financially prudent investment for households using NPV, IRR, and Payback Period as measurements of profitability.
- To evaluate the potential impact on profitability of different parameter values for key variables.

  To show the benefit(s) to society, in terms of reduced pressure on public water infrastructure, as well as increased disposable income for households over time, in order to understand the full economic benefits of proposed RWH systems. To create a comprehensive, generalizable, cost benefit analysis for evaluating RWH systems in different regional contexts which can be replicated.

Background

A changing climate is something we have been experiencing over the past century, with repercussions that extend to various ecological processes. Water related consequences have already begun to be felt (UN Water, 2010), for instance, in the widespread drought conditions in the western US (Figure 2) Rising temperatures are

Figure 2. Water supply stress index for the USA (Melillo et al., n.d.).

already affecting water cycles, such as can be seen in California and Texas, by inducing a highly variant wet and dry season with no apparent pattern exacerbating unpredictability (Walsh et al., 2014). Although precipitation is expected to increase in California and across the continental US in general, it has already become more concentrated into bigger events. This concentration of rainfall, and subsequent extension of dry periods, has a profound effect on water cycles. This effect can be seen in soils which will have a reduced ability to retain moisture, leading to erosion, a lack of groundwater recharge due to increased runoff, and increased evaporation leading to an increased water demand for agriculture and landscape use (UN Water, 2010). Texas has already adopted forward thinking RWH legislation in response to this issue, as the state has already experienced an estimated agricultural loss of 8 billion USD in 2011 due to drought, with other costs pushing this number higher (Bolhassani, 2014). RWH helps to mitigate these risks by capturing rainwater, reducing the demand on public infrastructure by supplementing tap water, as well as the ability to store water in preparation for prolonged dry seasons.

Sea level rise is another climate related consequence that will have a profound effect on freshwater resources. As flooding becomes more rampant in coastal areas, groundwater quality will be negatively affected (UN Water, 2010). This flooding of salt water will inevitably reduce the quality of water in aquifers due to an increase in salinity. Florida is at major risk for this to occur which is of special importance as it sits on one of the largest aquifers in the nation. Moreover, Florida is composed predominantly of limestone, a porous rock that helps to divert water to aquifers. While this attribute assists in recharging aquifers with rainwater, it is a negative feature in terms of mitigating salt water intrusion (Langevin & Zygnerski, 2013). In the case that major portions of an aquifer are compromised, filtration methods such as desalination will have to be implemented, further complicating the price of and access to clean drinking water (Siegel, 2017). In this scenario RWH can be of use by capturing rainwater before it is mixed in with compromised groundwater resources. Aquifers and above ground water reserves such as lakes, rivers, and other waterways are also at risk due to overuse (Lerner, 2018).

Water scarcity from overuse can be detrimental to freshwater resources leading to a complete drawdown of aquifers, rivers, and even lakes. These events continue to be an issue due to a seemingly endless increase in the human population and their water use demands. Even before an aquifer is completely drawn down, salt water intrusion can render it useless as salinity levels become more concentrated (Knowling, Werner, & Herckenrath, 2015; Langevin & Zygnerski, 2013; Siegel, 2017).

Lake Mead and the Colorado River is an example of how overuse has led to an extreme drawdown, which will be hard to recover from (Hiltzik, 2019; NASA, 2015). The Colorado River was divided using a hydroelectric dam to spread water across some states as well as provide electricity, especially to California. Currently it is estimated that the usage of the lower basin by itself is extracting 1.2 million-acre-feet above what the Colorado River can provide (Hiltzik, 2019). Subsequently, pollution becomes more of an issue as volume dwindles, furthering concentration levels of pollutants.

The overuse issue stems especially from irrigation for agricultural activities over the last 50 years, as crops being grown are some of the least efficient in terms of their demands for water (Figure 3) (Otto, 2020). This puts a myriad of aquifers across the state at risk for the sole purpose of profit as most of this produce is exported (Siegel, 2017).

California has already sought out Israel’s expertise in combatting their issues by fostering relationships between Israeli and Californian businesses and universities to find ways to curb use and increase efficiencies (Siegel, 2017). Furthermore, IDE Technologies, an Israeli company and the world’s foremost desalination plant manufacturer, has built the largest desalination plant in the western hemisphere off the coast of San Diego, producing 190M liters of water daily (IDE Technologies, n.d.). This example shows that overuse can be detrimental to the point of requiring novel ways to provide enough water sustainably. A study conducted by the National Centre for Groundwater Research and Training, based in Australia, found that aquifer depletion was vastly more attributable to overuse compared to effects of climate change (Knowling et al., 2015).

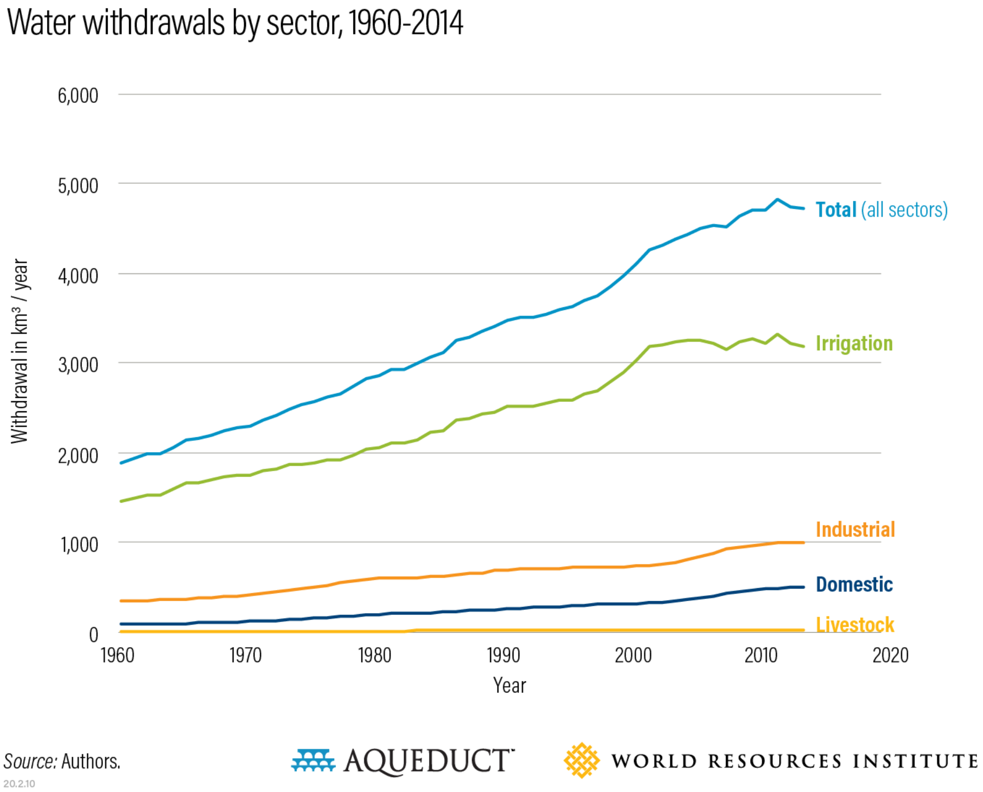


Figure 3. Water withdrawals 1960-2014 in USA (Otto, 2020).

Public Policy for Water Scarcity

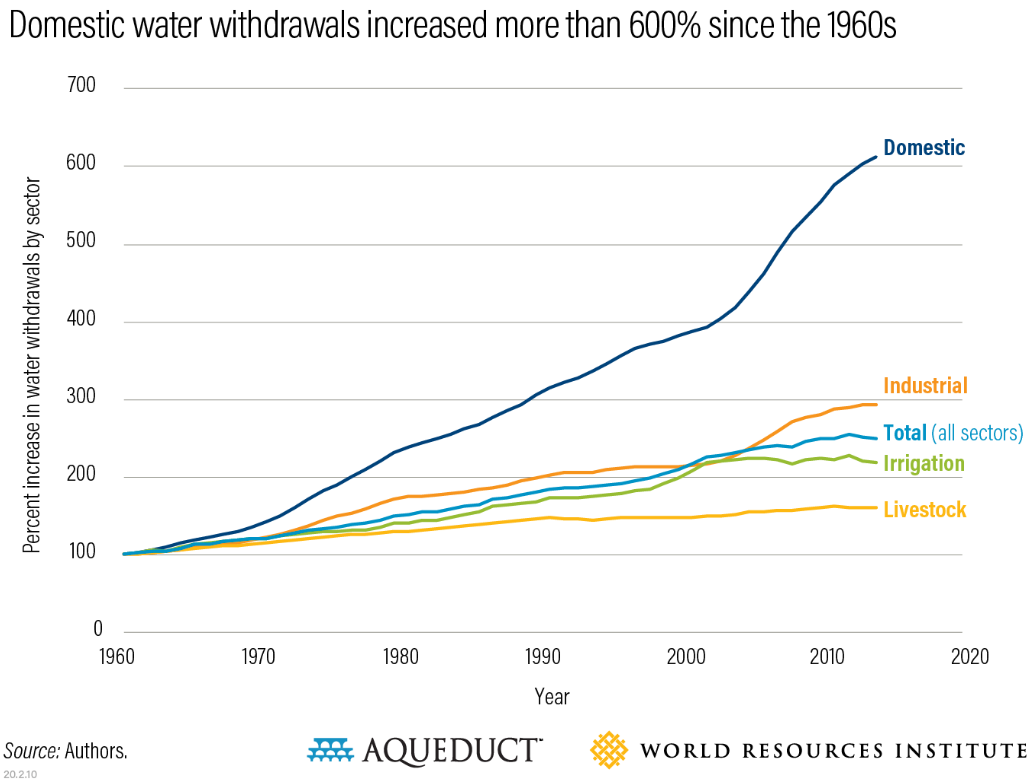
The Middle East is a prime example of how water related issues can stem from lack of proper planning, resource management, and innovation. Fresh water resources are not plentiful to begin with in this semiarid region which serves to magnify any shortages. It is easy to see the consequences of poor planning compared to the benefits of proper management, as exemplified by Israel relative to its neighbors, and even the rest of the world. Israel has managed to defy the odds of water scarcity attributed to their geography by leveraging a basic tenet: the public owns all the water within the country. This creates a basic rule that no one can use more than their fair share as everyone in the country has an equal right to the water itself, giving birth to a separate governing body tasked with the sole purpose of regulating the water industry. This has separated water issues from politics, allowing profits from state owned water utilities to be reinvested in the pursuit of efficiency, rather than being allocated to unrelated budgets concocted by politicians to serve their whims (Siegel, 2017).

In the US we have taken for granted our trove of natural resources while also neglecting long term water infrastructure investments, as this issue has not been seen as a pressing matter by politicians, who aim to please their constituents with interventions that yield gains in the short-term (Siegel, 2017). In order to create proper policy around these issues there needs to be proper capital allocation in the near term to head off long term issues.

Israel went from a freshwater reserve that could support an estimated maximum of two million people to a net exporter of water and water intensive crops, meanwhile supporting over twelve million people at any given moment. Meanwhile, Israel's neighbors suffer from water quality and scarcity issues as proper planning was never thoughtfully initiated (Siegel, 2017). One of the ways Israel innovated away their water scarcity issue was by inventing and deploying drip irrigation on all of their farms. This reduced water use attributed to agriculture by 30-60%. There was enough incentive to get all of the farms to purchase and deploy this new method of irrigation through the two-fold benefit of water use reduction and a promise of a substantial increase in yields. Both were realized and complete saturation of drip irrigation has been reached (Siegel, 2017).

US Policies for RWH Adoption

There could be a similar opportunity for municipalities in the US by stimulating RWH adoption through subsidies and educating households on its benefits. This is seen as a direct solution as domestic water use has skyrocketed since 1960, with a significantly higher growth rate than any other major use of water (Figure 4) (Otto, 2020). Currently, there are 19 states that have specific legislation on RWH. Most of this legislation pertains to the study of RWH and its potential benefits as well as externalities.


Domestic water withdrawals increased more than 600% since the 1960s

Source: Authors.

Figure 4. Percent change in US water withdrawals 1960-2014 (Otto, 2020).

The main concern associated with RWH is the diversion of rainwater away from groundwater resources. This concern has been largely debunked, as urban rainwater contributes very little to downstream groundwater reserves. In residential settings such as in Colorado, a homeowner cannot deploy more than two rain barrels, not exceeding 110 gallons, and can only use collected rainwater for outdoor purposes. Although this is a limiting factor, it is a step in the right direction as RWH was largely outlawed at the residential level in Colorado until 2009 (NCSL, 2018).

There are also states that are providing subsidies for property owners to install RWH systems. New Jersey provides up to 2,500 USD in rebates per residential property depending on the area of impervious surfaces, and the overall projected effectiveness of the proposed system. Commercial properties, including multi-family, can qualify for up to 10,000 USD in rebates (Eustace, Wimberly, Gusciora, & Huttle, 2016). Rhode Island provides a 10% tax credit based on the cost of the system, but is limited to 1,000 USD (NCSL, 2018).

Texas has possibly the most comprehensive RWH legislation the US. For example, new state facility construction, which meets certain thresholds, must include RWH in its design. Tax incentives exist in the form of sales tax exemption at the point of purchase, as well as a real estate tax exemption. Some municipalities in Texas offer further incentives and are encouraged to do so (NCSL, 2018). Austin has been the most progressive city with respect to residential RWH, offering up to a 50% tax credit with a maximum rebate of $5,000 (Austin Water, n.d.). Furthermore, there is a proposed bill in New York to further green infrastructure investments, including RWH, by providing homeowners a 50% tax credit for the costs of the investment up to 5,000 USD (NCSL, 2018).

Price of Water

The price of tap water has been steadily increasing across the nation over the past decade at a rate that vastly exceeds inflation (U.S. Department of Energy, 2017; Amadeo, 2018). According to a 2017 survey conducted by The U.S. Department of Energy (2017), national average water rates have increased by ~40% from 2008-2016. This is just the average, so some locales have seen sharper increases. This survey has also shed light on water-rich regions such as Florida. For example, the average annual escalation rates for Jacksonville and Miami were 7% and 6%, respectively (U.S. Department of Energy, 2017). These are above the national average, whereas Orlando experienced only a 0.4% escalation rate over the time period (U.S. Department of Energy, 2017). This shows that water-rich areas can also experience high annual rates of water price escalation, as infrastructure costs and reduced industrial use can put pressure on water prices. In addition, this also illustrates that price escalation rates are highly localized and variable, as Orlando sits between Jacksonville and Miami geographically.

Previous economic analyses of RWH systems have either kept the price of water constant or have attributed a singular fixed escalation rate (Vargas-Parra et al., 2019). This leaves vast room for error when focusing on a single locale, as future outcomes are hard to predict. However, this is a fine strategy when trying to model which locales have the potential to profitably install RHW systems, but policy makers need to have better tools in understanding the possible range of outcomes and which parameters are most susceptible to volatility.

RWH Cost Benefit Analyses (CBA)

The main costs associated with RWH are the purchase and installation of the system, as maintenance costs are usually minimal. In gravity fed systems the tank itself is usually the most expensive component, which makes up the majority of the costs (Vargas-Parra et al., 2019). In systems where the tank is situated below or on the ground the collected water needs to be pumped to the point of use adding to the system costs with ongoing electricity usage. A below ground installation would require additional costs to excavate and install the system. A two tank system where one tank is situated on or below ground and another on or right below the roof can provide greater efficiency as the pump is turned on and off only to fill the secondary tank, with the water being gravity fed to point of use (Figure 5) ("Aura-Lite Underground System," n.d.). In clustered systems this would work in a similar fashion with a water tower, or tanks situated uphill, mimicking the secondary tank in individual installations.

When evaluating clustered systems, the cost per gallon of water collected is less than individual installations as some level of economies of scale is achieved. Since the tanks are shared in the clustered system, larger tanks can be purchased which are more cost efficient in terms of capacity per dollar spent. Maintenance and upkeep costs are minimal and usually do not have a strong effect on profitability (Vargas-Parra et al., 2019). If potable water is desired, then a proper filtration system must be installed as well. The upfront and ongoing costs of filtration systems carry high costs but can be worth the investment under conditions in which potable water quality is at risk or as insurance to mitigate future calamities.

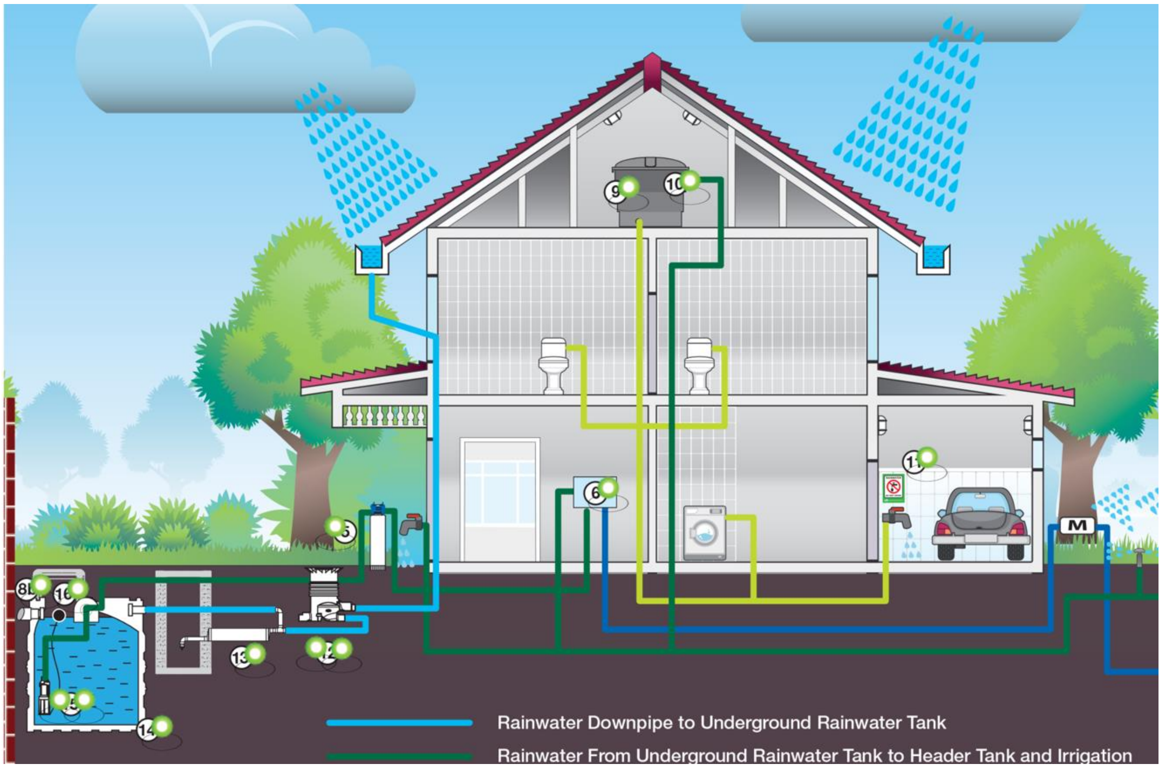


Figure 5. Single household two tank below ground RWH system (Aura-Lite Underground System, n.d.).

The lifespan of RWH systems is dependent on each component within the system. The tank itself, dependent on material, can last for more than 60 years in underground installations (Greenspec, n.d.). In above ground installations, plastic tanks tend to last only 20-30 years dependent on exposure to sunlight. Primary filters for dirt and debris tend to last for more than 60 years as well. Pumps and electric controllers have service lives between 10-15 years dependent on running hours. Submersible pumps can reduce upfront costs, compared to outside tank solutions, but come with risk of complete failure as they cannot be repaired (Greenspec, n.d.).

Past CBA studies have shown varying results with respect to profitability, which is to be expected due to site specific variables. For example, a life cycle analysis conducted on various RWH implementations in Barcelona, used singularly for laundry use, found that clustered (shared) systems in low and high-density areas are NPV positive, whereas individual implementations carried a negative NPV within the same time frame (Vargas-Parra et al., 2019). The analysis attributed a single water price escalation rate of 5%, rather than evaluating multiple possible outcomes (Vargas-Parra et al., 2019). This analysis is important and surprising, as it found that 80% of the cost savings in these systems is attributed to a reduction in detergent use, as the hardness of tap water requires larger amounts of detergent in comparison to rain water (Vargas-Parra et al., 2019). This does not diminish the importance of savings on tap water when accounting for other end uses, as only laundry use was studied in this analysis. This shows that there are promising ways to account for benefits of an RWH system aside from savings on tap water.

Several benefits accrue when adding a RWH system to a household, both economic and environmental. The economic benefits are accrued through annual cost savings on water utility bills and possibly laundry detergent costs. Environmental benefits include a reduction in GHG emissions, a reduction in detergent use, and reduced strain on freshwater resources (Vargas-Parra et al., 2019). Two life cycle analyses using Barcelona and the USA as case studies, showed that GHG emissions associated with water consumption are reduced when installing a RWH system due to the energy and emissions associated with the treatment and delivery of tap water when compared to the entire life cycle of RWH systems, individual or clustered (Vargas-Parra et al., 2019; Ghimire, Johnston, Ingwersen, & Sojka, 2017)

To assess the overall economic benefits of RWH systems, CBA models are constructed. Farreny et al. (2011), in a widely cited paper on the subject of RWH, conducted a CBA in a dense urban neighborhood in Granollers, Spain. This analysis assessed multistory apartment buildings, using four deployment methods, consisting of single building (individual) and neighborhood (clustered) installations with correspondence to new construction and retrofit implementations. They found that the current price of water, which did not reflect its actual value as the commodity is heavily subsidized in the EU, could not support RWH deployments in terms of return on investment (ROI). The results showed that at current water prices, the CBA resulted in a negative NPV in the lifecycle of the proposed systems, even with a 0% discount rate. He further described a scenario where if the water price were to increase almost fourfold, NPV would be positive in neighborhood level deployments. Individual deployments produced a negative NPV and no quantifiable payback periods. Farreny et al. (2011) described these as viable deployments at the neighborhood level in terms of mitigating water scarcity risk in addition to environmental benefits. Although they only found the benefits outweighing the costs once economies of scale have been achieved, they did show that there is an opportunity to improve on this model. For instance, savings on tap water was the only benefit measured, ignoring the possible savings on laundry detergent use as Vargas-Parra alluded to. Moreover, environmental benefits were not considered, some of which can be quantified such as GHG savings and avoided storm water run-off. Both of these assessments considered modest future price escalation, but only for a single scenario.

Considering the recent growth in water prices across the US there is cause for optimism with respect to RWH profitability at the household level. Sample and Liu's (2014) study on various RWH implementations found that if water prices were to double, almost all of the scenarios they modeled would reach break-even, although their current water rates resulted in a negative NPV without being paid back in the period in question. In this analysis there is also mention of improvement by including laundry use (Sample & Liu, 2014).

The national average water price has seen a sharp increase as previously mentioned, validating a generalizable examination of the future profitability of RWH systems in the US, especially CBAs that include a full range of direct financial benefits to those installing the system, and indirect benefits to society in avoided environmental and future infrastructure costs.

Research Questions, Hypotheses and Specific Aims

My research therefore addressed the following questions: Will continued escalation of water prices, over a 20-year period, provide justification for households to incur the capital costs associated with RWH systems? What scenarios, or combinations of parameter values for cost and benefit variables, result in positive NPVs, thus justifying investment in an RWH system? Can RWH provide enough of a public benefit, in terms of reduced pressure on public water infrastructure, to entice local governments to provide incentives for households to adopt such systems?

In answering these questions, I tested four main hypotheses:

- Hypothesis 1: Applying the average water price escalation rate of the past 9-years over the 20-year period, on a city by city basis, using the previous 30-year precipitation averages, will show at least one city in which RWH systems can produce payback periods of ≤ 13 years across all tiers of consumption sans any existing subsidy.
- Hypothesis 2: Average annual rainfall must be at least 12 inches concentrated in ≤40days to adequately provide a public benefit through RWH, or mean annual rainfall must be at least 30 inches to provide a public benefit and positive NPV.
- Hypothesis 3: Ongoing maintenance and electricity costs of the pump will be the second most significant parameter affecting profitability after water price escalation rates.
- Hypothesis 4: RWH is a best-case solution to reduce pressure on local municipalities to improve and add water infrastructure, and reduce their total GHG footprint, with financial data present showing a clear benefit for subsidies.

Specific Aims

To test these hypotheses, I:

1. Identified and estimated all variables necessary to construct the cost-benefit model.
2. Defined a generalizable baseline model.
3. Projected the future price movements of water rates using a 20-year time scale.

4. Conducted a sensitivity analysis adjusting parameter values for key variables to better understand which factors affect profitability and the range of possible outcomes.
5. Analyzed the potential public benefit that can arise from reduced pressure on public infrastructure and household income.

Chapter II

Methods

In order to evaluate the viability of residential RWH systems over a period of 20 years, cost benefit analyses were conducted for 30 major cities across the US. Mean values of all the statistics for the 30-city sample was used to construct the baseline CBA for both potable and non-potable end uses, with the only difference being the second stage UV filtration system and its associated maintenance costs. The most important data gathered were the historical behavior of household water prices from Circle of Blue, an organization dedicated to gathering information pertaining to water. Average precipitation, recent precipitation trends, water price trends, material costs, and population metrics were all used to test, using regression analysis, if there were any significant relationships between variables. Sensitivity analyses were conducted on future price trends, precipitation, and material costs to define the most prevalent conditions under which profitability and subsidy might be combined for RWH systems in order to benefit the public. CBA modeling was conducted in Excel. All costs were in USD.

Cost Benefit Analysis (CBA) Design

Water utility pricing was gathered from Circle of Blue for 30 major cities across the US spanning 2010-2018 (Table 1) (Walton & Lafond, 2018). These data were segmented to show the different prices municipalities charge for three tiers of consumption. The three tiers are 200, 400, and 600 gallons per day. The pricing data

Table 1. List of 30-city sample.

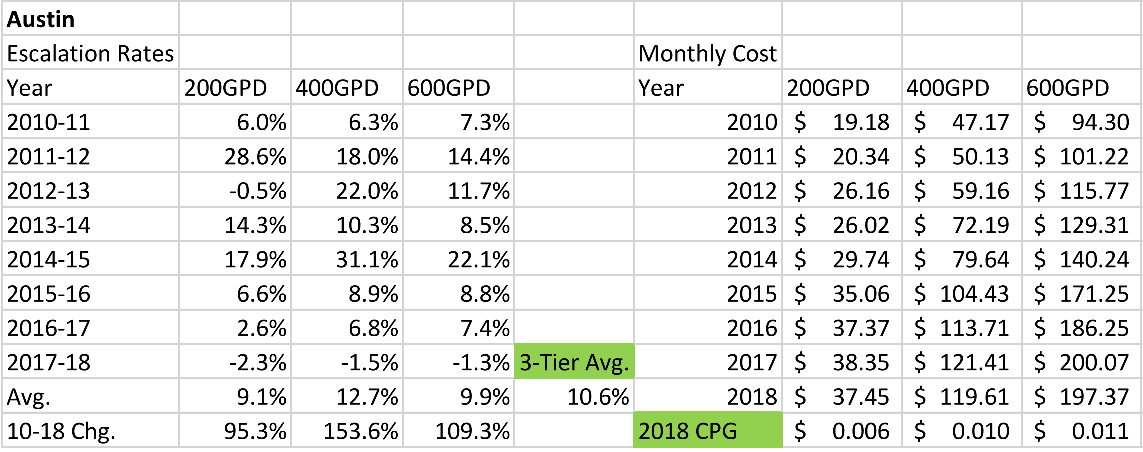
Atlanta, GA	Los Angeles, CA
Austin, TX	Memphis, TN
Baltimore, MD	Milwaukee, WI
Boston, MA	New York, NY
Charlotte, NC	Philadelphia, PA
Chicago, IL	Phoenix, AZ
Columbus, OH	Salt Lake City, UTA
Dallas, TX	San Antonio, TX
Denver, CO	San Diego, CA
Detroit, MI	San Francisco, CA
Fort Worth, TX	San Jose, CA
Houston, TX	Seattle, WA
Indianapolis, IND	Santa Fe, NM
Jacksonville, FL	Fresno, CA
Las Vegas	Tucson, AZ

included the monthly price of water at each respective consumption level over this 9-year timespan (Walton & Lafond, 2018). These data were organized to compile the price of water for each year and consumption level (the three columns on the right of Table 2), the year over year % change in water cost for each consumption level (the three columns on the left of Table 1), 9-year cumulative change, and the 9-year average change. These calculations are shown for Austin, one of the 30 US cities (Table 2).

Once this pricing data was organized for each city, I normalized the most recent year's monthly price at each level of consumption to express all water costs in 2018 cost per gallon (CPG) (Table 2). This enabled me to calculate the value of the potential precipitation captured, as each city has varying potential in terms of collectable rainwater. The formula for this is:

$$CPG = Monthly\ Price \div (Daily\ Consumption * \frac{365}{12})$$

Table 2. Example of water pricing data compiled for the city of Austin, TX.



Austin								
Escalation Rates					Monthly Cost			
Year	200GPD	400GPD	600GPD		Year	200GPD	400GPD	600GPD
2010-11	6.0%	6.3%	7.3%		2010	$ 19.18	$ 47.17	$ 94.30
2011-12	28.6%	18.0%	14.4%		2011	$ 20.34	$ 50.13	$ 101.22
2012-13	-0.5%	22.0%	11.7%		2012	$ 26.16	$ 59.16	$ 115.77
2013-14	14.3%	10.3%	8.5%		2013	$ 26.02	$ 72.19	$ 129.31
2014-15	17.9%	31.1%	22.1%		2014	$ 29.74	$ 79.64	$ 140.24
2015-16	6.6%	8.9%	8.8%		2015	$ 35.06	$ 104.43	$ 171.25
2016-17	2.6%	6.8%	7.4%		2016	$ 37.37	$ 113.71	$ 186.25
2017-18	-2.3%	-1.5%	-1.3%	3-Tier Avg.	2017	$ 38.35	$ 121.41	$ 200.07
Avg.	9.1%	12.7%	9.9%	10.6%	2018	$ 37.45	$ 119.61	$ 197.37
10-18 Chg.	95.3%	153.6%	109.3%		2018 CPG	$ 0.006	$ 0.010	$ 0.011

The output of this formula yielded the water pricing variable, 2018 CPG, for each consumption level across all cities, which is termed the "Usage Cost**.**" This number is the initial water price at year 0, or t=0. Due to the escalation rates in most cities and year over year volatility, the average of the three tiers' 9-year average water escalation rate, under the 3-Tier Avg. header, was applied uniformly across the 20-year timespan for each level of consumption for each respective city (Table 2). Use of each tier's 9-year average escalation rate was avoided, as some lower levels of consumption have larger escalation rates, thus presenting situations where at the end of the 20-year period consuming less water can actually be more expensive.

Estimating Rainwater Capture Benefits

The benefit of installing the RWH system is the avoided cost of paying for the cost of publicly supplied water substituted by captured rainwater. This is determined largely by how much water can be captured.

To estimate this quantity for each sample city, I calculated the maximum potential precipitation that is available for capture on an annual basis by this procedure. First, the annual precipitation in inches and roof area in square feet were multiplied to find the maximum precipitation available for capture, on average, for any given city. Precipitation data were readily accessible as the 30-year average of precipitation data compiled by NOAA, spanning 1981-2010 (Current Results, n.d.; NCEI, n.d.). It is imperative to use a long-term average as annual precipitation totals are highly variable, with some regions experiencing an increase in volatility (Current Results, n.d.; Hausfather, 2018; Walsh & Wuebbles, 2014).

In order to create an analysis that allowed comparison of the fundamentals of each city and its potential for RWH over the next 20 years, I kept certain variables constant. I chose 2,500 sf as a standard roof area, as this is seemingly in the range of most common household roof size across the US, although no official data on this were found.

I then multiplied the product of precipitation and roof area, by the standardized efficiency coefficient denominated in gallons, 0.623, that is used industry wide (Texas Water Development Board, 2005). This coefficient accounts for loss of water through evaporation and leakage while converting the rainfall amount from inches to gallons (U.S. Department of Energy, n.d.). This formula is written:

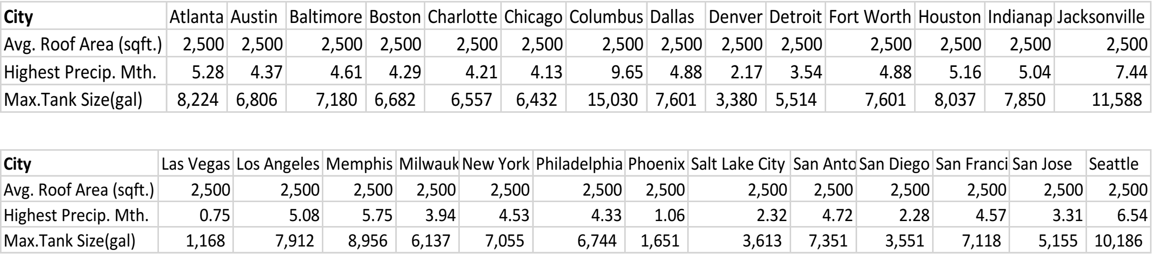
$$Max\ Capture(gal) = 0.623 * Roof\ Area * Ann. Precipitation$$

Benefits were then calculated for every level of consumption. To do so I simply multiplied the corresponding year's CPG (cost per gallon), for each level of consumption, with the volume of precipitation that I estimated could be captured, based on precipitation data. This was repeated for each year over the 20-year time-period. The resulting output gives the gross benefit dollar amount, delineated as “Max Capture”. The corresponding formula for this at t=1 is:

$$Gross\ Benefit\ yr1 = yr1\ CPG * Max\ Capture$$

I assumed that the installed RHW tank will be large enough to capture the full amount of average annual precipitation on our 2,500-sf roof. To select the corresponding tank size, I identified the highest monthly average precipitation for each city and concluded that the installed tank should have the capacity to capture the entirety of the most voluminous month’s rainfall events in terms of the 30-year average (Climate United States., n.d.) (Table 3). This conclusion honors the thought that in installing such a system, both the private and public benefit should be maximized, especially if a public subsidy is to be justified. No subsidies were applied at this initial stage of analysis, but were then explored further.

Table 3. Tank sizing data for the 30-city sample (Climate United States., n.d.).



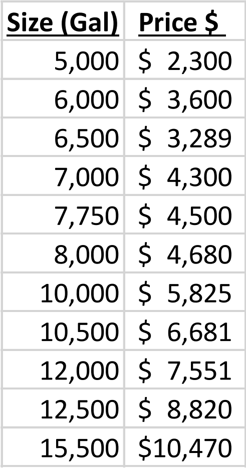
City	Atlanta	Austin	Baltimore	Boston	Charlotte	Chicago	Columbus	Dallas	Denver	Detroit	Fort Worth	Houston	Indianap	Jacksonville
Avg. Roof Area (sqft.)	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Highest Precip. Mth.	5.28	4.37	4.61	4.29	4.21	4.13	9.65	4.88	2.17	3.54	4.88	5.16	5.04	7.44
Max.Tank Size(gal)	8,224	6,806	7,180	6,682	6,557	6,432	15,030	7,601	3,380	5,514	7,601	8,037	7,850	11,588

City	Las Vegas	Los Angeles	Memphis	Milwauk	New York	Philadelphia	Phoenix	Salt Lake City	San Anto	San Diego	San Franci	San Jose	Seattle
Avg. Roof Area (sqft.)	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Highest Precip. Mth.	0.75	5.08	5.75	3.94	4.53	4.33	1.06	2.32	4.72	2.28	4.57	3.31	6.54
Max.Tank Size(gal)	1,168	7,912	8,956	6,137	7,055	6,744	1,651	3,613	7,351	3,551	7,118	5,155	10,186

Estimating Costs

Costs were estimated for above ground RWH solutions, as retrofitting houses with these systems is the focus of this study. The cost of the already sized plastic tank, based on the most voluminous month’s precipitation, was taken from two online retailers (Plastic Mart, n.d.; Rain Harvest Systems, n.d.) (Table 4). The cost of these tanks can vary considerably, but I assumed enough local distributors across these cities to garner the most competitive prices. Shipping costs were not considered to standardize the results, and assumed that a local supplier had these items in stock already at competitive prices. Only plastic (polyethylene) tanks were considered as a survey of current RWH operators proved that these were the most common tanks used. This option is also the most cost effective with a non-substantial tradeoff in terms of durability, making it an obvious choice (Thomas, Kirisits, Lye, & Kinney, 2014).

Table 4. Plastic RWH tank price sheet (Plastic Mart, n.d.; Rain Harvest Systems, n.d.).



Size (Gal)	Price $
5,000	$ 2,300
6,000	$ 3,600
6,500	$ 3,289
7,000	$ 4,300
7,750	$ 4,500
8,000	$ 4,680
10,000	$ 5,825
10,500	$ 6,681
12,000	$ 7,551
12,500	$ 8,820
15,500	$10,470

The rest of the component costs were obtained from the same source as the tank. Stage-1 filters keep debris from clogging the system and stage-2 UV filters kill bacteria and pathogens to make the water safe for potability. A 3-way backup valve is required to connect to municipal water, allowing a switch back and forth as needed. The pump needs enough power to get sufficient water pressure, this variable is highly dependent on the layout of any given house, as well as proximity and elevation of the tank with respect to the house. For modeling costs, I chose a mid-tier pump that was recommended with various systems which fall in the same range of water use as estimated in this study (Rain Harvest Systems, n.d.).

Installation and plumbing costs were estimated based on articles found on the internet and conversations I had with plumbers, and should be considered as educated estimates, not exact numbers (Fixr, n.d.). Acknowledging that cost of labor varies substantially nationwide, labor cost was held constant in order to compare potential RWH cost-effectiveness between cities in a standardized format. Annual maintenance and ongoing energy costs are mostly attributed to pumping, filter replacements, and cleaning costs. All of these have been conservatively estimated using best practices (Nelson, 2018; Sistek, 2008).

Below ground installation estimates add around a $10,000 increase to the cost of the system according to conversations with a Tennessee based firm (Rainwater Resources, n.d.). Due to costs associated with retrofitting RWH systems, below ground installations are unlikely to be a reasonable investment. New home construction may allow for the excavation and plumbing costs to be substantially reduced, possibly making below ground tanks a viable investment in regions which already show profitability in above ground retrofits. Homes which are not hooked up to municipal water supplies, usually in rural locations, can also save money by avoiding the plumbing and sewer installation costs, as well as the risks associated with drilling wells, in areas where precipitation allows for complete reliance on RWH systems (Rainwater Resources, n.d.).

Calculating Costs and Benefits

The only difference between potable (Table 5) and non-potable (Table 6) RWH system implementation in this analysis was the second stage UV filtration system and the associated costs with maintaining and replacing the filter. These two items were held constant across all cities and tank sizes for non-potable water delivery, reducing the cost of implementation by $1,300, the cost of the UV filtration system, and the ongoing maintenance costs by $250, the cost of replacing and operating the filters (Table 5) (Rain Harvest Systems, n.d.; Sistek, 2008). Plumbing and installation costs were not adjusted to keep the CBA model conservative.

Maintenance associated with the filter upkeep was hypothesized to be the most prohibitive ongoing cost for delivering potable water from the RWH system (Table 5). The variable “Maint. + Energy” contained energy costs associated with pumping the water, cleaning and regular maintenance, and the UV filter replacements. The filtration system was estimated to cost approximately $1,300 USD (Rain Harvest Systems, n.d.). Ongoing energy costs and cleaning are conservatively estimated to be $50 USD each annually, totaling $100 USD (Nelson, 2018). The UV filter replacements are estimated to cost approx. $250 USD annually (Sistek, 2008) for a total of $350 annually (Table 5). Aside from the cost of purchasing the RWH tank, the rest of the costs were held constant across all cities (Table 4). Tank sizing and costs were adjusted based on the most voluminous month’s precipitation. Labor costs were held constant across cities due to the volatile nature of contracting labor and can be seen under the “Install + Plumbing Costs” header (Table 5). This led to a conservative estimate of generally higher installation estimates found online (Fixr, n.d.). Using Austin, TX as an example, total initial installation costs were estimated to be $10,335 USD for potable water (Table 5) and $9,035 for non-potable water (Table 6).

Table 5. Costs at t=0 and t=1 for potable implementations in Austin, Texas.

Costs:		
Above Ground:		
Tank 7k Gal	$ (4,300)	
Gutters	$ (1,000)	
Stage-1 Filter	$ (35)	
Stage-2 UV Filter	$ (1,300)	
3-way backup valve	$ (450)	
Pump 1.5HP	$ (550)	
System Controller	$ (700)	
Install + Plumbing Costs	$ (2,000)	
Year		1
Maint. + Energy	$ -	$ (350.00)
Total Cost	$ (10,335)	$ (350.00)

Table 6. Costs at t=0 and t=1 for non-potable implementations in Austin, Texas.

Costs:		
Above Ground:		
Tank 7k Gal	$ (4,300)	
Gutters	$ (1,000)	
Stage-1 Filter	$ (35)	
Stage-2 UV Filter	$ -	
3-way backup valve	$ (450)	
Pump 1.5HP	$ (550)	
System Controller	$ (700)	
Install + Plumbing Costs	$ (2,000)	
Year		1
Maint. + Energy	$ -	$ (100.00)
Total Cost	$ (9,035)	$ (100.00)

Calculating Gross Benefits

The accrued benefits for RWH systems correspond to a cost savings on utility bills. In this analysis I only account for possible savings on water use and omit any potential savings on the wastewater portion of utility bills, as not every water utility provider accounts for wastewater directly; rather, they account for it indirectly by metering the water consumption and using that same amount to charge for sewer transportation (Gaines, 2011; Rainwater Resources, n.d.). This caveat can't be relied upon to calculate further savings as wastewater can be metered.

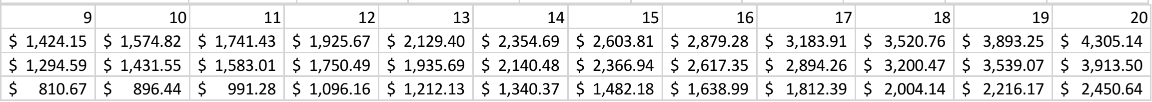
The data gathered for water utility costs were segregated into three tiers of consumption: 200, 400, and 600 gallons per day (GPD) (Walton & Lafond, 2018), then converted to average monthly water bills for each of these tiers for the 30 cities in the sample. The most recent year provided was 2018, so 2018 was used for the cost at year 0 (t=0) to start projections. In order to aid in further calculations and analysis, the 2018 cost of water for each tier was transformed to show the cost per gallon (CPG). The 2018 CPG was used as the base water cost at t=0; in the example of Austin, TX we start with \$0.0108 USD (Table 7).

In the first year of operation, t=1, I assumed benefits will only accrue after the escalation rate has been applied (Tables 2 & 7). The same escalation rate was applied for every subsequent year of the 20-year projection and kept uniform across all levels of consumption. The escalation rate used resulted from calculating the average of the three tiers' 9-year average escalation rates. For Austin, TX the resulting annual escalation rate was 10.6% (Table 2).

To finish calculating the accrued benefits I first calculated the maximum available rainfall we can capture by taking the annual precipitation rate, in this case 34.2 inches which is a 30-year average ending in 2010 obtained from NOAA, and multiplying it by the area of the roof, in this case 2,500 sf, and the efficiency coefficient 0.623. The output of this calculation is the maximum annual available precipitation in gallons, or “Max Capture”, we can reasonably expect. For Austin, TX this is 53,267 gallons annually and was kept constant throughout the 20-year time period. This assumption was adjusted in the sensitivity analysis to show how precipitation volatility can affect RWH performance.

The gross benefit is then calculated by multiplying the “Max Capture” by the corresponding years’ CPG. For example, in Austin, TX at the consumption level of 600GPD in the first year I multiplied $0.0120 by 53,267 which resulted in a gross benefit of $637.01 for that year (Table 7). The gross benefit was then calculated for every year at every level of consumption. The “Capture %” header shows the amount of water collected in the RWH tank compared to total usage (Table 7). Capture % declines proportionally with higher average daily water use (Table 7) because limited precipitation provides an ever-smaller percentage of daily water needs.

Table 7. Accrued benefits over the 20-years of an average potable RWH system in Austin, TX.



Benefits(yr):	Capture %:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
600GPD	24%	$ 637.01	$ 704.41	$ 778.93	$ 861.34	$ 952.47	$ 1,053.24	$ 1,164.67	$ 1,287.89	$ 1,424.15	$ 1,574.82	$ 1,741.43	$ 1,925.67	$ 2,129.40	$ 2,354.69	$ 2,603.81	$ 2,879.28	$ 3,183.91	$ 3,520.76	$ 3,893.25	$ 4,305.14
400GPD	36%	$ 579.06	$ 640.33	$ 708.07	$ 782.98	$ 865.82	$ 957.42	$ 1,058.72	$ 1,170.73	$ 1,294.59	$ 1,431.55	$ 1,583.01	$ 1,750.49	$ 1,935.69	$ 2,140.48	$ 2,366.94	$ 2,617.35	$ 2,894.26	$ 3,200.47	$ 3,539.07	$ 3,913.50
200GPD	73%	$ 362.61	$ 400.97	$ 443.40	$ 490.31	$ 542.18	$ 599.54	$ 662.97	$ 733.11	$ 810.67	$ 896.44	$ 991.28	$ 1,096.16	$ 1,212.13	$ 1,340.37	$ 1,482.18	$ 1,638.99	$ 1,812.39	$ 2,004.14	$ 2,216.17	$ 2,450.64

Measuring Profitability

To gauge profitability, NPV, IRR, and Payback Period were estimated as metrics for the net benefit at each level of consumption. The first year, t=0, only tallies the total cost of implementing the RWH system as benefits have yet to accrue. From the first year onward, I calculated the gross benefit for each year and each level of consumption by the amount of avoided water costs. Annual maintenance and energy costs were subtracted to to yield net benefit accrued in each year. A discount rate of 2% was chosen based on the accepted recent historical annual inflation rate (Amadeo, 2018). IRR was chosen as a metric due to its depiction of an annualized percentage which allows for a more digestible metric than a total benefit over a longer time horizon. Some calculations returned an "Error" in Excel due to a highly negative output for the investment. Payback period was calculated as the amount of years it would take to return the nominal amount invested, not adjusted for inflation. The number was rounded to the next whole year, rather than providing an exact point within any given year, accounting for some uncertainty.

Water Price Behavior

Considering the volatility of water price escalation rates, I did not want to solely rely on the previous 9-year average to draw conclusions 20-years into the future. In order to account for this uncertainty, I incorporated a sensitivity analysis with a selection of variables, including water price escalation rates, consisting of a low- and high-end escalation rate, in reference to the 9-year average. The 9-year average was considered the 'baseline' escalation rate.

I generated a spreadsheet with all the data points for each city and then ran simple regressions between pairs of variables in search of significant relationships. The first set of relationships I tested was between precipitation and water price escalation rates. I was able to compile the previous nine years of precipitation data for 27 out of the 30 cities, and matched these to the same nine years of water prices (Current Results, n.d.). I also used the difference between the average of the nine years of precipitation for each city and the NOAA 30-year average ending in 2010, and compared that differential to the 9-year average escalation rate, as well as 2018 CPG for the 200GPD usage tier (Current Results, n.d.; NCEI, n.d.). I also ran regressions comparing the previous 9-year precipitation averages and the 2018 CPG at the 600GPD usage tier for each city. The change in population sizes for the previous 10 years ('Pop Diff') was compared to the 9-year average escalation rate, as well as the 2018 CPG for the 600GPD usage tier. Lastly, I ran two separate regressions for population density compared to 2018 CPG and the 9-year average escalation rate.

Sensitivity Analysis

In order to draw more reliable conclusions from CBA, uncertainty in the values of different variables should be examined. To explore how profitability depends on parameter values of key variables, I adjusted the parameter values by ±20% for certain variables. The year over year change in water prices, precipitation, capital costs of equipment and supplies, and the cost of ongoing maintenance and energy were the variables explored through this sensitivity analysis. Preliminary regression analysis did not yield any significant relationships which would help with the decision-making process with respect to the range of outcomes. These various outcome scenarios were conducted for the city of Austin, Texas.

Change in Parameter Values

Considering the limited data available on water pricing and what influences pricing behavior, I made simple assumptions to create the range of possible outcomes. The first assumption was that price (the cost of water to a homeowner) was not going to decline throughout the 20-year period, overwhelmingly supported by the historical data over the period of 2010-2018. Although price can decline year to year, the implementation of an average escalation rate to be applied uniformly across all years smooths out the volatility which cannot be reasonably accounted for (Table 2) (Walton & Lafond, 2018; Water and Wastewater, 2017).

The second assumption made for modeling was that the 3-tier average escalation rate would be the midpoint of the range being applied. Lastly, the range above and below the midpoint should be equal to each other as to avoid optimistic or pessimistic bias. I decided that a ±20% change should be applied to the 3-tier average escalation rate, delineating a full spread of 40% between the lower and upper bound. To accomplish this I ran two scenarios, an increase of 20% in the escalation rate used across the 20-year time period and then a decrease of 20%, recording NPV and IRR outputs for each. In essence, there were six scenarios ran as this was done for both potable and non-potable implementations, and for the baseline parameter values.

Once these profitability outputs were recorded, they were divided by the original NPVs and IRRs to measure the percentage change in these two metrics when adjusting each parameter value. This was done for each variable evaluated: maintenance and energy costs, system implementation costs, roof size, and precipitation. Sensitivity analysis altering roof size and precipitation changes required changes in tank sizes to reflect capture efficiency. This allowed further understanding of which variables should be focused on when trying to gauge optimistic and pessimistic scenarios on the potential of RWH at the residential level over the next 20-years.

Application of Public Benefit and Subsidy

This modeling should also help policy makers understand the power of a subsidy on various RWH implementations. To draw conclusions from this analysis we must consider the current subsidy climate. To do so we identified Austin as a city which has a progressive and substantial subsidy. The Austin subsidy was applied to Austin and the rest of the 29 cities in our sample, in order to show the potential of subsidies on incentivizing implementation of potable RWH systems. Non-potable scenarios were not considered, as the objective of a subsidy would be to reduce as much pressure on municipal water supplies as possible. Moreover, non-potable use cases already show promising results, so a subsidy would just reinforce already projected profitability.

Chapter III

Results

Two sets of cost benefit analyses, showing both potable and non-potable above ground RWH system implementations, for the three tiers of consumption, 200, 400, and 600 gallons per day, were conducted for each of the 30 cities in the sample. All three tiers were examined, even though in almost all cases collected rainwater does not exceed consumption; some cities have different water pricing tiers for different levels of consumption, thus leading to different benefits for each tier.

Potable RWH Potential

Potable RWH systems, under the model assumptions, showed promising results in supporting tap water use, rather than fully replacing consumption. For example, in Austin, TX with respect to the 600GPD tier, the RWH system only covers 24% of our annual demand (Table 7). Atlanta, GA and Houston, TX encountered situations, both at the 200GPD consumption tier, where there was enough precipitation to exceed the 200GPD demand. This was accounted for by subtracting the amount of catchable precipitation over 100% from the accrued gross benefit (Tables 17 & 28).

In the case of Austin, the total installation cost of $10,335 were the entire costs in year 0 (Table 8). In year 1, for the 600GPD tier of the RWH system in operation, the net benefit is $287.01 (Table 8) which is the gross benefit minus the annual “Maint. + Energy” costs (Table 5).

The NPVs over the 20-year period for Austin were $13,586 under consumption of 600 GPD, $10,918 at 400 GPD, and $952 at 200 GPD (Table 8). IRRs for these same tiers were 8.9%, 7.8% and 2.6%.

Table 8. Profit and loss metrics in potable RWH for Austin, TX.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,335)	$ 287.01	$ 354.41	$ 428.93	$ 511.34	$ 602.47	$ 703.24	$ 814.67	$ 937.89	$ 1,074.15	$ 1,224.82	$ 1,391.43	$ 1,575.67	$ 1,779.40	$ 2,004.69	$ 2,253.81	$ 2,529.28	$ 2,833.91	$ 3,170.76	$ 3,543.25	$ 3,955.14
NPV:	$13,586.47																				
IRR:	8.9%																				
Payback Period:	$ (10,335)	$ (10,047.99)	$ (9,693.58)	$ (9,264.65)	$ (8,753.31)	$ (8,150.84)	$ (7,447.60)	$ (6,632.93)	$ (5,695.04)	$ (4,620.89)	$ (3,396.08)	$ (2,004.65)	$ (428.98)	$ 1,350.42	$ 3,355.11	$ 5,608.91	$ 8,138.20	$ 10,972.11	$ 14,142.86	$ 17,686.11	$ 21,641.25
400GPD:																					
Net Benefit:	$ (10,335)	$ 229.06	$ 290.33	$ 358.07	$ 432.98	$ 515.82	$ 607.42	$ 708.72	$ 820.73	$ 944.59	$ 1,081.55	$ 1,233.01	$ 1,400.49	$ 1,585.69	$ 1,790.48	$ 2,016.94	$ 2,267.35	$ 2,544.26	$ 2,850.47	$ 3,189.07	$ 3,563.50
NPV:	$10,918.31																				
IRR:	7.8%																				
Payback Period:	$ (10,335)	$ (10,105.94)	$ (9,815.61)	$ (9,457.54)	$ (9,024.55)	$ (8,508.73)	$ (7,901.31)	$ (7,192.59)	$ (6,371.86)	$ (5,427.27)	$ (4,345.72)	$ (3,112.71)	$ (1,712.22)	$ (126.54)	$ 1,663.94	$ 3,680.88	$ 5,948.23	$ 8,492.49	$ 11,342.96	$ 14,532.03	$ 18,095.53
200GPD:																					
Net Benefit:	$ (10,335)	$ 12.61	$ 50.97	$ 93.40	$ 140.31	$ 192.18	$ 249.54	$ 312.97	$ 383.11	$ 460.67	$ 546.44	$ 641.28	$ 746.16	$ 862.13	$ 990.37	$ 1,132.18	$ 1,288.99	$ 1,462.39	$ 1,654.14	$ 1,866.17	$ 2,100.64
NPV:	$952.31																				
IRR:	2.6%																				
Payback Period:	$ (10,335)	$ (10,322.39)	$ (10,271.42)	$ (10,178.02)	$ (10,037.71)	$ (9,845.53)	$ (9,595.99)	$ (9,283.02)	$ (8,899.91)	$ (8,439.24)	$ (7,892.79)	$ (7,251.51)	$ (6,505.35)	$ (5,643.22)	$ (4,652.85)	$ (3,520.67)	$ (2,231.68)	$ (769.29)	$ 884.85	$ 2,751.02	$ 4,851.66

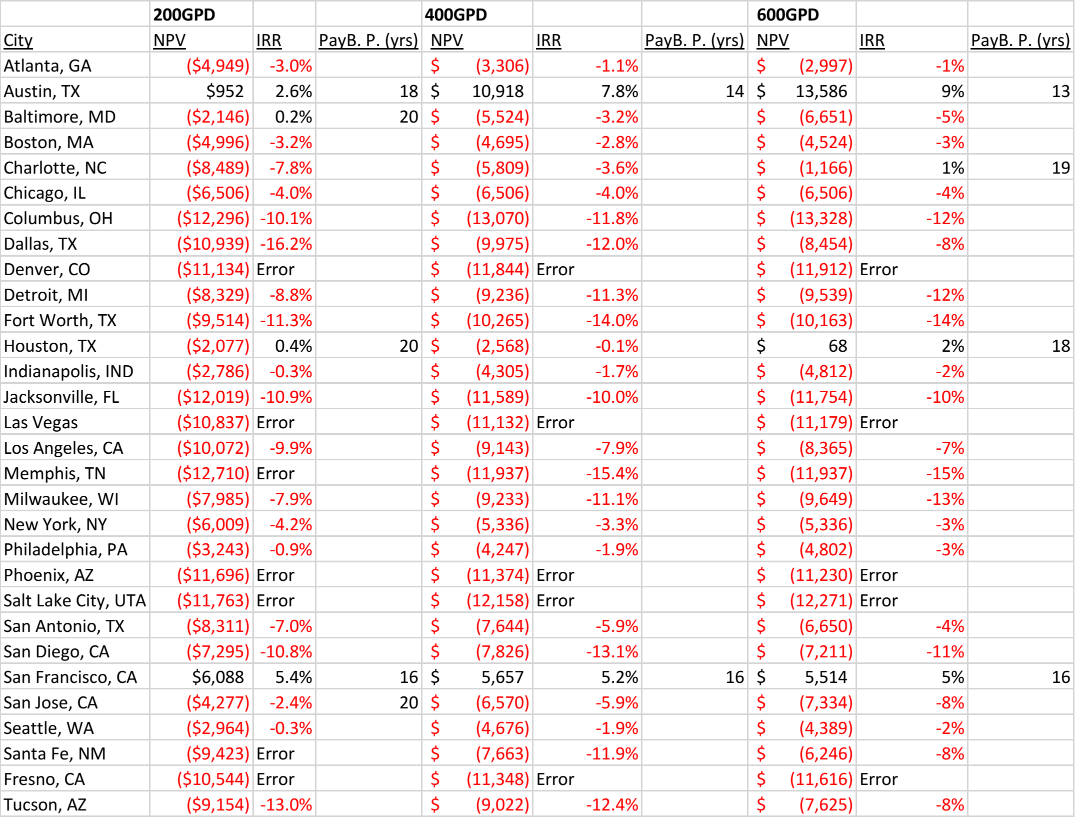
NPVs, IRRs and Payback Periods were calculated for every city at each level of consumption (Table 9). The output of all these analyses varied, with only some showing solid profitability in a city like Austin even before applying the current existing subsidies

(Table 8). Only two out of the 30 cities showed potential to be a profitable investment for a homeowner with an above ground RWH system capable of providing potable water without subsidy (Table 9). Profitability can also be highly dependent on which level of consumption is being analyzed as certain municipalities have tiered water pricing, i.e., price per gallon isn't uniform across all levels of consumption. In Austin, profitability potential across the three tiers, 200, 400, and 600GPD, showed us that the more one consumes the higher the benefit as water pricing is punitive as consumption scales (Tables 8 & 9). Payback period shrunk by 27%, from 18 to 13 years, when comparing 200GPD to 600GPD tiers in Austin (Table 9). This also confirmed my first hypothesis that at least one city would prove to have a payback period within 13 years.

This trend doesn't hold across all cities, as some cities have static pricing models across these three tiers, and in the case of Baltimore, MD the lowest tier of consumers on this scale receive the highest water prices and subsequently the largest benefit from harvesting rainwater (Table 9). IRR increased from 2.6% to 7.8% and 9% for the 200, 400, and 600GPD tiers, respectively, for Baltimore (Table 9). Note that existing subsidies were not applied for Austin in this analysis in order to normalize the results, and evaluate potential future subsidies for other locations.

Other than Austin, only San Francisco, CA showed the potential to feature a positive NPV, sans subsidy, if potable water is required (Table 9). Payback periods within the 20-year time period were achieved by only five cities in the 200GPD tier, two cities in the 400GPD tier, and four in the 600GPD tier (Table 9). Baltimore, Charlotte, and Houston didn't feature a positive NPV or IRR, but did yield a payback period within the 20-year time frame in at least one tier of consumption (Table 9). San Francisco

Table 9. Potable RWH system NPV, IRR and Payback Period for each city organized by water consumption tier.



	200GPD			400GPD			600GPD		
City	NPV	IRR	PayB. P. (yrs)	NPV	IRR	PayB. P. (yrs)	NPV	IRR	PayB. P. (yrs)
Atlanta, GA	($4,949)	-3.0%		$ (3,306)	-1.1%		$ (2,997)	-1%	
Austin, TX	$952	2.6%	18	$ 10,918	7.8%	14	$ 13,586	9%	13
Baltimore, MD	($2,146)	0.2%	20	$ (5,524)	-3.2%		$ (6,651)	-5%	
Boston, MA	($4,996)	-3.2%		$ (4,695)	-2.8%		$ (4,524)	-3%	
Charlotte, NC	($8,489)	-7.8%		$ (5,809)	-3.6%		$ (1,166)	1%	19
Chicago, IL	($6,506)	-4.0%		$ (6,506)	-4.0%		$ (6,506)	-4%	
Columbus, OH	($12,296)	-10.1%		$ (13,070)	-11.8%		$ (13,328)	-12%	
Dallas, TX	($10,939)	-16.2%		$ (9,975)	-12.0%		$ (8,454)	-8%	
Denver, CO	($11,134)	Error		$ (11,844)	Error		$ (11,912)	Error	
Detroit, MI	($8,329)	-8.8%		$ (9,236)	-11.3%		$ (9,539)	-12%	
Fort Worth, TX	($9,514)	-11.3%		$ (10,265)	-14.0%		$ (10,163)	-14%	
Houston, TX	($2,077)	0.4%	20	$ (2,568)	-0.1%		$ 68	2%	18
Indianapolis, IND	($2,786)	-0.3%		$ (4,305)	-1.7%		$ (4,812)	-2%	
Jacksonville, FL	($12,019)	-10.9%		$ (11,589)	-10.0%		$ (11,754)	-10%	
Las Vegas	($10,837)	Error		$ (11,132)	Error		$ (11,179)	Error	
Los Angeles, CA	($10,072)	-9.9%		$ (9,143)	-7.9%		$ (8,365)	-7%	
Memphis, TN	($12,710)	Error		$ (11,937)	-15.4%		$ (11,937)	-15%	
Milwaukee, WI	($7,985)	-7.9%		$ (9,233)	-11.1%		$ (9,649)	-13%	
New York, NY	($6,009)	-4.2%		$ (5,336)	-3.3%		$ (5,336)	-3%	
Philadelphia, PA	($3,243)	-0.9%		$ (4,247)	-1.9%		$ (4,802)	-3%	
Phoenix, AZ	($11,696)	Error		$ (11,374)	Error		$ (11,230)	Error	
Salt Lake City, UTA	($11,763)	Error		$ (12,158)	Error		$ (12,271)	Error	
San Antonio, TX	($8,311)	-7.0%		$ (7,644)	-5.9%		$ (6,650)	-4%	
San Diego, CA	($7,295)	-10.8%		$ (7,826)	-13.1%		$ (7,211)	-11%	
San Francisco, CA	$6,088	5.4%	16	$ 5,657	5.2%	16	$ 5,514	5%	16
San Jose, CA	($4,277)	-2.4%	20	$ (6,570)	-5.9%		$ (7,334)	-8%	
Seattle, WA	($2,964)	-0.3%		$ (4,676)	-1.9%		$ (4,389)	-2%	
Santa Fe, NM	($9,423)	Error		$ (7,663)	-11.9%		$ (6,246)	-8%	
Fresno, CA	($10,544)	Error		$ (11,348)	Error		$ (11,616)	Error	
Tucson, AZ	($9,154)	-13.0%		$ (9,022)	-12.4%		$ (7,625)	-8%	

and Austin both experienced double-digit water price escalation rates in the past nine years, 11.6% and 10.6% respectively, thus the continued escalation rates are much higher than the other three cities which show the potential to have payback periods within the 20-year timeframe (Table 10). Charlotte experienced a 22% growth in population over the last nine years, but saw the lowest escalation rates of the five cities that yielded a payback period within the 20 time frame (Table 10).

San Francisco and Austin also experienced less annual rainfall than the other three cities, 20.7 and 34.2 inches, respectively (Current Results, n.d.; NCEI, n.d.) (Table 10). San Francisco showed relatively high profitability from installing RWH systems due to its current high cost of water across all three consumption tiers (Walton & Lafond, 2018).

San Francisco’s 2018 CPG showed a higher cost the less one consumes: CPG for the 200, 400, and 600GPD tiers were 0.0118, $0.0116, $0.0115, respectively (Table 11). In contrast, in Austin the tiered water pricing model penalized higher use. 2018 CPG for the three tiers were $ .0062, $ .0098, $ .0108, respectively (Tables 7 & 11).

Table 10. Annual precipitation, precipitation days, concentration of rainfall, change in population from 2010-2019, and water price escalation rates for cities producing payback periods within 20-year period (Current Results, n.d.; NCEI, n.d.).

Statistics						
City	Precip. (Ann.)	Precip. Days	Precip. Conc.	Pop %^	2019 Pop.	Escalation Rate
Austin, TX	34.2	85	40%	27%	1,001,104	10.6%
Baltimore, MD	41.9	115	36%	-4%	594,450	6.6%
Charlotte, NC	41.6	112	37%	22%	889,019	6.4%
Houston, TX	49.8	105	47%	12%	2,359,480	6.6%
San Francisco, CA	20.7	63	33%	11%	897,536	11.6%

Table 11. 2018 CPG or CPG at t=0 for the 5 cities that returned payback periods within 20-years.

2018 CPG			
City	200GPD	400GPD	600GPD
Austin, TX	$ 0.0062	$ 0.0098	$ 0.0108
Baltimore, MD	$ 0.0065	$ 0.0049	$ 0.0043
Charlotte, NC	$ 0.0036	$ 0.0049	$ 0.0072
Houston, TX	$ 0.0057	$ 0.0055	$ 0.0065
San Francisco, CA	$ 0.0118	$ 0.0116	$ 0.0115

Austin showed a much higher profit potential than San Francisco, outside of the lowest consumption tier of 200GPD, due to the 60% difference in rainfall (Table 10), but identical implementation costs of $10,335. This was due to the concentration of rainfall in each city. Dividing annual precipitation by the number of precipitation days in each year showed how concentrated rainfall is (Table 10). The larger the number, the less concentrated and the more time available to collect the rainfall. In Austin the concentration of rainfall is 40%, whereas in San Francisco it is 33% (Table 10). Since one of our assumptions was that catchment efforts were maximized, scaled to account for the heaviest rainfall periods. Thus, the size of the tanks selected for modeling each city was the same, as their heaviest precipitation months are very similar, 4.37 inches for Austin and 4.57 for San Francisco, reflecting how tank size was chosen (Table 3) (Current Results, n.d.). This tank sizing method avoided overly optimistic profitability metrics with less than optimal water savings in the CBA scenarios.

Confirming the second hypothesis, the cities that showed a positive NPV (Austin and San Francisco), met the thresholds of having a 40% precipitation concentration or lower and at least 12 inches of rainfall. When looking at the five cities that produced payback periods within the 20-year timeframe, only Houston (47%) had a precipitation concentration of greater than 40%, but also had the highest rainfall of the five at almost 50 inches (Table 10).

Non-Potable RWH System Profitability

Running CBAs on non-potable RWH implementation yielded promising results. Thirteen cities showed the potential to produce a payback period, in at least one tier of consumption, within the 20-year timeframe (Table 12). Eleven cities showed this potential in the 200GPD consumption tier, twelve in the 400GPD tier, and thirteen in the 600GPD tier (Table 12). Potable implementation produced only five such cases (Table 9). Atlanta, Austin, Baltimore, Boston, Charlotte, Houston, Indianapolis, San Francisco, and

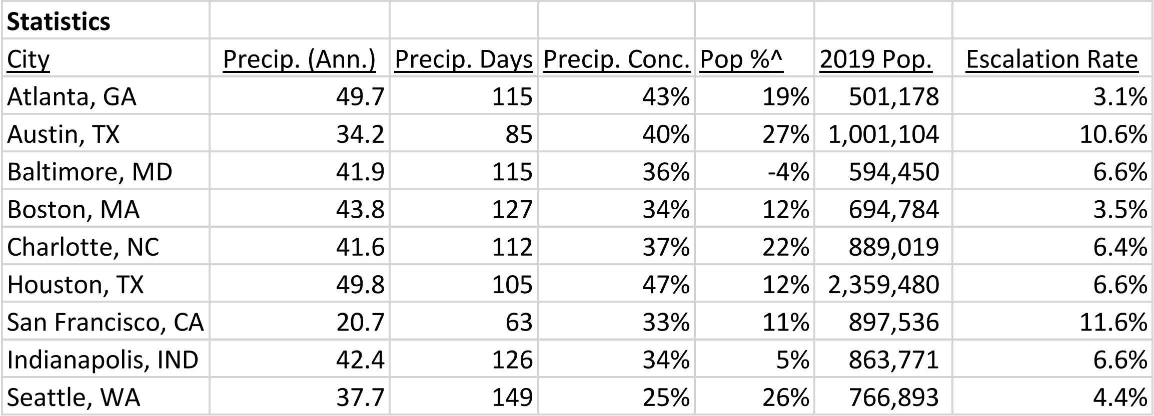
Seattle all produced positive NPVs in at least one consumption tier; potable implementations yielded two such cases (Table 9) (Table 12). Although there were more cases indicating profitability, there was still only one case, Austin, meeting the requirements of the first hypothesis to show a payback period within 13 years (Table 12).

Table 12. Non-Potable RWH system installation results organized by consumption tier.

200GPD				**400GPD**			**600GPD**		
City	NPV	IRR	PayB. P. (yrs)	NPV	IRR	PayB. P. (yrs)	NPV	IRR	PayB. P. (yrs)
Atlanta, GA	$334	2.3%	17	$1,977	3.9%	15	$2,285	4%	15
Austin, TX	$6,235	6.3%	14	$16,201	11.3%	11	$18,869	12%	10
Baltimore, MD	$3,136	4.7%	15	($242)	1.8%	18	($1,369)	1%	20
Boston, MA	$287	2.3%	17	$587	2.6%	17	$758	3%	17
Charlotte, NC	($3,206)	-1.5%		($527)	1.5%	18	$4,116	5%	14
Chicago, IL	($1,224)	0.9%	19	($1,224)	0.9%	19	($1,224)	1%	19
Columbus, OH	($7,014)	-4.1%		($7,787)	-5.1%		($8,045)	-5%	
Dallas, TX	($5,656)	-5.2%		($4,693)	-3.6%		($3,172)	-1%	
Denver, CO	($5,852)	Error		($6,562)	Error		($6,630)	Error	
Detroit, MI	($3,047)	-1.6%		($3,954)	-3.0%		($4,257)	-3%	
Fort Worth, TX	($4,232)	-3.1%		($4,983)	-4.2%		($4,881)	-4%	
Houston, TX	$3,233	4.6%	15	$2,715	4.2%	15	$5,350	6%	14
Indianapolis, IND	$2,496	4.1%	16	$977	2.8%	17	$470	2%	17
Jacksonville, FL	($6,736)	-4.4%		($6,307)	-3.8%		($6,472)	-4%	
Las Vegas	($5,555)	Error		($5,850)	Error		($5,897)	Error	
Los Angeles, CA	($10,072)	-9.9%		($9,143)	-7.9%		($8,365)	-7%	
Memphis, TN	($7,427)	-7.1%		($6,655)	-5.7%		($6,655)	-6%	
Milwaukee, WI	($2,703)	-1.1%		($3,951)	-2.9%		($4,366)	-4%	
New York, NY	($727)	1.3%	19	($54)	1.9%	20	($54)	2%	18
Philadelphia, PA	($3,243)	-0.9%		($4,247)	-1.9%		($4,802)	-3%	
Phoenix, AZ	($6,413)	Error		($6,092)	Error		($5,948)	Error	
Salt Lake City, UTA	($6,481)	-13.9%		($6,876)	-17.7%		($6,988)	-19%	
San Antonio, TX	($3,029)	-1.1%		($2,362)	-0.4%		($1,368)	1%	20
San Diego, CA	($2,013)	-1.2%		($2,544)	-2.2%		($1,929)	-1%	19
San Francisco, CA	$11,370	8.9%	13	$10,940	8.7%	13	$10,796	9%	13
San Jose, CA	$1,006	3.1%	17	($1,288)	0.5%	20	($2,052)	-1%	
Seattle, WA	$2,318	3.8%	15	$606	2.5%	17	$893	3%	17
Santa Fe, NM	($4,141)	-5.2%		($2,381)	-1.6%		($964)	1%	
Fresno, CA	($5,262)	-6.8%		($6,066)	-9.6%		($6,334)	-11%	
Tucson, AZ	($3,872)	-3.5%		($3,740)	-3.3%		($2,343)	-1%	

When pointing to specific metrics, we can see that having a relatively large population with sufficient rainfall indicated a promising outcome for collecting rainwater for non-potable use (Table 13), although the two cities with the most profitability potential, San Francisco and Austin, have the lowest amount of annual precipitation

Table 13. Key statistics for cities with payback periods ≤20years.



Statistics						
City	Precip. (Ann.)	Precip. Days	Precip. Conc.	Pop %^	2019 Pop.	Escalation Rate
Atlanta, GA	49.7	115	43%	19%	501,178	3.1%
Austin, TX	34.2	85	40%	27%	1,001,104	10.6%
Baltimore, MD	41.9	115	36%	-4%	594,450	6.6%
Boston, MA	43.8	127	34%	12%	694,784	3.5%
Charlotte, NC	41.6	112	37%	22%	889,019	6.4%
Houston, TX	49.8	105	47%	12%	2,359,480	6.6%
San Francisco, CA	20.7	63	33%	11%	897,536	11.6%
Indianapolis, IND	42.4	126	34%	5%	863,771	6.6%
Seattle, WA	37.7	149	25%	26%	766,893	4.4%

in this group. This is evidence of how important the water price escalation rate is (Table 13). Atlanta, Austin, Boston, Houston, Indianapolis, San Francisco, and Seattle showed a positive NPV across all three usage tiers (Table 12). This is important to note, as this reduces risk and may increase the chances of water conservation on the behavioral level. With respect to the second hypothesis, all the cities that showed positive NPVs met the minimum rainfall prediction of 12inches, with all but Atlanta and Houston, having a precipitation concentration of 40% or less (Table 13).

Water Price Behavior

In pursuing a greater understanding of what affects water pricing, I found that no variables showed correlations that were even remotely significant. There was, however, one variable, cumulative percentage change in population over the past 10 years with 2018 CPG at 600 GPD, that yielded results worth noting (Figure 6). A trend was evident, albeit the R^2 was only a relatively weak 0.16, and not significant. The main outliers,

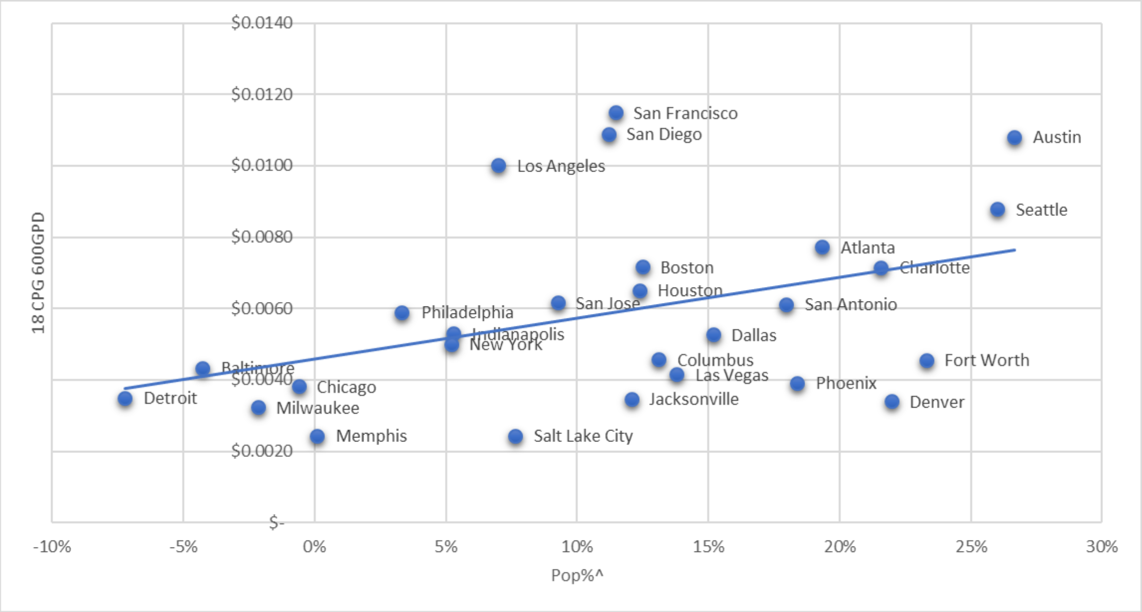


Figure 6. Comparing cumulative percentage change in population from 2010-2020 to 2018 water cost per gallon at 600GPD.

Los Angeles, San Diego and San Francisco, were all in California. Even after omitting these California cities from the results, an R^2 of only 0.35 was achieved, still not reaching the threshold for significance. Southern California is one of the most, if not the most, water stressed regions in the country (Figure 2), which could be why water prices are extremely high even though the increase in population size is about average (Melillo et al., n.d.; World Population Review, n.d.). Therefore, not a single metric helped to understand water price behavior, albeit population growth and water stress over time could have the potential to be part of a significant output when conducting a multivariate analysis on the subject with other variables not included here.

Sensitivity Analysis

In order to better understand the mechanics of what drives profitability when implementing RWH systems, I tested the influence of key variables on NPV and IRR using the 600GPD tier water use rate for Austin, Texas as an example. To do so, each variable was adjusted, one by one, to see how a 20% increase and then a 20% decrease from the baseline data affects NPV and IRR (Table 14). These values were then compared to the baseline outputs of NPV and IRR (Table 8), to show the percent change for each variable with these lower or higher parameter values (Table 15) (Figure 7).

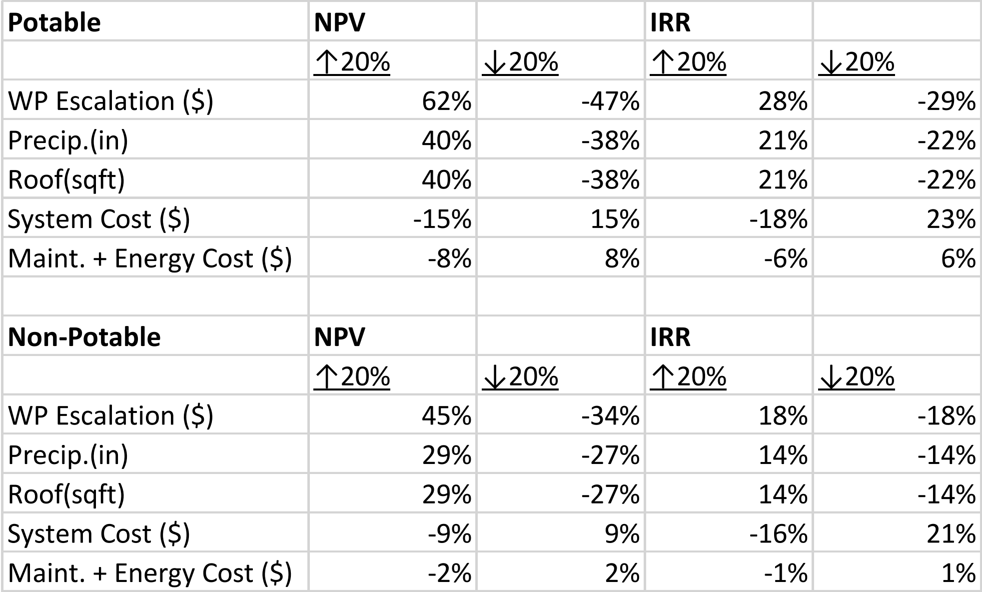
Table 14. Sensitivity of NPV and IRR to key variables of RWH systems in Austin, TX.

Potable	**NPV**		**IRR**	
600GPD	↑20%	↓20%	↑20%	↓20%
WP Escalation ($)	$ 22,030	$ 7,166	11%	6%
Precip.(in)	$ 19,080	$ 8,407	11%	7%
Roof(sqft)	$ 19,080	$ 8,407	11%	7%
System Cost ($)	$ 11,560	$ 15,613	7%	11%
Maint. + Energy Cost ($)	$ 12,464	$ 14,709	8%	9%
Non-Potable	**NPV**		**IRR**	
600GPD	↑20%	↓20%	↑20%	↓20%
WP Escalation ($)	$ 27,312	$ 12,449	15%	10%
Precip.(in)	$ 24,362	$ 13,689	14%	11%
Roof(sqft)	$ 24,362	$ 13,689	14%	11%
System Cost ($)	$ 17,097	$ 20,640	10%	15%
Maint. + Energy Cost ($)	$ 18,548	$ 19,189	12%	13%

Non-potable and potable scenarios showed differing results. Potable and non-potable implementations showed that NPV is most sensitive to changes in the water price escalation rate (Figure 7, Table 15). NPV was also more sensitive to an increase of 20% to the escalation rate than a decrease, observed in the 62% and 45% increase and the 47%

and 34% decrease in NPV for potable and non-potable implementations, respectively (Table 15) (Figure 7). IRR experienced this same phenomenon with only one variable, system cost. IRR did not show this divergence across the rest of the variables, as it held a close to symmetric result when comparing outputs to the baseline (Table 15).

Table 15. Percent change in NPV and IRR of adjusted parameter values over baseline.



Potable	**NPV**		**IRR**	
	↑20%	↓20%	↑20%	↓20%
WP Escalation ($)	62%	-47%	28%	-29%
Precip.(in)	40%	-38%	21%	-22%
Roof(sqft)	40%	-38%	21%	-22%
System Cost ($)	-15%	15%	-18%	23%
Maint. + Energy Cost ($)	-8%	8%	-6%	6%
Non-Potable	**NPV**		**IRR**	
	↑20%	↓20%	↑20%	↓20%
WP Escalation ($)	45%	-34%	18%	-18%
Precip.(in)	29%	-27%	14%	-14%
Roof(sqft)	29%	-27%	14%	-14%
System Cost ($)	-9%	9%	-16%	21%
Maint. + Energy Cost ($)	-2%	2%	-1%	1%

For the non-potable implementation, a reduction in system cost of 20% increased IRR by a staggering 21% and was the most effective variable at changing IRR (Table 15). An increase in system cost had a lesser effect than a decrease, shrinking IRR by 16%. In the potable scenario, escalation rate was still the most influential with respect to IRR, although system cost affects IRR more than NPV in both scenarios. Ongoing maintenance and energy costs were the least influential on NPV and IRR. This refutes the third hypothesis, which predicted that this would be the second most influential variable on profitability.

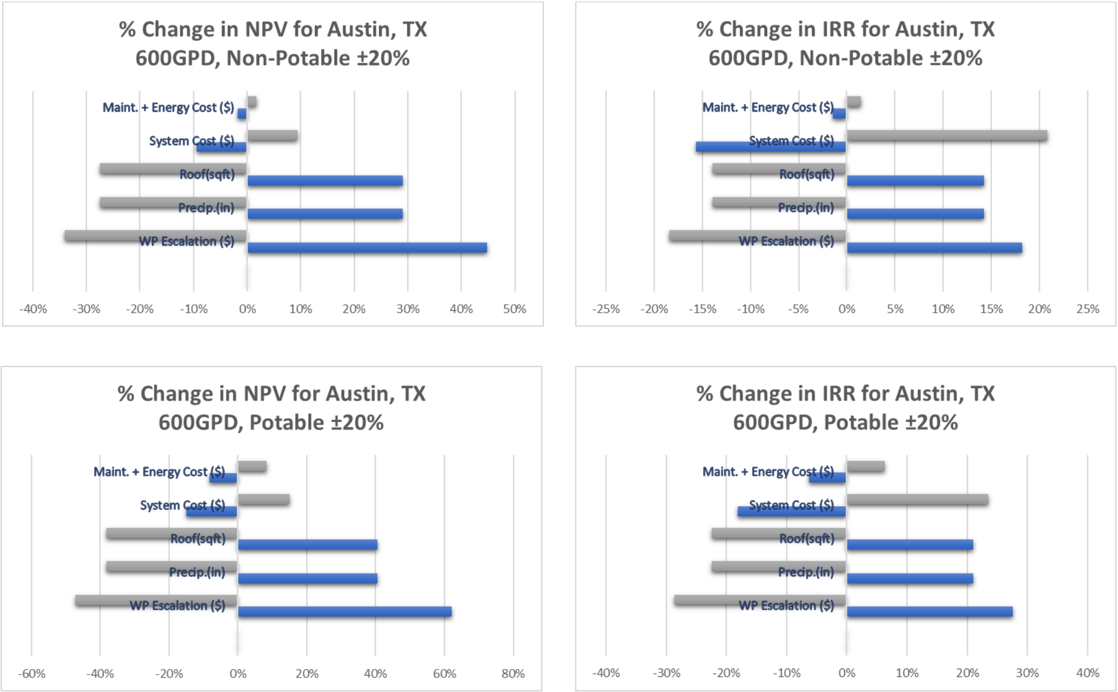


Figure 7. Key parameter adjustments effects on NPV and IRR, 600 GPD tier for Austin.

Precipitation volume and roof size shared similar results, and were the second and third most influential variables in the CBA model, indicating that changes in precipitation pose a major risk to profitability (Table 15, Figure 7). These two variables determine how much water can be captured and stored The results are also closer to being symmetric when comparing 20% increases and decreases. The comparison between NPV and IRR is important to note as IRR is an annualized number, whereas NPV is a cumulative one.

Application of Subsidy Relating to Public Policy

The difference between potable and non-potable implementations showed the potential of a modest cost reduction to markedly increase the potential of a RWH system's installation to turn a profit for the homeowner (Tables 9 & 12). To aid future policy decisions on the viability of subsidies for RWH systems, I applied Austin's subsidy structure to all 30 cities in our sample for potable implementations (Table 16). Austin has been able to implement a very effective subsidy, even though they already show profitability potential without it (Table 8) (Table 12). The subsidy offers up to 50% of the cost of the system including all parts and labor up to $5,000 which depends on whether one is using a motorized pump or gravity fed systems, providing the full amount for the former (Austin Water, n.d.). Essentially, this was applied through a $5,000 subsidy in year 0 to offset system installation costs.

Table 16. Potable results with Austin subsidy applied to all cities.

200GPD				**400GPD**			**600GPD**		
City	NPV	IRR	PayB. P. (yrs)	NPV	IRR	PayB. P. (yrs)	NPV	IRR	PayB. P. (yrs)
Atlanta, GA	($47)	1.9%	18	$ 1,596	4.3%	15	$ 1,905	5%	15
Austin, TX	$5,854	7.6%	14	$ 15,820	14.1%	10	$ 18,488	16%	9
Baltimore, MD	$2,756	5.4%	15	$ (622)	1.1%	19	$ (1,749)	-1%	
Boston, MA	($94)	1.8%	18	$ 207	2.3%	17	$ 378	3%	17
Charlotte, NC	($3,587)	-4.3%		$ (907)	0.7%	20	$ 3,736	6%	14
Chicago, IL	($1,604)	-0.2%		$ (1,604)	-0.2%		$ (1,604)	0%	
Columbus, OH	($7,394)	-7.7%		$ (8,168)	-9.6%		$ (8,426)	-10%	
Dallas, TX	($6,037)	-13.8%		$ (5,073)	-9.0%		$ (3,552)	-4%	
Denver, CO	($7,029)	Error		$ (7,739)	Error		$ (7,806)	Error	
Detroit, MI	($3,606)	-5.2%		$ (4,513)	-8.2%		$ (4,816)	-9%	
Fort Worth, TX	($4,612)	-8.0%		$ (5,363)	-11.1%		$ (5,261)	-11%	
Houston, TX	$2,825	5.3%	15	$ 2,334	4.8%	16	$ 4,970	7%	13
Indianapolis, IND	$2,116	4.5%	16	$ 596	2.8%	18	$ 90	2%	18
Jacksonville, FL	($7,117)	-8.5%		$ (6,687)	-7.5%		$ (6,852)	-8%	
Las Vegas	($7,604)	Error		$ (7,899)	Error		$ (7,947)	Error	
Los Angeles, CA	($5,170)	-7.1%		$ (4,241)	-4.8%		$ (3,463)	-3%	
Memphis, TN	($7,808)	Error		$ (7,035)	-13.2%		$ (7,035)	-13%	
Milwaukee, WI	($3,262)	-4.2%		$ (4,510)	-8.0%		$ (4,925)	-10%	
New York, NY	($1,107)	0.3%	20	$ (434)	1.3%	19	$ (434)	1%	19
Philadelphia, PA	$1,659	4.2%	16	$ 655	2.9%	17	$ 100	2%	18
Phoenix, AZ	($8,409)	Error		$ (8,087)	Error		$ (7,944)	Error	
Salt Lake City, UTA	($7,682)	Error		$ (8,077)	Error		$ (8,190)	Error	
San Antonio, TX	($3,409)	-3.5%		$ (2,742)	-2.2%		$ (1,748)	-1%	
San Diego, CA	($2,393)	-6.3%		$ (2,924)	-9.2%		$ (2,309)	-6%	
San Francisco, CA	$10,990	10.9%	12	$ 10,559	10.6%	12	$ 10,416	11%	12
San Jose, CA	($191)	1.7%	19	$ (2,484)	-2.5%		$ (3,248)	-4%	
Seattle, WA	$1,938	4.2%	15	$ 225	2.3%	18	$ 513	3%	17
Santa Fe, NM	($5,337)	Error		$ (3,578)	-8.5%		$ (2,160)	-3%	
Fresno, CA	($6,458)	Error		$ (7,262)	Error		$ (7,530)	Error	
Tucson, AZ	($5,068)	-10.7%		$ (4,936)	-10.0%		$ (3,539)	-5%	

The results showed promise as eleven cities showed payback periods within the 20-year timeframe in both the 200GPD and 400GPD tiers, with ten cities showing the same promise in the 600GPD tier (Table 16). Potable implementations with no subsidy applied only produced five cities with at least one tier of consumption providing a payback period with the 20-year timeframe (Table 9).

In most cases the modest reduction in system costs for non-potable implementations, \$1,300, coupled with a large reduction in annual energy and maintenance costs, \$250, had a larger effect than the subsidy alone on NPV specifically. IRR was higher when considering a large subsidy (Table 12) (Table 16). With nine cities showing positive NPVs in at least one consumption tier, I believe that our fourth hypothesis was justified as there is clearly potential across different locales (Table 16).

This also shows a more accurate view of potential profitability in Austin and effectiveness of the subsidy as a financial incentive when compared to the initial CBA conducted on potable water. Austin shows IRRs ranging from 7.6%, 14.1%, and 16% with the subsidy applied for each respective consumption tier, compared to 2.6%, 7.8%, and 9% sans subsidy (Tables 9 & 16).

Chapter IV

Discussion

The analyses allowed all hypotheses to be tested. At least one city with a payback back period of 13 years or less in both potable and non-potable scenarios without the application of a subsidy. Rainfall statistics were also largely proven to be significant within the range of certain thresholds mentioned in another hypothesis. Ongoing maintenance and energy costs were found to not be as meaningful as initially thought before conducting this analysis.

Subsidizing RWH Systems as Good Public Policy

The last hypothesis posited that RWH was the ideal solution to combat pressure on water infrastructure and that subsidies were warranted due to the public benefit. Evidence exists for this as growth in domestic water use has significantly outpaced all other major forms of water withdrawals (Figure 4). Stormwater runoff was not a focus on this paper but this is important to note as a benefit of RWH, as it reduces pressure on stormwater infrastructure and can have an immense benefit to the public if done at scale. Other indirect public benefits from subsidizing RHW systems would be reduced GHG emissions compared to municipal water sources, and mitigation of health risks from the corroded pipes possible from harsh municipal water. Moreover, if sufficient subsidies are in place, the financial risk to households in installing these systems can be reduced, especially if water prices were to increase with greater velocity (Figure 7) (Vargas-Parra et al., 2019; Ghimire, Johnston, Ingwersen, & Sojka, 2017).

Non-potable scenarios were not modeled, as the objective of a subsidy would be to reduce as much pressure on municipal water supplies as possible. However, we can readily deduce that if this type of subsidy were to show promise in potable use cases then clearly non-potable use cases would benefit even more from a cost reduction. Lobbying for widespread subsidy is warranted, due to the clear public benefit being provided when capturing rainwater. This comes especially in the form of reduced stress on public water infrastructure with respect to demand, as well as capturing stormwater runoff. Rainwater in most municipalities is also less corrosive to appliances and pipes, reducing the amounts of laundry detergent required, potentially reducing pressure on water treatment (Vargas-Parra et al., 2019). Rainwater is also known to be better for irrigating plants than municipal water sources (Kennedy, 2017).

Building on what we noted on subsidies earlier, there are currently only a few subsidies in place for residential RWH systems throughout the US, but mostly are either insufficient or unclear (NCSL, 2018). For example, Texas allows a homeowner to request a reduction in property taxes based on the system being installed, but there aren’t clear guidelines for exact dollar amounts. Texas also offers rebates on sales tax associated with purchasing the system (TWDB, n.d.). Tucson, AZ has clear guidelines on its subsidy, offering up to $2,000 in the form of a rebate (City of Tucson, n.d.). This amount was effective in catalyzing adoption, but may be insufficient to provide a real net profit to homeowners (Table 12) (Davis, 2018). The focus on Austin for the examples presented throughout this study was due to its strong subsidy.

Numerous cities showed the ability produce IRRs that far exceeded inflation when a potential subsidy was applied (Table 16). If we were to take into consideration non-potable scenarios, this would show an even brighter effect on helping households in mitigating risks associated with their water consumption.

The potential of a public benefit shows even greater promise if we take into account behavioral changes that can occur. In Tucson, residents who installed a RWH system and stayed living in those homes saw a “significant” reduction in water demand “far beyond estimates”, whereas detractors believed there wouldn’t be water savings as people would use more if they knew they were collecting additional water (City of Tucson, n.d.).

A Tool to Aid Policy and Homeowners

Going from the first step of this model all the way to the sensitivity analysis should be the end goal for either a policy maker, or homeowner, when conducting a similar analysis with more location specific data. Considering the limitations in observing 30 cities’ potential and then focusing only on Austin, I could not shed light on the risks each variable imposes and potential rewards for every city in the sample. There were also limitations in pricing the systems as one could hire professional installers or choose to order the materials themselves and hire a plumber directly. My experience with contacting installers was not successful as they were reluctant to share detailed pricing information and were not focused on residential installs. This uncertainty in the initial cost is one reason why a sensitivity analysis is important, as it shows how changes in certain variables can affect the viability of such systems (Figure 7).

Notes on Profitability

With respect to profitability comparisons between NPV and IRR, it is important to note that IRR is an annualized number, whereas NPV is a cumulative one. Since this analysis was created to show an initial framework of a model to assess the potential benefits of RWH, one can change the length of the analysis. In this case it was 20 years, which would lead you to IRR initially, as it is an annualized number. Another caveat to be noted, is that if one runs the analysis, and profitability is achieved across all consumption tiers, then achieving profitability can be said to be less risky as RWH can reduce your consumption tier vis-a-vi the utility provider. Another important caveat to note is our selection of roof size. Profitability is equally sensitive to roof size and precipitation (Figure 7). This factor can dramatically change viability as consumption might not scale with roof sizes after a certain threshold.

Implementation Innovation and End Use

Although how one uses water is very important when conducting this analysis, I believed it was more effective to delineate consumption tiers, rather than measuring each possible end-use. This helped in making the analysis easier, as on water utility bills we can easily see total water consumed. If one is debating potable versus non-potable, all one would have to do is make simple calculations of the proportion used for irrigation and indoor non-potable use to evaluate financial benefit from implementing an RWH system.

There is also ample room to creatively reduce costs. One option is a gravity fed system (Figure 1), or even a partially gravity fed system where one pumps water to a tank situated on or inside the roof of a home using a solar pump, allowing for gravity to do its job when water is needed in the evening (Figure 4). Clustered or shared systems might also be implemented to reach some cost reductions in filtration, maintenance, and upfront cost per gallon.

Conclusions

Water scarcity continues to be a pressing issue which needs proper planning and coordination to overcome. Moreover, the current infrastructure in place to provide point of use tap water is deteriorating or already compromised in many cities, as shown in the examples of Flint, MI and the Deloitte report on the current state of water infrastructure. Water stressed regions are scrambling to make up for poor planning and a lack of environmental protection. Considering the current landscape, it is imperative that subsidies are implemented for these systems at the residential level across the continental US.

The data and analysis presented here indicates that a subsidy has the potential to provide a viable path to meaningful water savings through RWH adoption. Reduction in GHG emissions associated with water use could also prove to be a worthwhile public benefit. Furthermore, RWH systems would also act as an insurance policy against the corrosion of the current infrastructure. These three public benefits, along with monetary savings for households, should be part of a meaningful long-term solution, as pressure on current infrastructure continues to climb with population growth.

The framework put forth in this thesis should provide municipalities with an initial tool to gauge the scope and potential of a subsidy. Furthermore, it should provide homeowners with a more complete analysis of what an investment in such a system would entail, clearly showing the associated benefits and risks that can fluctuate depending on the behavior of key variables. Although laundry detergent savings were not calculated, I believe it is important for a homeowner to add this into an analysis with their specific spending habits. This space is also ripe for innovation to help reduce upfront as well as ongoing maintenance costs. Overall, there is ample evidence to show the potential of water savings in a decentralized manner, where homeowners take on infrastructure improvements while reducing pressure on the public to act.

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Ancillary Appendix 1

Potable Cost Benefit Analyses by City

Table 17. Atlanta, GA potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0077	$ 0.0080	$ 0.0082	$ 0.0085	$ 0.0087	$ 0.0090	$ 0.0093	$ 0.0096	$ 0.0098	$ 0.0102	$ 0.0105	$ 0.0108	$ 0.0111	$ 0.0115	$ 0.0118	$ 0.0122	$ 0.0125	$ 0.0129	$ 0.0133	$ 0.0137	$ 0.0141
400 GPD CPG	$ 0.0076	$ 0.0078	$ 0.0080	$ 0.0083	$ 0.0085	$ 0.0088	$ 0.0091	$ 0.0093	$ 0.0096	$ 0.0099	$ 0.0102	$ 0.0105	$ 0.0109	$ 0.0112	$ 0.0115	$ 0.0119	$ 0.0122	$ 0.0126	$ 0.0130	$ 0.0134	$ 0.0138
200 GPD CPG	$ 0.0070	$ 0.0072	$ 0.0074	$ 0.0077	$ 0.0079	$ 0.0082	$ 0.0084	$ 0.0087	$ 0.0089	$ 0.0092	$ 0.0095	$ 0.0098	$ 0.0101	$ 0.0104	$ 0.0107	$ 0.0110	$ 0.0114	$ 0.0117	$ 0.0121	$ 0.0124	$ 0.0128
Benefits:																					
Precip.(in)		49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70	49.70
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408	77,408
Benefits(yr):	Capture %:																				
600GPD	35%	$ 617.25	$ 636.16	$ 655.66	$ 675.75	$ 696.45	$ 717.79	$ 739.78	$ 762.45	$ 785.81	$ 809.89	$ 834.70	$ 860.27	$ 886.63	$ 913.80	$ 941.80	$ 970.65	$ 1,000.39	$ 1,031.05	$ 1,062.64	$ 1,095.19
400GPD	53%	$ 602.74	$ 621.21	$ 640.24	$ 659.86	$ 680.07	$ 700.91	$ 722.39	$ 744.52	$ 767.33	$ 790.84	$ 815.07	$ 840.05	$ 865.79	$ 892.31	$ 919.65	$ 947.83	$ 976.87	$ 1,006.80	$ 1,037.65	$ 1,069.44
200GPD	106%	$ 525.43	$ 541.53	$ 558.13	$ 575.23	$ 592.85	$ 611.02	$ 629.74	$ 649.03	$ 668.92	$ 689.41	$ 710.54	$ 732.31	$ 754.74	$ 777.87	$ 801.70	$ 826.27	$ 851.58	$ 877.67	$ 904.57	$ 932.28
Costs:																					
Above Ground:																					
Tank 8k Gal	$ (4,680)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,715)	$ 267.25	$ 286.16	$ 305.66	$ 325.75	$ 346.45	$ 367.79	$ 389.78	$ 412.45	$ 435.81	$ 459.89	$ 484.70	$ 510.27	$ 536.63	$ 563.80	$ 591.80	$ 620.65	$ 650.39	$ 681.05	$ 712.64	$ 745.19
NPV:	($2,997.25)																				
IRR:	-0.8%																				
Payback Period:	$ (10,715)	$(10,447.75)	$(10,161.58)	$ (9,855.93)	$(9,530.18)	$(9,183.73)	$(8,815.94)	$(8,426.16)	$(8,013.71)	$(7,577.90)	$(7,118.02)	$(6,633.32)	$(6,123.04)	$(5,586.41)	$(5,022.61)	$(4,430.81)	$(3,810.16)	$(3,159.77)	$(2,478.72)	$ (1,766.08)	$ (1,020.89)
400GPD:																					
Net Benefit:	$ (10,715)	$ 252.74	$ 271.21	$ 290.24	$ 309.86	$ 330.07	$ 350.91	$ 372.39	$ 394.52	$ 417.33	$ 440.84	$ 465.07	$ 490.05	$ 515.79	$ 542.31	$ 569.65	$ 597.83	$ 626.87	$ 656.80	$ 687.65	$ 719.44
NPV:	($3,305.70)																				
IRR:	-1.1%																				
Payback Period:	$ (10,715)	$(10,462.26)	$(10,191.05)	$ (9,900.81)	$(9,590.96)	$(9,260.88)	$(8,909.97)	$(8,537.58)	$(8,143.06)	$(7,725.73)	$(7,284.89)	$(6,819.81)	$(6,329.76)	$(5,813.98)	$(5,271.67)	$(4,702.01)	$(4,104.18)	$(3,477.31)	$(2,820.51)	$ (2,132.86)	$ (1,413.41)
200GPD:																					
Net Benefit:	$ (10,715)	$ 175.43	$ 191.53	$ 208.13	$ 225.23	$ 242.85	$ 261.02	$ 279.74	$ 299.03	$ 318.92	$ 339.41	$ 360.54	$ 382.31	$ 404.74	$ 427.87	$ 451.70	$ 476.27	$ 501.58	$ 527.67	$ 554.57	$ 582.28
NPV:	($4,948.64)																				
IRR:	-3.0%																				
Payback Period:	$ (10,715)	$(10,539.57)	$(10,348.03)	$(10,139.90)	$(9,914.68)	$(9,671.83)	$(9,410.81)	$(9,131.07)	$(8,832.04)	$(8,513.12)	$(8,173.71)	$(7,813.17)	$(7,430.87)	$(7,026.12)	$(6,598.25)	$(6,146.55)	$(5,670.28)	$(5,168.70)	$(4,641.03)	$ (4,086.46)	$ (3,504.18)

Table 18. Austin, TX potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0108	$ 0.0120	$ 0.0132	$ 0.0146	$ 0.0162	$ 0.0179	$ 0.0198	$ 0.0219	$ 0.0242	$ 0.0267	$ 0.0296	$ 0.0327	$ 0.0362	$ 0.0400	$ 0.0442	$ 0.0489	$ 0.0541	$ 0.0598	$ 0.0661	$ 0.0731	$ 0.0808
400 GPD CPG	$ 0.0098	$ 0.0109	$ 0.0120	$ 0.0133	$ 0.0147	$ 0.0163	$ 0.0180	$ 0.0199	$ 0.0220	$ 0.0243	$ 0.0269	$ 0.0297	$ 0.0329	$ 0.0363	$ 0.0402	$ 0.0444	$ 0.0491	$ 0.0543	$ 0.0601	$ 0.0664	$ 0.0735
200 GPD CPG	$ 0.0062	$ 0.0068	$ 0.0075	$ 0.0083	$ 0.0092	$ 0.0102	$ 0.0113	$ 0.0124	$ 0.0138	$ 0.0152	$ 0.0168	$ 0.0186	$ 0.0206	$ 0.0228	$ 0.0252	$ 0.0278	$ 0.0308	$ 0.0340	$ 0.0376	$ 0.0416	$ 0.0460
Benefits:																					
Precip.(in)		34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267	53,267
Benefits(yr):	Capture %:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
600GPD	24%	$ 637.01	$ 704.41	$ 778.93	$ 861.34	$ 952.47	$ 1,053.24	$ 1,164.67	$ 1,287.89	$ 1,424.15	$ 1,574.82	$ 1,741.43	$ 1,925.67	$ 2,129.40	$ 2,354.69	$ 2,603.81	$ 2,879.28	$ 3,183.91	$ 3,520.76	$ 3,893.25	$ 4,305.14
400GPD	36%	$ 579.06	$ 640.33	$ 708.07	$ 782.98	$ 865.82	$ 957.42	$ 1,058.72	$ 1,170.73	$ 1,294.59	$ 1,431.55	$ 1,583.01	$ 1,750.49	$ 1,935.69	$ 2,140.48	$ 2,366.94	$ 2,617.35	$ 2,894.26	$ 3,200.47	$ 3,539.07	$ 3,913.50
200GPD	73%	$ 362.61	$ 400.97	$ 443.40	$ 490.31	$ 542.18	$ 599.54	$ 662.97	$ 733.11	$ 810.67	$ 896.44	$ 991.28	$ 1,096.16	$ 1,212.13	$ 1,340.37	$ 1,482.18	$ 1,638.99	$ 1,812.39	$ 2,004.14	$ 2,216.17	$ 2,450.64
Costs:																					
Above Ground:																					
Tank 7k Gal	$ (4,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,335)	$ 287.01	$ 354.41	$ 428.93	$ 511.34	$ 602.47	$ 703.24	$ 814.67	$ 937.89	$ 1,074.15	$ 1,224.82	$ 1,391.43	$ 1,575.67	$ 1,779.40	$ 2,004.69	$ 2,253.81	$ 2,529.28	$ 2,833.91	$ 3,170.76	$ 3,543.25	$ 3,955.14
NPV:	$13,586.47																				
IRR:	8.9%																				
Payback Period:	$ (10,335)	$ (10,047.99)	$ (9,693.58)	$ (9,264.65)	$ (8,753.31)	$ (8,150.84)	$ (7,447.60)	$ (6,632.93)	$ (5,695.04)	$ (4,620.89)	$ (3,396.08)	$ (2,004.65)	$ (428.98)	$ 1,350.42	$ 3,355.11	$ 5,608.91	$ 8,138.20	$ 10,972.11	$ 14,142.86	$ 17,686.11	$ 21,641.25
400GPD:																					
Net Benefit:	$ (10,335)	$ 229.06	$ 290.33	$ 358.07	$ 432.98	$ 515.82	$ 607.42	$ 708.72	$ 820.73	$ 944.59	$ 1,081.55	$ 1,233.01	$ 1,400.49	$ 1,585.69	$ 1,790.48	$ 2,016.94	$ 2,267.35	$ 2,544.26	$ 2,850.47	$ 3,189.07	$ 3,563.50
NPV:	$10,918.31																				
IRR:	7.8%																				
Payback Period:	$ (10,335)	$ (10,105.94)	$ (9,815.61)	$ (9,457.54)	$ (9,024.55)	$ (8,508.73)	$ (7,901.31)	$ (7,192.59)	$ (6,371.86)	$ (5,427.27)	$ (4,345.72)	$ (3,112.71)	$ (1,712.22)	$ (126.54)	$ 1,663.94	$ 3,680.88	$ 5,948.23	$ 8,492.49	$ 11,342.96	$ 14,532.03	$ 18,095.53
200GPD:																					
Net Benefit:	$ (10,335)	$ 12.61	$ 50.97	$ 93.40	$ 140.31	$ 192.18	$ 249.54	$ 312.97	$ 383.11	$ 460.67	$ 546.44	$ 641.28	$ 746.16	$ 862.13	$ 990.37	$ 1,132.18	$ 1,288.99	$ 1,462.39	$ 1,654.14	$ 1,866.17	$ 2,100.64
NPV:	$952.31																				
IRR:	2.6%																				
Payback Period:	$ (10,335)	$ (10,322.39)	$ (10,271.42)	$ (10,178.02)	$ (10,037.71)	$ (9,845.53)	$ (9,595.99)	$ (9,283.02)	$ (8,899.91)	$ (8,439.24)	$ (7,892.79)	$ (7,251.51)	$ (6,505.35)	$ (5,643.22)	$ (4,652.85)	$ (3,520.67)	$ (2,231.68)	$ (769.29)	$ 884.85	$ 2,751.02	$ 4,851.66

Table 19. Baltimore, MD potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0043	$ 0.0046	$ 0.0049	$ 0.0053	$ 0.0056	$ 0.0060	$ 0.0064	$ 0.0068	$ 0.0072	$ 0.0077	$ 0.0082	$ 0.0087	$ 0.0093	$ 0.0099	$ 0.0106	$ 0.0113	$ 0.0120	$ 0.0128	$ 0.0137	$ 0.0146	$ 0.0155
400 GPD CPG	$ 0.0049	$ 0.0052	$ 0.0055	$ 0.0059	$ 0.0063	$ 0.0067	$ 0.0072	$ 0.0076	$ 0.0081	$ 0.0087	$ 0.0092	$ 0.0098	$ 0.0105	$ 0.0112	$ 0.0119	$ 0.0127	$ 0.0135	$ 0.0144	$ 0.0154	$ 0.0164	$ 0.0174
200 GPD CPG	$ 0.0065	$ 0.0069	$ 0.0074	$ 0.0079	$ 0.0084	$ 0.0089	$ 0.0095	$ 0.0101	$ 0.0108	$ 0.0115	$ 0.0123	$ 0.0131	$ 0.0139	$ 0.0149	$ 0.0158	$ 0.0169	$ 0.0180	$ 0.0192	$ 0.0204	$ 0.0218	$ 0.0232
Benefits:																					
Precip.(in)		41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259	65,259
Benefits(yr):	Capture %:																				
600GPD	30%	$ 302.05	$ 321.91	$ 343.07	$ 365.62	$ 389.65	$ 415.26	$ 442.56	$ 471.65	$ 502.65	$ 535.69	$ 570.90	$ 608.43	$ 648.42	$ 691.04	$ 736.46	$ 784.87	$ 836.46	$ 891.44	$ 950.04	$ 1,012.49
400GPD	45%	$ 339.49	$ 361.81	$ 385.59	$ 410.94	$ 437.95	$ 466.74	$ 497.41	$ 530.11	$ 564.96	$ 602.09	$ 641.67	$ 683.85	$ 728.80	$ 776.70	$ 827.75	$ 882.16	$ 940.15	$ 1,001.95	$ 1,067.81	$ 1,138.00
200GPD	89%	$ 451.71	$ 481.40	$ 513.04	$ 546.76	$ 582.70	$ 621.00	$ 661.82	$ 705.33	$ 751.69	$ 801.10	$ 853.76	$ 909.87	$ 969.68	$ 1,033.42	$ 1,101.35	$ 1,173.74	$ 1,250.89	$ 1,333.12	$ 1,420.75	$ 1,514.13
Costs:																					
Above Ground:																					
Tank 7k Gal	$ (4,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,335)	$ (47.95)	$ (28.09)	$ (6.93)	$ 15.62	$ 39.65	$ 65.26	$ 92.56	$ 121.65	$ 152.65	$ 185.69	$ 220.90	$ 258.43	$ 298.42	$ 341.04	$ 386.46	$ 434.87	$ 486.46	$ 541.44	$ 600.04	$ 662.49
NPV:	($6,651.04)																				
IRR:	-4.7%																				
Payback Period:	$ (10,335)	$(10,382.95)	$(10,411.04)	$(10,417.98)	$(10,402.36)	$(10,362.71)	$(10,297.45)	$(10,204.90)	$(10,083.25)	$(9,930.60)	$(9,744.92)	$(9,524.02)	$(9,265.59)	$(8,967.17)	$(8,626.13)	$(8,239.67)	$(7,804.80)	$(7,318.34)	$(6,776.89)	$ (6,176.85)	$ (5,514.36)
400GPD:																					
Net Benefit:	$ (10,335)	$ (10.51)	$ 11.81	$ 35.59	$ 60.94	$ 87.95	$ 116.74	$ 147.41	$ 180.11	$ 214.96	$ 252.09	$ 291.67	$ 333.85	$ 378.80	$ 426.70	$ 477.75	$ 532.16	$ 590.15	$ 651.95	$ 717.81	$ 788.00
NPV:	($5,523.99)																				
IRR:	-3.2%																				
Payback Period:	$ (10,335)	$(10,345.51)	$(10,333.70)	$(10,298.11)	$(10,237.17)	$(10,149.22)	$(10,032.49)	$ (9,885.07)	$ (9,704.96)	$(9,490.00)	$(9,237.91)	$(8,946.25)	$(8,612.40)	$(8,233.60)	$(7,806.90)	$(7,329.15)	$(6,796.99)	$(6,206.84)	$(5,554.89)	$ (4,837.08)	$ (4,049.09)
200GPD:																					
Net Benefit:	$ (10,335)	$ 101.71	$ 131.40	$ 163.04	$ 196.76	$ 232.70	$ 271.00	$ 311.82	$ 355.33	$ 401.69	$ 451.10	$ 503.76	$ 559.87	$ 619.68	$ 683.42	$ 751.35	$ 823.74	$ 900.89	$ 983.12	$ 1,070.75	$ 1,164.13
NPV:	($2,146.29)																				
IRR:	0.2%																				
Payback Period:	$ (10,335)	$(10,233.29)	$(10,101.90)	$ (9,938.86)	$ (9,742.10)	$ (9,509.39)	$ (9,238.39)	$ (8,926.57)	$ (8,571.24)	$(8,169.55)	$(7,718.45)	$(7,214.70)	$(6,654.82)	$(6,035.14)	$(5,351.72)	$(4,600.37)	$(3,776.63)	$(2,875.73)	$(1,892.61)	$ (821.87)	$ 342.27

Table 20. Boston, MA Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0072	$ 0.0074	$ 0.0077	$ 0.0080	$ 0.0082	$ 0.0085	$ 0.0088	$ 0.0091	$ 0.0094	$ 0.0098	$ 0.0101	$ 0.0105	$ 0.0108	$ 0.0112	$ 0.0116	$ 0.0120	$ 0.0124	$ 0.0129	$ 0.0133	$ 0.0138	$ 0.0143
400 GPD CPG	$ 0.0071	$ 0.0073	$ 0.0076	$ 0.0078	$ 0.0081	$ 0.0084	$ 0.0087	$ 0.0090	$ 0.0093	$ 0.0096	$ 0.0100	$ 0.0103	$ 0.0107	$ 0.0110	$ 0.0114	$ 0.0118	$ 0.0122	$ 0.0127	$ 0.0131	$ 0.0136	$ 0.0140
200 GPD CPG	$ 0.0069	$ 0.0071	$ 0.0074	$ 0.0076	$ 0.0079	$ 0.0082	$ 0.0084	$ 0.0087	$ 0.0090	$ 0.0094	$ 0.0097	$ 0.0100	$ 0.0104	$ 0.0107	$ 0.0111	$ 0.0115	$ 0.0119	$ 0.0123	$ 0.0127	$ 0.0132	$ 0.0137
Benefits:																					
Precip.(in)		43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219	68,219
Benefits(yr):	Capture %:																				
600GPD	31%	$ 506.77	$ 524.45	$ 542.75	$ 561.69	$ 581.29	$ 601.57	$ 622.57	$ 644.29	$ 666.77	$ 690.04	$ 714.12	$ 739.04	$ 764.83	$ 791.52	$ 819.14	$ 847.72	$ 877.30	$ 907.92	$ 939.60	$ 972.39
400GPD	47%	$ 499.03	$ 516.44	$ 534.46	$ 553.11	$ 572.42	$ 592.39	$ 613.06	$ 634.45	$ 656.59	$ 679.51	$ 703.22	$ 727.76	$ 753.15	$ 779.43	$ 806.63	$ 834.78	$ 863.91	$ 894.06	$ 925.25	$ 957.54
200GPD	93%	$ 485.45	$ 502.39	$ 519.92	$ 538.06	$ 556.84	$ 576.27	$ 596.38	$ 617.19	$ 638.73	$ 661.02	$ 684.08	$ 707.95	$ 732.66	$ 758.23	$ 784.68	$ 812.07	$ 840.40	$ 869.73	$ 900.08	$ 931.49
Costs:																					
Above Ground:																					
Tank 7k Gal	$ (4,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,335)	$ 156.77	$ 174.45	$ 192.75	$ 211.69	$ 231.29	$ 251.57	$ 272.57	$ 294.29	$ 316.77	$ 340.04	$ 364.12	$ 389.04	$ 414.83	$ 441.52	$ 469.14	$ 497.72	$ 527.30	$ 557.92	$ 589.60	$ 622.39
NPV:	($4,523.79)																				
IRR:	-2.6%																				
Payback Period:	$ (10,335)	$ (10,178.23)	$ (10,003.79)	$ (9,811.04)	$(9,599.35)	$(9,368.06)	$(9,116.48)	$(8,843.92)	$(8,549.62)	$(8,232.85)	$(7,892.81)	$(7,528.69)	$(7,139.65)	$(6,724.82)	$(6,283.30)	$(5,814.17)	$(5,316.44)	$(4,789.14)	$(4,231.22)	$ (3,641.62)	$ (3,019.24)
400GPD:																					
Net Benefit:	$ (10,335)	$ 149.03	$ 166.44	$ 184.46	$ 203.11	$ 222.42	$ 242.39	$ 263.06	$ 284.45	$ 306.59	$ 329.51	$ 353.22	$ 377.76	$ 403.15	$ 429.43	$ 456.63	$ 484.78	$ 513.91	$ 544.06	$ 575.25	$ 607.54
NPV:	($4,695.08)																				
IRR:	-2.8%																				
Payback Period:	$ (10,335)	$ (10,185.97)	$ (10,019.53)	$ (9,835.07)	$(9,631.95)	$(9,409.54)	$(9,167.15)	$(8,904.08)	$(8,619.63)	$(8,313.04)	$(7,983.53)	$(7,630.31)	$(7,252.56)	$(6,849.40)	$(6,419.97)	$(5,963.34)	$(5,478.56)	$(4,964.65)	$(4,420.59)	$ (3,845.34)	$ (3,237.80)
200GPD:																					
Net Benefit:	$ (10,335)	$ 135.45	$ 152.39	$ 169.92	$ 188.06	$ 206.84	$ 226.27	$ 246.38	$ 267.19	$ 288.73	$ 311.02	$ 334.08	$ 357.95	$ 382.66	$ 408.23	$ 434.68	$ 462.07	$ 490.40	$ 519.73	$ 550.08	$ 581.49
NPV:	($4,995.69)																				
IRR:	-3.2%																				
Payback Period:	$ (10,335)	$ (10,199.55)	$ (10,047.16)	$ (9,877.24)	$(9,689.17)	$(9,482.33)	$(9,256.06)	$(9,009.68)	$(8,742.49)	$(8,453.76)	$(8,142.74)	$(7,808.66)	$(7,450.71)	$(7,068.05)	$(6,659.82)	$(6,225.14)	$(5,763.07)	$(5,272.67)	$(4,752.94)	$ (4,202.86)	$ (3,621.37)

Table 21. Charlotte, NC Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0072	$ 0.0076	$ 0.0081	$ 0.0086	$ 0.0092	$ 0.0098	$ 0.0104	$ 0.0110	$ 0.0117	$ 0.0125	$ 0.0133	$ 0.0141	$ 0.0151	$ 0.0160	$ 0.0170	$ 0.0181	$ 0.0193	$ 0.0205	$ 0.0218	$ 0.0232	$ 0.0247
400 GPD CPG	$ 0.0049	$ 0.0052	$ 0.0055	$ 0.0059	$ 0.0062	$ 0.0066	$ 0.0071	$ 0.0075	$ 0.0080	$ 0.0085	$ 0.0091	$ 0.0096	$ 0.0103	$ 0.0109	$ 0.0116	$ 0.0124	$ 0.0131	$ 0.0140	$ 0.0149	$ 0.0158	$ 0.0168
200 GPD CPG	$ 0.0036	$ 0.0038	$ 0.0040	$ 0.0043	$ 0.0046	$ 0.0049	$ 0.0052	$ 0.0055	$ 0.0058	$ 0.0062	$ 0.0066	$ 0.0070	$ 0.0075	$ 0.0080	$ 0.0085	$ 0.0090	$ 0.0096	$ 0.0102	$ 0.0109	$ 0.0116	$ 0.0123
Benefits:																					
Precip.(in)		41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792	64,792
Benefits(yr):	Capture %:																				
600GPD	30%	$ 493.41	$ 524.94	$ 558.49	$ 594.18	$ 632.15	$ 672.55	$ 715.53	$ 761.26	$ 809.91	$ 861.67	$ 916.73	$ 975.32	$ 1,037.65	$ 1,103.96	$ 1,174.51	$ 1,249.57	$ 1,329.43	$ 1,414.39	$ 1,504.78	$ 1,600.95
400GPD	44%	$ 336.26	$ 357.75	$ 380.61	$ 404.94	$ 430.81	$ 458.35	$ 487.64	$ 518.80	$ 551.96	$ 587.23	$ 624.76	$ 664.68	$ 707.16	$ 752.36	$ 800.44	$ 851.59	$ 906.01	$ 963.91	$ 1,025.51	$ 1,091.05
200GPD	89%	$ 245.55	$ 261.24	$ 277.94	$ 295.70	$ 314.60	$ 334.70	$ 356.09	$ 378.85	$ 403.06	$ 428.82	$ 456.23	$ 485.38	$ 516.40	$ 549.40	$ 584.51	$ 621.87	$ 661.61	$ 703.89	$ 748.88	$ 796.73
Costs:																					
Above Ground:																					
Tank 7k Gal	$ (4,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,335)	$ 143.41	$ 174.94	$ 208.49	$ 244.18	$ 282.15	$ 322.55	$ 365.53	$ 411.26	$ 459.91	$ 511.67	$ 566.73	$ 625.32	$ 687.65	$ 753.96	$ 824.51	$ 899.57	$ 979.43	$ 1,064.39	$ 1,154.78	$ 1,250.95
NPV:	($1,166.13)																				
IRR:	1.1%																				
Payback Period:	$ (10,335)	$(10,191.59)	$(10,016.65)	$ (9,808.17)	$ (9,563.99)	$ (9,281.84)	$ (8,959.29)	$ (8,593.76)	$ (8,182.50)	$ (7,722.60)	$ (7,210.93)	$ (6,644.20)	$ (6,018.88)	$ (5,331.23)	$ (4,577.27)	$ (3,752.76)	$(2,853.18)	$(1,873.75)	$ (809.36)	$ 345.42	$ 1,596.36
400GPD:																					
Net Benefit:	$ (10,335)	$ (13.74)	$ 7.75	$ 30.61	$ 54.94	$ 80.81	$ 108.35	$ 137.64	$ 168.80	$ 201.96	$ 237.23	$ 274.76	$ 314.68	$ 357.16	$ 402.36	$ 450.44	$ 501.59	$ 556.01	$ 613.91	$ 675.51	$ 741.05
NPV:	($5,808.83)																				
IRR:	-3.6%																				
Payback Period:	$ (10,335)	$(10,348.74)	$(10,340.99)	$(10,310.38)	$(10,255.45)	$(10,174.63)	$(10,066.29)	$ (9,928.65)	$ (9,759.85)	$ (9,557.89)	$ (9,320.66)	$ (9,045.91)	$ (8,731.22)	$ (8,374.06)	$ (7,971.70)	$ (7,521.27)	$(7,019.68)	$(6,463.66)	$(5,849.75)	$ (5,174.23)	$ (4,433.18)
200GPD:																					
Net Benefit:	$ (10,335)	$ (104.45)	$ (88.76)	$ (72.06)	$ (54.30)	$ (35.40)	$ (15.30)	$ 6.09	$ 28.85	$ 53.06	$ 78.82	$ 106.23	$ 135.38	$ 166.40	$ 199.40	$ 234.51	$ 271.87	$ 311.61	$ 353.89	$ 398.88	$ 446.73
NPV:	($8,488.67)																				
IRR:	-7.8%																				
Payback Period:	$ (10,335)	$(10,439.45)	$(10,528.20)	$(10,600.27)	$(10,654.56)	$(10,689.96)	$(10,705.26)	$(10,699.17)	$(10,670.31)	$(10,617.25)	$(10,538.43)	$(10,432.21)	$(10,296.82)	$(10,130.42)	$ (9,931.02)	$ (9,696.50)	$(9,424.64)	$(9,113.02)	$(8,759.13)	$ (8,360.26)	$ (7,913.52)

Table 22. Chicago, IL Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0038	$ 0.0042	$ 0.0045	$ 0.0049	$ 0.0054	$ 0.0059	$ 0.0064	$ 0.0070	$ 0.0076	$ 0.0083	$ 0.0090	$ 0.0098	$ 0.0107	$ 0.0116	$ 0.0127	$ 0.0138	$ 0.0151	$ 0.0164	$ 0.0179	$ 0.0195	$ 0.0212
400 GPD CPG	$ 0.0038	$ 0.0042	$ 0.0045	$ 0.0049	$ 0.0054	$ 0.0059	$ 0.0064	$ 0.0070	$ 0.0076	$ 0.0083	$ 0.0090	$ 0.0098	$ 0.0107	$ 0.0116	$ 0.0127	$ 0.0138	$ 0.0151	$ 0.0164	$ 0.0179	$ 0.0195	$ 0.0212
200 GPD CPG	$ 0.0038	$ 0.0042	$ 0.0045	$ 0.0049	$ 0.0054	$ 0.0059	$ 0.0064	$ 0.0070	$ 0.0076	$ 0.0083	$ 0.0090	$ 0.0098	$ 0.0107	$ 0.0116	$ 0.0127	$ 0.0138	$ 0.0151	$ 0.0164	$ 0.0179	$ 0.0195	$ 0.0212
Benefits:																					
Precip.(in)		36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472	57,472
Benefits(yr):	Capture %:																				
600GPD	26%	$ 239.59	$ 261.00	$ 284.32	$ 309.73	$ 337.41	$ 367.56	$ 400.41	$ 436.19	$ 475.17	$ 517.63	$ 563.89	$ 614.28	$ 669.17	$ 728.97	$ 794.12	$ 865.08	$ 942.39	$ 1,026.60	$ 1,118.34	$ 1,218.28
400GPD	39%	$ 239.59	$ 261.00	$ 284.32	$ 309.73	$ 337.41	$ 367.56	$ 400.41	$ 436.19	$ 475.17	$ 517.63	$ 563.89	$ 614.28	$ 669.17	$ 728.97	$ 794.12	$ 865.08	$ 942.39	$ 1,026.60	$ 1,118.34	$ 1,218.28
200GPD	79%	$ 239.59	$ 261.00	$ 284.32	$ 309.73	$ 337.41	$ 367.56	$ 400.41	$ 436.19	$ 475.17	$ 517.63	$ 563.89	$ 614.28	$ 669.17	$ 728.97	$ 794.12	$ 865.08	$ 942.39	$ 1,026.60	$ 1,118.34	$ 1,218.28
Costs:																					
Above Ground:																					
Tank 7k Gal	$ (4,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,335)	$ (110.41)	$ (89.00)	$ (65.68)	$ (40.27)	$ (12.59)	$ 17.56	$ 50.41	$ 86.19	$ 125.17	$ 167.63	$ 213.89	$ 264.28	$ 319.17	$ 378.97	$ 444.12	$ 515.08	$ 592.39	$ 676.60	$ 768.34	$ 868.28
NPV:	($6,505.80)																				
IRR:	-4.0%																				
Payback Period:	$ (10,335)	$(10,445.41)	$(10,534.41)	$(10,600.09)	$(10,640.35)	$(10,652.94)	$(10,635.38)	$(10,584.97)	$(10,498.78)	$(10,373.61)	$(10,205.98)	$(9,992.09)	$(9,727.81)	$(9,408.64)	$(9,029.67)	$(8,585.55)	$(8,070.47)	$(7,478.08)	$(6,801.48)	$ (6,033.14)	$ (5,164.87)
400GPD:																					
Net Benefit:	$ (10,335)	$ (110.41)	$ (89.00)	$ (65.68)	$ (40.27)	$ (12.59)	$ 17.56	$ 50.41	$ 86.19	$ 125.17	$ 167.63	$ 213.89	$ 264.28	$ 319.17	$ 378.97	$ 444.12	$ 515.08	$ 592.39	$ 676.60	$ 768.34	$ 868.28
NPV:	($6,505.80)																				
IRR:	-4.0%																				
Payback Period:	$ (10,335)	$(10,445.41)	$(10,534.41)	$(10,600.09)	$(10,640.35)	$(10,652.94)	$(10,635.38)	$(10,584.97)	$(10,498.78)	$(10,373.61)	$(10,205.98)	$(9,992.09)	$(9,727.81)	$(9,408.64)	$(9,029.67)	$(8,585.55)	$(8,070.47)	$(7,478.08)	$(6,801.48)	$ (6,033.14)	$ (5,164.87)
200GPD:																					
Net Benefit:	$ (10,335)	$ (110.41)	$ (89.00)	$ (65.68)	$ (40.27)	$ (12.59)	$ 17.56	$ 50.41	$ 86.19	$ 125.17	$ 167.63	$ 213.89	$ 264.28	$ 319.17	$ 378.97	$ 444.12	$ 515.08	$ 592.39	$ 676.60	$ 768.34	$ 868.28
NPV:	($6,505.80)																				
IRR:	-4.0%																				
Payback Period:	$ (10,335)	$(10,445.41)	$(10,534.41)	$(10,600.09)	$(10,640.35)	$(10,652.94)	$(10,635.38)	$(10,584.97)	$(10,498.78)	$(10,373.61)	$(10,205.98)	$(9,992.09)	$(9,727.81)	$(9,408.64)	$(9,029.67)	$(8,585.55)	$(8,070.47)	$(7,478.08)	$(6,801.48)	$ (6,033.14)	$ (5,164.87)

Table 23. Columbus, OH Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0046	$ 0.0048	$ 0.0049	$ 0.0051	$ 0.0053	$ 0.0055	$ 0.0057	$ 0.0059	$ 0.0062	$ 0.0064	$ 0.0066	$ 0.0069	$ 0.0072	$ 0.0074	$ 0.0077	$ 0.0080	$ 0.0083	$ 0.0086	$ 0.0089	$ 0.0093	$ 0.0096
400 GPD CPG	$ 0.0048	$ 0.0049	$ 0.0051	$ 0.0053	$ 0.0055	$ 0.0057	$ 0.0059	$ 0.0062	$ 0.0064	$ 0.0066	$ 0.0069	$ 0.0072	$ 0.0074	$ 0.0077	$ 0.0080	$ 0.0083	$ 0.0086	$ 0.0090	$ 0.0093	$ 0.0096	$ 0.0100
200 GPD CPG	$ 0.0053	$ 0.0055	$ 0.0057	$ 0.0059	$ 0.0061	$ 0.0064	$ 0.0066	$ 0.0069	$ 0.0071	$ 0.0074	$ 0.0077	$ 0.0080	$ 0.0083	$ 0.0086	$ 0.0089	$ 0.0092	$ 0.0096	$ 0.0100	$ 0.0103	$ 0.0107	$ 0.0111
Benefits:																					
Precip.(in)		39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210	61,210
Benefits(yr):	Capture %:																				
600GPD	28%	$ 290.82	$ 301.85	$ 313.31	$ 325.20	$ 337.53	$ 350.34	$ 363.63	$ 377.43	$ 391.75	$ 406.61	$ 422.04	$ 438.05	$ 454.67	$ 471.93	$ 489.83	$ 508.42	$ 527.71	$ 547.73	$ 568.51	$ 590.08
400GPD	42%	$ 302.13	$ 313.60	$ 325.50	$ 337.85	$ 350.66	$ 363.97	$ 377.78	$ 392.11	$ 406.99	$ 422.43	$ 438.46	$ 455.10	$ 472.36	$ 490.29	$ 508.89	$ 528.20	$ 548.24	$ 569.04	$ 590.63	$ 613.04
200GPD	84%	$ 336.08	$ 348.83	$ 362.06	$ 375.80	$ 390.06	$ 404.86	$ 420.22	$ 436.16	$ 452.71	$ 469.89	$ 487.72	$ 506.22	$ 525.43	$ 545.36	$ 566.06	$ 587.53	$ 609.83	$ 632.96	$ 656.98	$ 681.91
Costs:																					
Above Ground:																					
Tank 15k Gal	$ (8,600)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (14,635)	$ (59.18)	$ (48.15)	$ (36.69)	$ (24.80)	$ (12.47)	$ 0.34	$ 13.63	$ 27.43	$ 41.75	$ 56.61	$ 72.04	$ 88.05	$ 104.67	$ 121.93	$ 139.83	$ 158.42	$ 177.71	$ 197.73	$ 218.51	$ 240.08
NPV:	($13,327.67)																				
IRR:	-12.4%																				
Payback Period:	$ (14,635)	$(14,694.18)	$(14,742.32)	$(14,779.02)	$(14,803.82)	$(14,816.29)	$(14,815.95)	$(14,802.32)	$(14,774.89)	$(14,733.14)	$(14,676.52)	$(14,604.48)	$(14,516.43)	$(14,411.75)	$(14,289.83)	$(14,150.00)	$(13,991.58)	$(13,813.87)	$(13,616.14)	$(13,397.63)	$(13,157.55)
400GPD:																					
Net Benefit:	$ (14,635)	$ (47.87)	$ (36.40)	$ (24.50)	$ (12.15)	$ 0.66	$ 13.97	$ 27.78	$ 42.11	$ 56.99	$ 72.43	$ 88.46	$ 105.10	$ 122.36	$ 140.29	$ 158.89	$ 178.20	$ 198.24	$ 219.04	$ 240.63	$ 263.04
NPV:	($13,069.69)																				
IRR:	-11.8%																				
Payback Period:	$ (14,635)	$(14,682.87)	$(14,719.27)	$(14,743.77)	$(14,755.92)	$(14,755.26)	$(14,741.29)	$(14,713.51)	$(14,671.40)	$(14,614.41)	$(14,541.98)	$(14,453.52)	$(14,348.42)	$(14,226.06)	$(14,085.77)	$(13,926.88)	$(13,748.69)	$(13,550.45)	$(13,331.41)	$(13,090.79)	$(12,827.75)
200GPD:																					
Net Benefit:	$ (14,635)	$ (13.92)	$ (1.17)	$ 12.06	$ 25.80	$ 40.06	$ 54.86	$ 70.22	$ 86.16	$ 102.71	$ 119.89	$ 137.72	$ 156.22	$ 175.43	$ 195.36	$ 216.06	$ 237.53	$ 259.83	$ 282.96	$ 306.98	$ 331.91
NPV:	($12,295.77)																				
IRR:	-10.1%																				
Payback Period:	$ (14,635)	$(14,648.92)	$(14,650.10)	$(14,638.03)	$(14,612.23)	$(14,572.17)	$(14,517.32)	$(14,447.10)	$(14,360.93)	$(14,258.22)	$(14,138.33)	$(14,000.62)	$(13,844.40)	$(13,668.97)	$(13,473.60)	$(13,257.55)	$(13,020.01)	$(12,760.19)	$(12,477.23)	$(12,170.25)	$(11,838.34)

Table 24. Dallas, TX Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0053	$ 0.0055	$ 0.0057	$ 0.0060	$ 0.0062	$ 0.0065	$ 0.0068	$ 0.0071	$ 0.0073	$ 0.0077	$ 0.0080	$ 0.0083	$ 0.0087	$ 0.0090	$ 0.0094	$ 0.0098	$ 0.0102	$ 0.0107	$ 0.0111	$ 0.0116	$ 0.0121
400 GPD CPG	$ 0.0042	$ 0.0044	$ 0.0046	$ 0.0048	$ 0.0050	$ 0.0052	$ 0.0054	$ 0.0057	$ 0.0059	$ 0.0061	$ 0.0064	$ 0.0067	$ 0.0070	$ 0.0072	$ 0.0076	$ 0.0079	$ 0.0082	$ 0.0086	$ 0.0089	$ 0.0093	$ 0.0097
200 GPD CPG	$ 0.0036	$ 0.0037	$ 0.0039	$ 0.0040	$ 0.0042	$ 0.0044	$ 0.0046	$ 0.0048	$ 0.0050	$ 0.0052	$ 0.0054	$ 0.0056	$ 0.0059	$ 0.0061	$ 0.0064	$ 0.0066	$ 0.0069	$ 0.0072	$ 0.0075	$ 0.0078	$ 0.0082
Benefits:																					
Precip.(in)		37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562	58,562
Benefits(yr):	Capture %:																				
600GPD	27%	$ 322.08	$ 335.70	$ 349.90	$ 364.69	$ 380.11	$ 396.19	$ 412.94	$ 430.40	$ 448.60	$ 467.57	$ 487.34	$ 507.95	$ 529.43	$ 551.82	$ 575.15	$ 599.47	$ 624.82	$ 651.25	$ 678.78	$ 707.49
400GPD	40%	$ 258.12	$ 269.03	$ 280.41	$ 292.27	$ 304.62	$ 317.51	$ 330.93	$ 344.93	$ 359.51	$ 374.71	$ 390.56	$ 407.07	$ 424.29	$ 442.23	$ 460.93	$ 480.42	$ 500.74	$ 521.91	$ 543.98	$ 566.98
200GPD	80%	$ 217.63	$ 226.83	$ 236.43	$ 246.42	$ 256.84	$ 267.70	$ 279.02	$ 290.82	$ 303.12	$ 315.94	$ 329.30	$ 343.22	$ 357.74	$ 372.86	$ 388.63	$ 405.07	$ 422.19	$ 440.05	$ 458.66	$ 478.05
Costs:																					
Above Ground:																					
Tank 8k Gal	$ (4,680)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,715)	$ (27.92)	$ (14.30)	$ (0.10)	$ 14.69	$ 30.11	$ 46.19	$ 62.94	$ 80.40	$ 98.60	$ 117.57	$ 137.34	$ 157.95	$ 179.43	$ 201.82	$ 225.15	$ 249.47	$ 274.82	$ 301.25	$ 328.78	$ 357.49
NPV:	($8,453.76)																				
IRR:	-8.1%																				
Payback Period:	$ (10,715)	$(10,742.92)	$(10,757.22)	$(10,757.32)	$(10,742.63)	$(10,712.51)	$(10,666.32)	$(10,603.38)	$(10,522.98)	$(10,424.38)	$(10,306.81)	$(10,169.46)	$(10,011.51)	$ (9,832.08)	$ (9,630.26)	$ (9,405.10)	$ (9,155.63)	$ (8,880.81)	$ (8,579.56)	$ (8,250.78)	$ (7,893.29)
400GPD:																					
Net Benefit:	$ (10,715)	$ (91.88)	$ (80.97)	$ (69.59)	$ (57.73)	$ (45.38)	$ (32.49)	$ (19.07)	$ (5.07)	$ 9.51	$ 24.71	$ 40.56	$ 57.07	$ 74.29	$ 92.23	$ 110.93	$ 130.42	$ 150.74	$ 171.91	$ 193.98	$ 216.98
NPV:	($9,975.40)																				
IRR:	-12.0%																				
Payback Period:	$ (10,715)	$(10,806.88)	$(10,887.85)	$(10,957.44)	$(11,015.18)	$(11,060.55)	$(11,093.05)	$(11,112.12)	$(11,117.19)	$(11,107.68)	$(11,082.97)	$(11,042.41)	$(10,985.33)	$(10,911.05)	$(10,818.82)	$(10,707.89)	$(10,577.47)	$(10,426.73)	$(10,254.82)	$(10,060.84)	$ (9,843.86)
200GPD:																					
Net Benefit:	$ (10,715)	$ (132.37)	$ (123.17)	$ (113.57)	$ (103.58)	$ (93.16)	$ (82.30)	$ (70.98)	$ (59.18)	$ (46.88)	$ (34.06)	$ (20.70)	$ (6.78)	$ 7.74	$ 22.86	$ 38.63	$ 55.07	$ 72.19	$ 90.05	$ 108.66	$ 128.05
NPV:	($10,938.51)																				
IRR:	-16.2%																				
Payback Period:	$ (10,715)	$(10,847.37)	$(10,970.54)	$(11,084.11)	$(11,187.69)	$(11,280.84)	$(11,363.14)	$(11,434.11)	$(11,493.29)	$(11,540.17)	$(11,574.23)	$(11,594.93)	$(11,601.71)	$(11,593.97)	$(11,571.10)	$(11,532.47)	$(11,477.41)	$(11,405.21)	$(11,315.17)	$(11,206.51)	$(11,078.46)

Table 25. Denver, CO Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0034	$ 0.0035	$ 0.0036	$ 0.0038	$ 0.0039	$ 0.0041	$ 0.0042	$ 0.0043	$ 0.0045	$ 0.0047	$ 0.0048	$ 0.0050	$ 0.0052	$ 0.0054	$ 0.0056	$ 0.0058	$ 0.0060	$ 0.0062	$ 0.0064	$ 0.0066	$ 0.0069
400 GPD CPG	$ 0.0035	$ 0.0036	$ 0.0038	$ 0.0039	$ 0.0041	$ 0.0042	$ 0.0043	$ 0.0045	$ 0.0047	$ 0.0048	$ 0.0050	$ 0.0052	$ 0.0054	$ 0.0056	$ 0.0058	$ 0.0060	$ 0.0062	$ 0.0064	$ 0.0066	$ 0.0069	$ 0.0071
200 GPD CPG	$ 0.0048	$ 0.0050	$ 0.0051	$ 0.0053	$ 0.0055	$ 0.0057	$ 0.0059	$ 0.0061	$ 0.0063	$ 0.0066	$ 0.0068	$ 0.0070	$ 0.0073	$ 0.0076	$ 0.0078	$ 0.0081	$ 0.0084	$ 0.0087	$ 0.0090	$ 0.0093	$ 0.0097
Benefits:																					
Precip.(in)		15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297	24,297
Benefits(yr):	Capture %:																				
600GPD	11%	$ 85.62	$ 88.68	$ 91.84	$ 95.12	$ 98.51	$ 102.02	$ 105.66	$ 109.43	$ 113.33	$ 117.37	$ 121.55	$ 125.89	$ 130.38	$ 135.03	$ 139.84	$ 144.83	$ 149.99	$ 155.34	$ 160.88	$ 166.62
400GPD	17%	$ 88.66	$ 91.83	$ 95.10	$ 98.49	$ 102.00	$ 105.64	$ 109.41	$ 113.31	$ 117.35	$ 121.54	$ 125.87	$ 130.36	$ 135.01	$ 139.82	$ 144.81	$ 149.97	$ 155.32	$ 160.86	$ 166.59	$ 172.53
200GPD	33%	$ 120.49	$ 124.79	$ 129.24	$ 133.85	$ 138.62	$ 143.57	$ 148.69	$ 153.99	$ 159.48	$ 165.17	$ 171.06	$ 177.16	$ 183.47	$ 190.02	$ 196.79	$ 203.81	$ 211.08	$ 218.60	$ 226.40	$ 234.47
Costs:																					
Above Ground:																					
Tank 4k Gal	$ (2,340)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (8,375)	$ (264.38)	$ (261.32)	$ (258.16)	$ (254.88)	$ (251.49)	$ (247.98)	$ (244.34)	$ (240.57)	$ (236.67)	$ (232.63)	$ (228.45)	$ (224.11)	$ (219.62)	$ (214.97)	$ (210.16)	$ (205.17)	$ (200.01)	$ (194.66)	$ (189.12)	$ (183.38)
NPV:	($11,911.88)																				
IRR:	#NUM!																				
Payback Period:	$ (8,375)	$ (8,639.38)	$ (8,900.70)	$ (9,158.86)	$ (9,413.74)	$ (9,665.24)	$ (9,913.22)	$(10,157.56)	$(10,398.13)	$(10,634.81)	$(10,867.44)	$(11,095.88)	$(11,320.00)	$(11,539.62)	$(11,754.59)	$(11,964.75)	$(12,169.92)	$(12,369.93)	$(12,564.59)	$(12,753.71)	$(12,937.09)
400GPD:																					
Net Benefit:	$ (8,375)	$ (261.34)	$ (258.17)	$ (254.90)	$ (251.51)	$ (248.00)	$ (244.36)	$ (240.59)	$ (236.69)	$ (232.65)	$ (228.46)	$ (224.13)	$ (219.64)	$ (214.99)	$ (210.18)	$ (205.19)	$ (200.03)	$ (194.68)	$ (189.14)	$ (183.41)	$ (177.47)
NPV:	($11,844.07)																				
IRR:	#NUM!																				
Payback Period:	$ (8,375)	$ (8,636.34)	$ (8,894.51)	$ (9,149.41)	$ (9,400.92)	$ (9,648.91)	$ (9,893.27)	$(10,133.86)	$(10,370.55)	$(10,603.20)	$(10,831.66)	$(11,055.79)	$(11,275.43)	$(11,490.43)	$(11,700.61)	$(11,905.80)	$(12,105.83)	$(12,300.51)	$(12,489.65)	$(12,673.06)	$(12,850.53)
200GPD:																					
Net Benefit:	$ (8,375)	$ (229.51)	$ (225.21)	$ (220.76)	$ (216.15)	$ (211.38)	$ (206.43)	$ (201.31)	$ (196.01)	$ (190.52)	$ (184.83)	$ (178.94)	$ (172.84)	$ (166.53)	$ (159.98)	$ (153.21)	$ (146.19)	$ (138.92)	$ (131.40)	$ (123.60)	$ (115.53)
NPV:	($11,134.17)																				
IRR:	#NUM!																				
Payback Period:	$ (8,375)	$ (8,604.51)	$ (8,829.71)	$ (9,050.47)	$ (9,266.62)	$ (9,478.00)	$ (9,684.43)	$ (9,885.75)	$(10,081.76)	$(10,272.28)	$(10,457.11)	$(10,636.06)	$(10,808.90)	$(10,975.43)	$(11,135.41)	$(11,288.62)	$(11,434.81)	$(11,573.73)	$(11,705.13)	$(11,828.73)	$(11,944.26)

Table 26. Detroit, MI Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0035	$ 0.0037	$ 0.0039	$ 0.0042	$ 0.0044	$ 0.0047	$ 0.0050	$ 0.0053	$ 0.0056	$ 0.0059	$ 0.0063	$ 0.0067	$ 0.0071	$ 0.0075	$ 0.0079	$ 0.0084	$ 0.0089	$ 0.0095	$ 0.0100	$ 0.0106	$ 0.0113
400 GPD CPG	$ 0.0037	$ 0.0039	$ 0.0042	$ 0.0044	$ 0.0047	$ 0.0050	$ 0.0053	$ 0.0056	$ 0.0059	$ 0.0063	$ 0.0066	$ 0.0070	$ 0.0075	$ 0.0079	$ 0.0084	$ 0.0089	$ 0.0094	$ 0.0100	$ 0.0106	$ 0.0112	$ 0.0119
200 GPD CPG	$ 0.0043	$ 0.0045	$ 0.0048	$ 0.0051	$ 0.0054	$ 0.0057	$ 0.0061	$ 0.0064	$ 0.0068	$ 0.0072	$ 0.0077	$ 0.0081	$ 0.0086	$ 0.0091	$ 0.0097	$ 0.0103	$ 0.0109	$ 0.0115	$ 0.0122	$ 0.0130	$ 0.0138
Benefits:																					
Precip.(in)		33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176	52,176
Benefits(yr):	Capture %:																				
600GPD	24%	$ 194.10	$ 205.77	$ 218.14	$ 231.25	$ 245.16	$ 259.90	$ 275.53	$ 292.09	$ 309.65	$ 328.27	$ 348.01	$ 368.93	$ 391.12	$ 414.63	$ 439.56	$ 465.99	$ 494.01	$ 523.71	$ 555.20	$ 588.58
400GPD	36%	$ 204.77	$ 217.08	$ 230.13	$ 243.97	$ 258.63	$ 274.18	$ 290.67	$ 308.15	$ 326.67	$ 346.32	$ 367.14	$ 389.21	$ 412.61	$ 437.42	$ 463.72	$ 491.60	$ 521.16	$ 552.50	$ 585.71	$ 620.93
200GPD	71%	$ 236.68	$ 250.91	$ 266.00	$ 281.99	$ 298.94	$ 316.92	$ 335.97	$ 356.17	$ 377.59	$ 400.29	$ 424.36	$ 449.87	$ 476.92	$ 505.60	$ 536.00	$ 568.22	$ 602.39	$ 638.61	$ 677.00	$ 717.71
Costs:																					
Above Ground:																					
Tank 6k Gal	$ (3,600)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (9,635)	$ (155.90)	$ (144.23)	$ (131.86)	$ (118.75)	$ (104.84)	$ (90.10)	$ (74.47)	$ (57.91)	$ (40.35)	$ (21.73)	$ (1.99)	$ 18.93	$ 41.12	$ 64.63	$ 89.56	$ 115.99	$ 144.01	$ 173.71	$ 205.20	$ 238.58
NPV:	($9,539.45)																				
IRR:	-12.3%																				
Payback Period:	$ (9,635)	$ (9,790.90)	$ (9,935.14)	$(10,067.00)	$(10,185.74)	$(10,290.58)	$(10,380.69)	$(10,455.16)	$(10,513.07)	$(10,553.42)	$(10,575.14)	$(10,577.14)	$(10,558.20)	$(10,517.09)	$(10,452.46)	$(10,362.90)	$(10,246.91)	$(10,102.90)	$(9,929.19)	$ (9,723.99)	$ (9,485.41)
400GPD:																					
Net Benefit:	$ (9,635)	$ (145.23)	$ (132.92)	$ (119.87)	$ (106.03)	$ (91.37)	$ (75.82)	$ (59.33)	$ (41.85)	$ (23.33)	$ (3.68)	$ 17.14	$ 39.21	$ 62.61	$ 87.42	$ 113.72	$ 141.60	$ 171.16	$ 202.50	$ 235.71	$ 270.93
NPV:	($9,236.18)																				
IRR:	-11.3%																				
Payback Period:	$ (9,635)	$ (9,780.23)	$ (9,913.16)	$(10,033.03)	$(10,139.06)	$(10,230.43)	$(10,306.24)	$(10,365.58)	$(10,407.43)	$(10,430.76)	$(10,434.44)	$(10,417.30)	$(10,378.09)	$(10,315.48)	$(10,228.06)	$(10,114.34)	$ (9,972.73)	$ (9,801.57)	$(9,599.08)	$ (9,363.36)	$ (9,092.43)
200GPD:																					
Net Benefit:	$ (9,635)	$ (113.32)	$ (99.09)	$ (84.00)	$ (68.01)	$ (51.06)	$ (33.08)	$ (14.03)	$ 6.17	$ 27.59	$ 50.29	$ 74.36	$ 99.87	$ 126.92	$ 155.60	$ 186.00	$ 218.22	$ 252.39	$ 288.61	$ 327.00	$ 367.71
NPV:	($8,328.96)																				
IRR:	-8.8%																				
Payback Period:	$ (9,635)	$ (9,748.32)	$ (9,847.41)	$ (9,931.41)	$ (9,999.42)	$(10,050.48)	$(10,083.56)	$(10,097.58)	$(10,091.41)	$(10,063.82)	$(10,013.53)	$ (9,939.17)	$ (9,839.29)	$ (9,712.37)	$ (9,556.77)	$ (9,370.77)	$ (9,152.55)	$ (8,900.16)	$(8,611.55)	$ (8,284.55)	$ (7,916.84)

Table 27. Fort Worth, TX Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0046	$ 0.0047	$ 0.0049	$ 0.0050	$ 0.0052	$ 0.0054	$ 0.0055	$ 0.0057	$ 0.0059	$ 0.0061	$ 0.0063	$ 0.0065	$ 0.0067	$ 0.0069	$ 0.0072	$ 0.0074	$ 0.0076	$ 0.0079	$ 0.0081	$ 0.0084	$ 0.0087
400 GPD CPG	$ 0.0045	$ 0.0046	$ 0.0048	$ 0.0049	$ 0.0051	$ 0.0053	$ 0.0054	$ 0.0056	$ 0.0058	$ 0.0060	$ 0.0062	$ 0.0064	$ 0.0066	$ 0.0068	$ 0.0070	$ 0.0073	$ 0.0075	$ 0.0077	$ 0.0080	$ 0.0083	$ 0.0085
200 GPD CPG	$ 0.0051	$ 0.0052	$ 0.0054	$ 0.0056	$ 0.0058	$ 0.0059	$ 0.0061	$ 0.0063	$ 0.0065	$ 0.0068	$ 0.0070	$ 0.0072	$ 0.0074	$ 0.0077	$ 0.0079	$ 0.0082	$ 0.0085	$ 0.0087	$ 0.0090	$ 0.0093	$ 0.0096
Benefits:																					
Precip.(in)		37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44	37.44
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313	58,313
Benefits(yr):	Capture %:																				
600GPD	27%	$ 274.54	$ 283.52	$ 292.80	$ 302.38	$ 312.28	$ 322.50	$ 333.05	$ 343.95	$ 355.20	$ 366.82	$ 378.83	$ 391.22	$ 404.02	$ 417.24	$ 430.90	$ 445.00	$ 459.56	$ 474.60	$ 490.13	$ 506.16
400GPD	40%	$ 269.86	$ 278.69	$ 287.80	$ 297.22	$ 306.95	$ 316.99	$ 327.36	$ 338.08	$ 349.14	$ 360.56	$ 372.36	$ 384.55	$ 397.13	$ 410.12	$ 423.54	$ 437.40	$ 451.71	$ 466.50	$ 481.76	$ 497.52
200GPD	80%	$ 304.50	$ 314.47	$ 324.76	$ 335.38	$ 346.36	$ 357.69	$ 369.40	$ 381.48	$ 393.97	$ 406.86	$ 420.17	$ 433.92	$ 448.12	$ 462.78	$ 477.92	$ 493.56	$ 509.71	$ 526.39	$ 543.62	$ 561.40
Costs:																					
Above Ground:																					
Tank 8k Gal	$ (4,680)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,715)	$ (75.46)	$ (66.48)	$ (57.20)	$ (47.62)	$ (37.72)	$ (27.50)	$ (16.95)	$ (6.05)	$ 5.20	$ 16.82	$ 28.83	$ 41.22	$ 54.02	$ 67.24	$ 80.90	$ 95.00	$ 109.56	$ 124.60	$ 140.13	$ 156.16
NPV:	($10,163.37)																				
IRR:	-13.6%																				
Payback Period:	$ (10,715)	$(10,790.46)	$(10,856.93)	$(10,914.13)	$(10,961.75)	$(10,999.47)	$(11,026.98)	$(11,043.93)	$(11,049.98)	$(11,044.78)	$(11,027.96)	$(10,999.13)	$(10,957.91)	$(10,903.88)	$(10,836.64)	$(10,755.74)	$(10,660.74)	$(10,551.18)	$(10,426.59)	$(10,286.46)	$(10,130.30)
400GPD:																					
Net Benefit:	$ (10,715)	$ (80.14)	$ (71.31)	$ (62.20)	$ (52.78)	$ (43.05)	$ (33.01)	$ (22.64)	$ (11.92)	$ (0.86)	$ 10.56	$ 22.36	$ 34.55	$ 47.13	$ 60.12	$ 73.54	$ 87.40	$ 101.71	$ 116.50	$ 131.76	$ 147.52
NPV:	($10,264.96)																				
IRR:	-14.0%																				
Payback Period:	$ (10,715)	$(10,795.14)	$(10,866.46)	$(10,928.65)	$(10,981.43)	$(11,024.48)	$(11,057.49)	$(11,080.13)	$(11,092.05)	$(11,092.91)	$(11,082.35)	$(11,059.99)	$(11,025.44)	$(10,978.31)	$(10,918.19)	$(10,844.65)	$(10,757.24)	$(10,655.53)	$(10,539.03)	$(10,407.27)	$(10,259.75)
200GPD:																					
Net Benefit:	$ (10,715)	$ (45.50)	$ (35.53)	$ (25.24)	$ (14.62)	$ (3.64)	$ 7.69	$ 19.40	$ 31.48	$ 43.97	$ 56.86	$ 70.17	$ 83.92	$ 98.12	$ 112.78	$ 127.92	$ 143.56	$ 159.71	$ 176.39	$ 193.62	$ 211.40
NPV:	($9,513.77)																				
IRR:	-11.3%																				
Payback Period:	$ (10,715)	$(10,760.50)	$(10,796.03)	$(10,821.27)	$(10,835.89)	$(10,839.53)	$(10,831.84)	$(10,812.44)	$(10,780.96)	$(10,737.00)	$(10,680.14)	$(10,609.97)	$(10,526.05)	$(10,427.93)	$(10,315.15)	$(10,187.23)	$(10,043.67)	$ (9,883.95)	$ (9,707.56)	$ (9,513.95)	$ (9,302.55)

Table 28. Houston, TX Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0065	$ 0.0069	$ 0.0074	$ 0.0079	$ 0.0084	$ 0.0090	$ 0.0095	$ 0.0102	$ 0.0108	$ 0.0115	$ 0.0123	$ 0.0131	$ 0.0140	$ 0.0149	$ 0.0159	$ 0.0169	$ 0.0180	$ 0.0192	$ 0.0204	$ 0.0218	$ 0.0232
400 GPD CPG	$ 0.0055	$ 0.0058	$ 0.0062	$ 0.0066	$ 0.0070	$ 0.0075	$ 0.0080	$ 0.0085	$ 0.0091	$ 0.0097	$ 0.0103	$ 0.0110	$ 0.0117	$ 0.0125	$ 0.0133	$ 0.0141	$ 0.0151	$ 0.0161	$ 0.0171	$ 0.0182	$ 0.0194
200 GPD CPG	$ 0.0057	$ 0.0060	$ 0.0064	$ 0.0069	$ 0.0073	$ 0.0078	$ 0.0083	$ 0.0088	$ 0.0094	$ 0.0100	$ 0.0107	$ 0.0114	$ 0.0121	$ 0.0129	$ 0.0138	$ 0.0147	$ 0.0156	$ 0.0167	$ 0.0178	$ 0.0189	$ 0.0202
Benefits:																					
Precip.(in)		49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564	77,564
Benefits(yr):	Capture %:																				
600GPD	35%	$ 538.64	$ 573.95	$ 611.57	$ 651.66	$ 694.38	$ 739.89	$ 788.39	$ 840.07	$ 895.14	$ 953.82	$ 1,016.34	$ 1,082.97	$ 1,153.96	$ 1,229.60	$ 1,310.20	$ 1,396.09	$ 1,487.60	$ 1,585.12	$ 1,689.02	$ 1,799.74
400GPD	53%	$ 450.92	$ 480.48	$ 511.97	$ 545.53	$ 581.29	$ 619.40	$ 660.00	$ 703.26	$ 749.36	$ 798.48	$ 850.83	$ 906.60	$ 966.03	$ 1,029.35	$ 1,096.83	$ 1,168.73	$ 1,245.34	$ 1,326.97	$ 1,413.96	$ 1,506.64
200GPD	106%	$ 438.90	$ 498.86	$ 531.56	$ 566.41	$ 603.54	$ 643.10	$ 685.25	$ 730.17	$ 778.04	$ 829.04	$ 883.38	$ 941.29	$ 1,002.99	$ 1,068.74	$ 1,138.80	$ 1,213.45	$ 1,292.99	$ 1,377.75	$ 1,468.06	$ 1,564.29
Costs:																					
Above Ground:																					
Tank 8k Gal	$ (4,680)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,715)	$ 188.64	$ 223.95	$ 261.57	$ 301.66	$ 344.38	$ 389.89	$ 438.39	$ 490.07	$ 545.14	$ 603.82	$ 666.34	$ 732.97	$ 803.96	$ 879.60	$ 960.20	$ 1,046.09	$ 1,137.60	$ 1,235.12	$ 1,339.02	$ 1,449.74
NPV:	$67.95																				
IRR:	2.1%																				
Payback Period:	$ (10,715)	$(10,526.36)	$(10,302.42)	$(10,040.85)	$ (9,739.19)	$ (9,394.81)	$ (9,004.92)	$ (8,566.53)	$ (8,076.45)	$ (7,531.31)	$ (6,927.49)	$(6,261.15)	$(5,528.18)	$(4,724.23)	$(3,844.63)	$(2,884.43)	$(1,838.34)	$ (700.74)	$ 534.38	$ 1,873.40	$ 3,323.14
400GPD:																					
Net Benefit:	$ (10,715)	$ 100.92	$ 130.48	$ 161.97	$ 195.53	$ 231.29	$ 269.40	$ 310.00	$ 353.26	$ 399.36	$ 448.48	$ 500.83	$ 556.60	$ 616.03	$ 679.35	$ 746.83	$ 818.73	$ 895.34	$ 976.97	$ 1,063.96	$ 1,156.64
NPV:	($2,567.64)																				
IRR:	-0.1%																				
Payback Period:	$ (10,715)	$(10,614.08)	$(10,483.61)	$(10,321.63)	$(10,126.10)	$ (9,894.81)	$ (9,625.41)	$ (9,315.41)	$ (8,962.15)	$ (8,562.79)	$ (8,114.30)	$(7,613.47)	$(7,056.87)	$(6,440.85)	$(5,761.49)	$(5,014.67)	$(4,195.94)	$(3,300.60)	$(2,323.63)	$ (1,259.67)	$ (103.03)
200GPD:																					
Net Benefit:	$ (10,715)	$ 88.90	$ 148.86	$ 181.56	$ 216.41	$ 253.54	$ 293.10	$ 335.25	$ 380.17	$ 428.04	$ 479.04	$ 533.38	$ 591.29	$ 652.99	$ 718.74	$ 788.80	$ 863.45	$ 942.99	$ 1,027.75	$ 1,118.06	$ 1,214.29
NPV:	($2,077.36)																				
IRR:	0.4%																				
Payback Period:	$ (10,715)	$(10,626.10)	$(10,477.23)	$(10,295.67)	$(10,079.26)	$ (9,825.73)	$ (9,532.63)	$ (9,197.38)	$ (8,817.20)	$ (8,389.17)	$ (7,910.13)	$(7,376.74)	$(6,785.45)	$(6,132.46)	$(5,413.72)	$(4,624.92)	$(3,761.48)	$(2,818.48)	$(1,790.74)	$ (672.68)	$ 541.62

Table 29. Indianapolis, IND Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0053	$ 0.0057	$ 0.0060	$ 0.0064	$ 0.0069	$ 0.0073	$ 0.0078	$ 0.0083	$ 0.0089	$ 0.0095	$ 0.0101	$ 0.0107	$ 0.0115	$ 0.0122	$ 0.0130	$ 0.0139	$ 0.0148	$ 0.0158	$ 0.0168	$ 0.0179	$ 0.0191
400 GPD CPG	$ 0.0055	$ 0.0059	$ 0.0063	$ 0.0067	$ 0.0072	$ 0.0076	$ 0.0081	$ 0.0087	$ 0.0093	$ 0.0099	$ 0.0105	$ 0.0112	$ 0.0120	$ 0.0128	$ 0.0136	$ 0.0145	$ 0.0155	$ 0.0165	$ 0.0176	$ 0.0187	$ 0.0200
200 GPD CPG	$ 0.0063	$ 0.0067	$ 0.0071	$ 0.0076	$ 0.0081	$ 0.0086	$ 0.0092	$ 0.0098	$ 0.0105	$ 0.0111	$ 0.0119	$ 0.0127	$ 0.0135	$ 0.0144	$ 0.0154	$ 0.0164	$ 0.0175	$ 0.0186	$ 0.0198	$ 0.0212	$ 0.0226
Benefits:																					
Precip.(in)		42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038	66,038
Benefits(yr):	Capture %:																				
600GPD	30%	$ 373.66	$ 398.40	$ 424.78	$ 452.91	$ 482.90	$ 514.88	$ 548.97	$ 585.32	$ 624.08	$ 665.40	$ 709.46	$ 756.44	$ 806.53	$ 859.93	$ 916.87	$ 977.59	$ 1,042.32	$ 1,111.34	$ 1,184.92	$ 1,263.39
400GPD	45%	$ 390.40	$ 416.25	$ 443.82	$ 473.21	$ 504.54	$ 537.95	$ 573.57	$ 611.55	$ 652.04	$ 695.22	$ 741.25	$ 790.34	$ 842.67	$ 898.47	$ 957.96	$ 1,021.39	$ 1,089.03	$ 1,161.14	$ 1,238.02	$ 1,320.00
200GPD	90%	$ 440.64	$ 469.81	$ 500.92	$ 534.09	$ 569.46	$ 607.17	$ 647.37	$ 690.24	$ 735.94	$ 784.67	$ 836.63	$ 892.03	$ 951.09	$ 1,014.07	$ 1,081.22	$ 1,152.81	$ 1,229.15	$ 1,310.54	$ 1,397.32	$ 1,489.84
Costs:																					
Above Ground:																					
Tank 8k Gal	$ (4,680)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,715)	$ 23.66	$ 48.40	$ 74.78	$ 102.91	$ 132.90	$ 164.88	$ 198.97	$ 235.32	$ 274.08	$ 315.40	$ 359.46	$ 406.44	$ 456.53	$ 509.93	$ 566.87	$ 627.59	$ 692.32	$ 761.34	$ 834.92	$ 913.39
NPV:	($4,812.00)																				
IRR:	-2.2%																				
Payback Period:	$ (10,715)	$(10,691.34)	$(10,642.94)	$(10,568.16)	$(10,465.25)	$(10,332.35)	$(10,167.47)	$ (9,968.50)	$ (9,733.18)	$ (9,459.11)	$ (9,143.71)	$(8,784.24)	$(8,377.81)	$(7,921.28)	$(7,411.35)	$(6,844.47)	$(6,216.89)	$(5,524.57)	$(4,763.23)	$ (3,928.31)	$ (3,014.92)
400GPD:																					
Net Benefit:	$ (10,715)	$ 40.40	$ 66.25	$ 93.82	$ 123.21	$ 154.54	$ 187.95	$ 223.57	$ 261.55	$ 302.04	$ 345.22	$ 391.25	$ 440.34	$ 492.67	$ 548.47	$ 607.96	$ 671.39	$ 739.03	$ 811.14	$ 888.02	$ 970.00
NPV:	($4,305.46)																				
IRR:	-1.7%																				
Payback Period:	$ (10,715)	$(10,674.60)	$(10,608.34)	$(10,514.52)	$(10,391.32)	$(10,236.78)	$(10,048.83)	$ (9,825.26)	$ (9,563.71)	$ (9,261.67)	$ (8,916.45)	$(8,525.20)	$(8,084.86)	$(7,592.20)	$(7,043.73)	$(6,435.77)	$(5,764.37)	$(5,025.35)	$(4,214.21)	$ (3,326.19)	$ (2,356.19)
200GPD:																					
Net Benefit:	$ (10,715)	$ 90.64	$ 119.81	$ 150.92	$ 184.09	$ 219.46	$ 257.17	$ 297.37	$ 340.24	$ 385.94	$ 434.67	$ 486.63	$ 542.03	$ 601.09	$ 664.07	$ 731.22	$ 802.81	$ 879.15	$ 960.54	$ 1,047.32	$ 1,139.84
NPV:	($2,785.86)																				
IRR:	-0.3%																				
Payback Period:	$ (10,715)	$(10,624.36)	$(10,504.55)	$(10,353.63)	$(10,169.53)	$ (9,950.08)	$ (9,692.91)	$ (9,395.54)	$ (9,055.31)	$ (8,669.37)	$ (8,234.70)	$(7,748.07)	$(7,206.04)	$(6,604.94)	$(5,940.87)	$(5,209.65)	$(4,406.84)	$(3,527.69)	$(2,567.15)	$ (1,519.83)	$ (379.99)

Table 30. Jacksonville, FL Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0035	$ 0.0036	$ 0.0038	$ 0.0040	$ 0.0041	$ 0.0043	$ 0.0045	$ 0.0047	$ 0.0049	$ 0.0051	$ 0.0054	$ 0.0056	$ 0.0058	$ 0.0061	$ 0.0064	$ 0.0066	$ 0.0069	$ 0.0072	$ 0.0076	$ 0.0079	$ 0.0082
400 GPD CPG	$ 0.0036	$ 0.0037	$ 0.0039	$ 0.0041	$ 0.0042	$ 0.0044	$ 0.0046	$ 0.0048	$ 0.0050	$ 0.0052	$ 0.0055	$ 0.0057	$ 0.0060	$ 0.0062	$ 0.0065	$ 0.0068	$ 0.0071	$ 0.0074	$ 0.0077	$ 0.0081	$ 0.0084
200 GPD CPG	$ 0.0038	$ 0.0040	$ 0.0041	$ 0.0043	$ 0.0045	$ 0.0047	$ 0.0049	$ 0.0051	$ 0.0054	$ 0.0056	$ 0.0058	$ 0.0061	$ 0.0064	$ 0.0067	$ 0.0069	$ 0.0073	$ 0.0076	$ 0.0079	$ 0.0083	$ 0.0086	$ 0.0090
Benefits:																					
Precip.(in)		52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613	81,613
Benefits(yr):	Capture %:																				
600GPD	37%	$ 296.44	$ 309.50	$ 323.14	$ 337.38	$ 352.24	$ 367.77	$ 383.97	$ 400.89	$ 418.56	$ 437.00	$ 456.26	$ 476.37	$ 497.36	$ 519.27	$ 542.16	$ 566.05	$ 590.99	$ 617.04	$ 644.23	$ 672.62
400GPD	56%	$ 303.25	$ 316.62	$ 330.57	$ 345.13	$ 360.34	$ 376.22	$ 392.80	$ 410.11	$ 428.18	$ 447.05	$ 466.75	$ 487.32	$ 508.80	$ 531.22	$ 554.62	$ 579.07	$ 604.58	$ 631.22	$ 659.04	$ 688.08
200GPD	112%	$ 285.51	$ 298.09	$ 311.23	$ 324.94	$ 339.26	$ 354.21	$ 369.82	$ 386.12	$ 403.13	$ 420.90	$ 439.44	$ 458.81	$ 479.03	$ 500.14	$ 522.18	$ 545.19	$ 569.21	$ 594.29	$ 620.48	$ 647.83
Costs:																					
Above Ground:																					
Tank 12k Gal	$ (7,551)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (13,586)	$ (53.56)	$ (40.50)	$ (26.86)	$ (12.62)	$ 2.24	$ 17.77	$ 33.97	$ 50.89	$ 68.56	$ 87.00	$ 106.26	$ 126.37	$ 147.36	$ 169.27	$ 192.16	$ 216.05	$ 240.99	$ 267.04	$ 294.23	$ 322.62
NPV:	($11,754.17)																				
IRR:	-10.3%																				
Payback Period:	$ (13,586)	$(13,639.56)	$(13,680.07)	$(13,706.93)	$(13,719.55)	$(13,717.31)	$(13,699.54)	$(13,665.57)	$(13,614.68)	$(13,546.12)	$(13,459.12)	$(13,352.86)	$(13,226.49)	$(13,079.13)	$(12,909.86)	$(12,717.70)	$(12,501.65)	$(12,260.66)	$(11,993.62)	$(11,699.40)	$(11,376.78)
400GPD:																					
Net Benefit:	$ (13,586)	$ (46.75)	$ (33.38)	$ (19.43)	$ (4.87)	$ 10.34	$ 26.22	$ 42.80	$ 60.11	$ 78.18	$ 97.05	$ 116.75	$ 137.32	$ 158.80	$ 181.22	$ 204.62	$ 229.07	$ 254.58	$ 281.22	$ 309.04	$ 338.08
NPV:	($11,589.15)																				
IRR:	-10.0%																				
Payback Period:	$ (13,586)	$(13,632.75)	$(13,666.13)	$(13,685.56)	$(13,690.43)	$(13,680.09)	$(13,653.86)	$(13,611.06)	$(13,550.95)	$(13,472.77)	$(13,375.72)	$(13,258.96)	$(13,121.64)	$(12,962.85)	$(12,781.63)	$(12,577.01)	$(12,347.94)	$(12,093.36)	$(11,812.13)	$(11,503.09)	$(11,165.01)
200GPD:																					
Net Benefit:	$ (13,586)	$ (64.49)	$ (51.91)	$ (38.77)	$ (25.06)	$ (10.74)	$ 4.21	$ 19.82	$ 36.12	$ 53.13	$ 70.90	$ 89.44	$ 108.81	$ 129.03	$ 150.14	$ 172.18	$ 195.19	$ 219.21	$ 244.29	$ 270.48	$ 297.83
NPV:	($12,018.66)																				
IRR:	-10.9%																				
Payback Period:	$ (13,586)	$(13,650.49)	$(13,702.40)	$(13,741.17)	$(13,766.23)	$(13,776.97)	$(13,772.76)	$(13,752.94)	$(13,716.82)	$(13,663.69)	$(13,592.79)	$(13,503.35)	$(13,394.54)	$(13,265.51)	$(13,115.37)	$(12,943.20)	$(12,748.01)	$(12,528.80)	$(12,284.51)	$(12,014.02)	$(11,716.20)

Table 31. Las Vegas, NV Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0042	$ 0.0044	$ 0.0047	$ 0.0051	$ 0.0054	$ 0.0058	$ 0.0062	$ 0.0066	$ 0.0070	$ 0.0075	$ 0.0080	$ 0.0086	$ 0.0092	$ 0.0098	$ 0.0105	$ 0.0112	$ 0.0120	$ 0.0128	$ 0.0136	$ 0.0146	$ 0.0156
400 GPD CPG	$ 0.0044	$ 0.0047	$ 0.0050	$ 0.0053	$ 0.0057	$ 0.0061	$ 0.0065	$ 0.0069	$ 0.0074	$ 0.0079	$ 0.0085	$ 0.0090	$ 0.0097	$ 0.0103	$ 0.0110	$ 0.0118	$ 0.0126	$ 0.0134	$ 0.0144	$ 0.0153	$ 0.0164
200 GPD CPG	$ 0.0057	$ 0.0061	$ 0.0066	$ 0.0070	$ 0.0075	$ 0.0080	$ 0.0085	$ 0.0091	$ 0.0097	$ 0.0104	$ 0.0111	$ 0.0119	$ 0.0127	$ 0.0135	$ 0.0145	$ 0.0155	$ 0.0165	$ 0.0176	$ 0.0188	$ 0.0201	$ 0.0215
Benefits:																					
Precip.(in)		4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542
Benefits(yr):	Capture %:																				
600GPD	3%	$ 29.03	$ 31.01	$ 33.13	$ 35.39	$ 37.81	$ 40.39	$ 43.15	$ 46.10	$ 49.24	$ 52.61	$ 56.20	$ 60.03	$ 64.13	$ 68.51	$ 73.19	$ 78.19	$ 83.52	$ 89.23	$ 95.32	$ 101.83
400GPD	4%	$ 30.56	$ 32.64	$ 34.87	$ 37.25	$ 39.80	$ 42.51	$ 45.42	$ 48.52	$ 51.83	$ 55.37	$ 59.15	$ 63.19	$ 67.50	$ 72.11	$ 77.03	$ 82.29	$ 87.91	$ 93.91	$ 100.32	$ 107.17
200GPD	9%	$ 40.11	$ 42.85	$ 45.78	$ 48.90	$ 52.24	$ 55.81	$ 59.62	$ 63.69	$ 68.04	$ 72.68	$ 77.65	$ 82.95	$ 88.61	$ 94.66	$ 101.13	$ 108.03	$ 115.41	$ 123.28	$ 131.70	$ 140.69
Costs:																					
Above Ground:																					
Tank 1.2k Gal	$ (560)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (6,595)	$ (320.97)	$ (318.99)	$ (316.87)	$ (314.61)	$ (312.19)	$ (309.61)	$ (306.85)	$ (303.90)	$ (300.76)	$ (297.39)	$ (293.80)	$ (289.97)	$ (285.87)	$ (281.49)	$ (276.81)	$ (271.81)	$ (266.48)	$ (260.77)	$ (254.68)	$ (248.17)
NPV:	($11,179.39)																				
IRR:	#NUM!																				
Payback Period:	$ (6,595)	$ (6,915.97)	$ (7,234.95)	$ (7,551.82)	$ (7,866.43)	$ (8,178.62)	$ (8,488.22)	$ (8,795.07)	$ (9,098.98)	$ (9,399.73)	$ (9,697.13)	$(9,990.93)	$(10,280.90)	$(10,566.77)	$(10,848.25)	$(11,125.06)	$(11,396.88)	$(11,663.35)	$(11,924.13)	$(12,178.81)	$(12,426.98)
400GPD:																					
Net Benefit:	$ (6,595)	$ (319.44)	$ (317.36)	$ (315.13)	$ (312.75)	$ (310.20)	$ (307.49)	$ (304.58)	$ (301.48)	$ (298.17)	$ (294.63)	$ (290.85)	$ (286.81)	$ (282.50)	$ (277.89)	$ (272.97)	$ (267.71)	$ (262.09)	$ (256.09)	$ (249.68)	$ (242.83)
NPV:	($11,132.30)																				
IRR:	#NUM!																				
Payback Period:	$ (6,595)	$ (6,914.44)	$ (7,231.80)	$ (7,546.93)	$ (7,859.68)	$ (8,169.88)	$ (8,477.37)	$ (8,781.95)	$ (9,083.44)	$ (9,381.61)	$ (9,676.24)	$(9,967.10)	$(10,253.91)	$(10,536.41)	$(10,814.30)	$(11,087.27)	$(11,354.98)	$(11,617.07)	$(11,873.16)	$(12,122.84)	$(12,365.67)
200GPD:																					
Net Benefit:	$ (6,595)	$ (309.89)	$ (307.15)	$ (304.22)	$ (301.10)	$ (297.76)	$ (294.19)	$ (290.38)	$ (286.31)	$ (281.96)	$ (277.32)	$ (272.35)	$ (267.05)	$ (261.39)	$ (255.34)	$ (248.87)	$ (241.97)	$ (234.59)	$ (226.72)	$ (218.30)	$ (209.31)
NPV:	($10,836.98)																				
IRR:	#NUM!																				
Payback Period:	$ (6,595)	$ (6,904.89)	$ (7,212.03)	$ (7,516.26)	$ (7,817.35)	$ (8,115.11)	$ (8,409.30)	$ (8,699.68)	$ (8,985.99)	$ (9,267.95)	$ (9,545.26)	$(9,817.62)	$(10,084.67)	$(10,346.06)	$(10,601.39)	$(10,850.27)	$(11,092.24)	$(11,326.83)	$(11,553.55)	$(11,771.85)	$(11,981.15)

Table 32. Los Angeles, CA Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0100	$ 0.0108	$ 0.0117	$ 0.0127	$ 0.0138	$ 0.0149	$ 0.0161	$ 0.0174	$ 0.0189	$ 0.0204	$ 0.0221	$ 0.0240	$ 0.0259	$ 0.0281	$ 0.0304	$ 0.0329	$ 0.0356	$ 0.0386	$ 0.0418	$ 0.0452	$ 0.0489
400 GPD CPG	$ 0.0090	$ 0.0098	$ 0.0106	$ 0.0114	$ 0.0124	$ 0.0134	$ 0.0145	$ 0.0157	$ 0.0170	$ 0.0184	$ 0.0199	$ 0.0216	$ 0.0233	$ 0.0253	$ 0.0274	$ 0.0296	$ 0.0321	$ 0.0347	$ 0.0376	$ 0.0407	$ 0.0440
200 GPD CPG	$ 0.0078	$ 0.0085	$ 0.0091	$ 0.0099	$ 0.0107	$ 0.0116	$ 0.0126	$ 0.0136	$ 0.0147	$ 0.0159	$ 0.0173	$ 0.0187	$ 0.0202	$ 0.0219	$ 0.0237	$ 0.0257	$ 0.0278	$ 0.0301	$ 0.0326	$ 0.0352	$ 0.0382
Benefits:																					
Precip.(in)		12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936
Benefits(yr):	Capture %:																				
600GPD	9%	$ 216.07	$ 233.91	$ 253.22	$ 274.13	$ 296.76	$ 321.26	$ 347.79	$ 376.50	$ 407.59	$ 441.24	$ 477.68	$ 517.12	$ 559.81	$ 606.03	$ 656.07	$ 710.24	$ 768.88	$ 832.36	$ 901.09	$ 975.48
400GPD	14%	$ 194.40	$ 210.45	$ 227.82	$ 246.63	$ 267.00	$ 289.04	$ 312.91	$ 338.74	$ 366.71	$ 396.99	$ 429.77	$ 465.25	$ 503.66	$ 545.25	$ 590.27	$ 639.00	$ 691.76	$ 748.88	$ 810.71	$ 877.65
200GPD	27%	$ 168.48	$ 182.39	$ 197.45	$ 213.75	$ 231.40	$ 250.51	$ 271.19	$ 293.58	$ 317.82	$ 344.06	$ 372.47	$ 403.23	$ 436.52	$ 472.56	$ 511.58	$ 553.82	$ 599.54	$ 649.04	$ 702.63	$ 760.64
Costs:																					
Above Ground:																					
Tank 8k Gal	$ (4,680)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,715)	$ (133.93)	$ (116.09)	$ (96.78)	$ (75.87)	$ (53.24)	$ (28.74)	$ (2.21)	$ 26.50	$ 57.59	$ 91.24	$ 127.68	$ 167.12	$ 209.81	$ 256.03	$ 306.07	$ 360.24	$ 418.88	$ 482.36	$ 551.09	$ 625.48
NPV:	($8,365.27)																				
IRR:	-6.5%																				
Payback Period:	$ (10,715)	$(10,848.93)	$(10,965.02)	$(11,061.80)	$(11,137.67)	$(11,190.91)	$(11,219.65)	$(11,221.86)	$(11,195.35)	$(11,137.76)	$(11,046.52)	$(10,918.84)	$(10,751.73)	$(10,541.92)	$(10,285.88)	$ (9,979.82)	$ (9,619.58)	$ (9,200.70)	$ (8,718.34)	$ (8,167.25)	$(7,541.77)
400GPD:																					
Net Benefit:	$ (10,715)	$ (155.60)	$ (139.55)	$ (122.18)	$ (103.37)	$ (83.00)	$ (60.96)	$ (37.09)	$ (11.26)	$ 16.71	$ 46.99	$ 79.77	$ 115.25	$ 153.66	$ 195.25	$ 240.27	$ 289.00	$ 341.76	$ 398.88	$ 460.71	$ 527.65
NPV:	($9,142.60)																				
IRR:	-7.9%																				
Payback Period:	$ (10,715)	$(10,870.60)	$(11,010.15)	$(11,132.33)	$(11,235.70)	$(11,318.70)	$(11,379.65)	$(11,416.75)	$(11,428.00)	$(11,411.29)	$(11,364.30)	$(11,284.54)	$(11,169.28)	$(11,015.62)	$(10,820.37)	$(10,580.10)	$(10,291.10)	$ (9,949.33)	$ (9,550.46)	$ (9,089.74)	$(8,562.10)
200GPD:																					
Net Benefit:	$ (10,715)	$ (181.52)	$ (167.61)	$ (152.55)	$ (136.25)	$ (118.60)	$ (99.49)	$ (78.81)	$ (56.42)	$ (32.18)	$ (5.94)	$ 22.47	$ 53.23	$ 86.52	$ 122.56	$ 161.58	$ 203.82	$ 249.54	$ 299.04	$ 352.63	$ 410.64
NPV:	($10,072.22)																				
IRR:	-9.9%																				
Payback Period:	$ (10,715)	$(10,896.52)	$(11,064.13)	$(11,216.67)	$(11,352.92)	$(11,471.52)	$(11,571.01)	$(11,649.81)	$(11,706.23)	$(11,738.41)	$(11,744.34)	$(11,721.87)	$(11,668.65)	$(11,582.13)	$(11,459.57)	$(11,297.99)	$(11,094.18)	$(10,844.63)	$(10,545.59)	$(10,192.96)	$(9,782.32)

Table 33. Memphis, TN Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0024	$ 0.0026	$ 0.0027	$ 0.0028	$ 0.0029	$ 0.0031	$ 0.0032	$ 0.0034	$ 0.0035	$ 0.0037	$ 0.0038	$ 0.0040	$ 0.0042	$ 0.0044	$ 0.0046	$ 0.0048	$ 0.0051	$ 0.0053	$ 0.0055	$ 0.0058	$ 0.0061
400 GPD CPG	$ 0.0024	$ 0.0026	$ 0.0027	$ 0.0028	$ 0.0029	$ 0.0031	$ 0.0032	$ 0.0034	$ 0.0035	$ 0.0037	$ 0.0038	$ 0.0040	$ 0.0042	$ 0.0044	$ 0.0046	$ 0.0048	$ 0.0051	$ 0.0053	$ 0.0055	$ 0.0058	$ 0.0061
200 GPD CPG	$ 0.0024	$ 0.0026	$ 0.0027	$ 0.0028	$ 0.0029	$ 0.0031	$ 0.0032	$ 0.0034	$ 0.0035	$ 0.0037	$ 0.0038	$ 0.0040	$ 0.0042	$ 0.0044	$ 0.0046	$ 0.0048	$ 0.0051	$ 0.0053	$ 0.0055	$ 0.0058	$ 0.0061
Benefits:																					
Precip.(in)		53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7	53.7
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638	83,638
Benefits(yr):	Capture %:																				
600GPD	38%	$ 213.54	$ 223.50	$ 233.91	$ 244.82	$ 256.23	$ 268.17	$ 280.68	$ 293.76	$ 307.45	$ 321.79	$ 336.79	$ 352.48	$ 368.92	$ 386.11	$ 404.11	$ 422.95	$ 442.67	$ 463.30	$ 484.90	$ 507.50
400GPD	57%	$ 213.54	$ 223.50	$ 233.91	$ 244.82	$ 256.23	$ 268.17	$ 280.68	$ 293.76	$ 307.45	$ 321.79	$ 336.79	$ 352.48	$ 368.92	$ 386.11	$ 404.11	$ 422.95	$ 442.67	$ 463.30	$ 484.90	$ 507.50
200GPD	115%	$ 182.42	$ 190.93	$ 199.83	$ 209.14	$ 218.89	$ 229.10	$ 239.77	$ 250.95	$ 262.65	$ 274.89	$ 287.71	$ 301.12	$ 315.16	$ 329.85	$ 345.22	$ 361.32	$ 378.16	$ 395.79	$ 414.24	$ 433.55
Costs:																					
Above Ground:																					
Tank 10k Gal	$ (5,825)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (11,860)	$ (136.46)	$ (126.50)	$ (116.09)	$ (105.18)	$ (93.77)	$ (81.83)	$ (69.32)	$ (56.24)	$ (42.55)	$ (28.21)	$ (13.21)	$ 2.48	$ 18.92	$ 36.11	$ 54.11	$ 72.95	$ 92.67	$ 113.30	$ 134.90	$ 157.50
NPV:	($11,937.12)																				
IRR:	-15.4%																				
Payback Period:	$ (11,860)	$(11,996.46)	$(12,122.96)	$(12,239.05)	$(12,344.23)	$(12,438.00)	$(12,519.83)	$(12,589.15)	$(12,645.39)	$(12,687.94)	$(12,716.15)	$(12,729.37)	$(12,726.88)	$(12,707.97)	$(12,671.86)	$(12,617.74)	$(12,544.79)	$(12,452.13)	$(12,338.83)	$(12,203.93)	$(12,046.43)
400GPD:																					
Net Benefit:	$ (11,860)	$ (136.46)	$ (126.50)	$ (116.09)	$ (105.18)	$ (93.77)	$ (81.83)	$ (69.32)	$ (56.24)	$ (42.55)	$ (28.21)	$ (13.21)	$ 2.48	$ 18.92	$ 36.11	$ 54.11	$ 72.95	$ 92.67	$ 113.30	$ 134.90	$ 157.50
NPV:	($11,937.12)																				
IRR:	-15.4%																				
Payback Period:	$ (11,860)	$(11,996.46)	$(12,122.96)	$(12,239.05)	$(12,344.23)	$(12,438.00)	$(12,519.83)	$(12,589.15)	$(12,645.39)	$(12,687.94)	$(12,716.15)	$(12,729.37)	$(12,726.88)	$(12,707.97)	$(12,671.86)	$(12,617.74)	$(12,544.79)	$(12,452.13)	$(12,338.83)	$(12,203.93)	$(12,046.43)
200GPD:																					
Net Benefit:	$ (11,860)	$ (167.58)	$ (159.07)	$ (150.17)	$ (140.86)	$ (131.11)	$ (120.90)	$ (110.23)	$ (99.05)	$ (87.35)	$ (75.11)	$ (62.29)	$ (48.88)	$ (34.84)	$ (20.15)	$ (4.78)	$ 11.32	$ 28.16	$ 45.79	$ 64.24	$ 83.55
NPV:	($12,709.61)																				
IRR:	#NUM!																				
Payback Period:	$ (11,860)	$(12,027.58)	$(12,186.65)	$(12,336.82)	$(12,477.68)	$(12,608.79)	$(12,729.69)	$(12,839.92)	$(12,938.97)	$(13,026.32)	$(13,101.42)	$(13,163.71)	$(13,212.59)	$(13,247.44)	$(13,267.59)	$(13,272.37)	$(13,261.05)	$(13,232.89)	$(13,187.10)	$(13,122.87)	$(13,039.32)

Table 34. Milwaukee, WI Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0032	$ 0.0034	$ 0.0036	$ 0.0039	$ 0.0041	$ 0.0044	$ 0.0046	$ 0.0049	$ 0.0052	$ 0.0056	$ 0.0059	$ 0.0063	$ 0.0067	$ 0.0071	$ 0.0075	$ 0.0080	$ 0.0085	$ 0.0090	$ 0.0096	$ 0.0102	$ 0.0108
400 GPD CPG	$ 0.0035	$ 0.0037	$ 0.0039	$ 0.0042	$ 0.0044	$ 0.0047	$ 0.0050	$ 0.0053	$ 0.0056	$ 0.0060	$ 0.0064	$ 0.0068	$ 0.0072	$ 0.0076	$ 0.0081	$ 0.0086	$ 0.0092	$ 0.0097	$ 0.0103	$ 0.0110	$ 0.0117
200 GPD CPG	$ 0.0042	$ 0.0045	$ 0.0048	$ 0.0051	$ 0.0054	$ 0.0057	$ 0.0061	$ 0.0065	$ 0.0069	$ 0.0073	$ 0.0077	$ 0.0082	$ 0.0087	$ 0.0093	$ 0.0098	$ 0.0105	$ 0.0111	$ 0.0118	$ 0.0125	$ 0.0133	$ 0.0142
Benefits:																					
Precip.(in)		34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201	54,201
Benefits(yr):	Capture %:																				
600GPD	25%	$ 186.11	$ 197.70	$ 210.02	$ 223.10	$ 237.00	$ 251.76	$ 267.44	$ 284.10	$ 301.80	$ 320.60	$ 340.57	$ 361.78	$ 384.32	$ 408.26	$ 433.69	$ 460.71	$ 489.40	$ 519.89	$ 552.28	$ 586.68
400GPD	37%	$ 200.42	$ 212.90	$ 226.16	$ 240.25	$ 255.22	$ 271.11	$ 288.00	$ 305.94	$ 325.00	$ 345.25	$ 366.75	$ 389.60	$ 413.87	$ 439.65	$ 467.03	$ 496.12	$ 527.03	$ 559.86	$ 594.73	$ 631.78
200GPD	74%	$ 243.34	$ 258.50	$ 274.60	$ 291.70	$ 309.88	$ 329.18	$ 349.68	$ 371.47	$ 394.60	$ 419.19	$ 445.30	$ 473.04	$ 502.50	$ 533.80	$ 567.06	$ 602.38	$ 639.90	$ 679.76	$ 722.11	$ 767.09
Costs:																					
Above Ground:																					
Tank 6k Gal	$ (3,600)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (9,635)	$ (163.89)	$ (152.30)	$ (139.98)	$ (126.90)	$ (113.00)	$ (98.24)	$ (82.56)	$ (65.90)	$ (48.20)	$ (29.40)	$ (9.43)	$ 11.78	$ 34.32	$ 58.26	$ 83.69	$ 110.71	$ 139.40	$ 169.89	$ 202.28	$ 236.68
NPV:	($9,648.54)																				
IRR:	-12.6%																				
Payback Period:	$ (9,635)	$ (9,798.89)	$ (9,951.19)	$(10,091.17)	$(10,218.07)	$(10,331.08)	$(10,429.32)	$(10,511.88)	$(10,577.77)	$(10,625.97)	$(10,655.38)	$(10,664.81)	$(10,653.02)	$(10,618.70)	$(10,560.44)	$(10,476.75)	$(10,366.05)	$(10,226.64)	$(10,056.75)	$ (9,854.48)	$ (9,617.80)
400GPD:																					
Net Benefit:	$ (9,635)	$ (149.58)	$ (137.10)	$ (123.84)	$ (109.75)	$ (94.78)	$ (78.89)	$ (62.00)	$ (44.06)	$ (25.00)	$ (4.75)	$ 16.75	$ 39.60	$ 63.87	$ 89.65	$ 117.03	$ 146.12	$ 177.03	$ 209.86	$ 244.73	$ 281.78
NPV:	($9,232.76)																				
IRR:	-11.1%																				
Payback Period:	$ (9,635)	$ (9,784.58)	$ (9,921.68)	$(10,045.52)	$(10,155.27)	$(10,250.05)	$(10,328.94)	$(10,390.94)	$(10,434.99)	$(10,459.99)	$(10,464.75)	$(10,448.00)	$(10,408.40)	$(10,344.54)	$(10,254.89)	$(10,137.86)	$ (9,991.73)	$ (9,814.71)	$ (9,604.85)	$ (9,360.11)	$ (9,078.33)
200GPD:																					
Net Benefit:	$ (9,635)	$ (106.66)	$ (91.50)	$ (75.40)	$ (58.30)	$ (40.12)	$ (20.82)	$ (0.32)	$ 21.47	$ 44.60	$ 69.19	$ 95.30	$ 123.04	$ 152.50	$ 183.80	$ 217.06	$ 252.38	$ 289.90	$ 329.76	$ 372.11	$ 417.09
NPV:	($7,985.43)																				
IRR:	-7.9%																				
Payback Period:	$ (9,635)	$ (9,741.66)	$ (9,833.16)	$ (9,908.56)	$ (9,966.86)	$(10,006.99)	$(10,027.81)	$(10,028.12)	$(10,006.66)	$ (9,962.05)	$ (9,892.87)	$ (9,797.57)	$ (9,674.54)	$ (9,522.03)	$ (9,338.23)	$ (9,121.17)	$ (8,868.80)	$ (8,578.90)	$ (8,249.13)	$ (7,877.03)	$ (7,459.94)

Table 35. New York, NY Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0050	$ 0.0053	$ 0.0055	$ 0.0058	$ 0.0061	$ 0.0064	$ 0.0067	$ 0.0070	$ 0.0074	$ 0.0077	$ 0.0081	$ 0.0085	$ 0.0089	$ 0.0094	$ 0.0098	$ 0.0103	$ 0.0108	$ 0.0113	$ 0.0119	$ 0.0125	$ 0.0131
400 GPD CPG	$ 0.0050	$ 0.0053	$ 0.0055	$ 0.0058	$ 0.0061	$ 0.0064	$ 0.0067	$ 0.0070	$ 0.0074	$ 0.0077	$ 0.0081	$ 0.0085	$ 0.0089	$ 0.0094	$ 0.0098	$ 0.0103	$ 0.0108	$ 0.0113	$ 0.0119	$ 0.0125	$ 0.0131
200 GPD CPG	$ 0.0050	$ 0.0053	$ 0.0055	$ 0.0058	$ 0.0061	$ 0.0064	$ 0.0067	$ 0.0070	$ 0.0074	$ 0.0077	$ 0.0081	$ 0.0085	$ 0.0089	$ 0.0094	$ 0.0098	$ 0.0103	$ 0.0108	$ 0.0113	$ 0.0119	$ 0.0125	$ 0.0131
Benefits:																					
Precip.(in)		49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9	49.9
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719	77,719
Benefits(yr):	Capture %:																				
600GPD	35%	$ 408.57	$ 428.67	$ 449.77	$ 471.90	$ 495.12	$ 519.48	$ 545.04	$ 571.87	$ 600.01	$ 629.53	$ 660.51	$ 693.01	$ 727.11	$ 762.89	$ 800.43	$ 839.82	$ 881.14	$ 924.50	$ 970.00	$ 1,017.73
400GPD	53%	$ 408.57	$ 428.67	$ 449.77	$ 471.90	$ 495.12	$ 519.48	$ 545.04	$ 571.87	$ 600.01	$ 629.53	$ 660.51	$ 693.01	$ 727.11	$ 762.89	$ 800.43	$ 839.82	$ 881.14	$ 924.50	$ 970.00	$ 1,017.73
200GPD	106%	$ 382.15	$ 400.96	$ 420.69	$ 441.39	$ 463.11	$ 485.90	$ 509.81	$ 534.90	$ 561.22	$ 588.83	$ 617.81	$ 648.21	$ 680.11	$ 713.57	$ 748.69	$ 785.53	$ 824.18	$ 864.74	$ 907.29	$ 951.93
Costs:																					
Above Ground:																					
Tank 7k Gal	$ (4,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,335)	$ 58.57	$ 78.67	$ 99.77	$ 121.90	$ 145.12	$ 169.48	$ 195.04	$ 221.87	$ 250.01	$ 279.53	$ 310.51	$ 343.01	$ 377.11	$ 412.89	$ 450.43	$ 489.82	$ 531.14	$ 574.50	$ 620.00	$ 667.73
NPV:	($5,336.38)																				
IRR:	-3.3%																				
Payback Period:	$ (10,335)	$(10,276.43)	$(10,197.76)	$(10,098.00)	$ (9,976.10)	$ (9,830.98)	$ (9,661.50)	$ (9,466.45)	$ (9,244.59)	$ (8,994.58)	$ (8,715.05)	$(8,404.54)	$(8,061.53)	$(7,684.42)	$(7,271.53)	$(6,821.10)	$(6,331.28)	$(5,800.13)	$(5,225.63)	$ (4,605.63)	$ (3,937.90)
400GPD:																					
Net Benefit:	$ (10,335)	$ 58.57	$ 78.67	$ 99.77	$ 121.90	$ 145.12	$ 169.48	$ 195.04	$ 221.87	$ 250.01	$ 279.53	$ 310.51	$ 343.01	$ 377.11	$ 412.89	$ 450.43	$ 489.82	$ 531.14	$ 574.50	$ 620.00	$ 667.73
NPV:	($5,336.38)																				
IRR:	-3.3%																				
Payback Period:	$ (10,335)	$(10,276.43)	$(10,197.76)	$(10,098.00)	$ (9,976.10)	$ (9,830.98)	$ (9,661.50)	$ (9,466.45)	$ (9,244.59)	$ (8,994.58)	$ (8,715.05)	$(8,404.54)	$(8,061.53)	$(7,684.42)	$(7,271.53)	$(6,821.10)	$(6,331.28)	$(5,800.13)	$(5,225.63)	$ (4,605.63)	$ (3,937.90)
200GPD:																					
Net Benefit:	$ (10,335)	$ 32.15	$ 50.96	$ 70.69	$ 91.39	$ 113.11	$ 135.90	$ 159.81	$ 184.90	$ 211.22	$ 238.83	$ 267.81	$ 298.21	$ 330.11	$ 363.57	$ 398.69	$ 435.53	$ 474.18	$ 514.74	$ 557.29	$ 601.93
NPV:	($6,009.15)																				
IRR:	-4.2%																				
Payback Period:	$ (10,335)	$(10,302.85)	$(10,251.89)	$(10,181.20)	$(10,089.81)	$ (9,976.70)	$ (9,840.80)	$ (9,680.99)	$ (9,496.09)	$ (9,284.87)	$ (9,046.04)	$(8,778.23)	$(8,480.02)	$(8,149.92)	$(7,786.34)	$(7,387.66)	$(6,952.13)	$(6,477.95)	$(5,963.21)	$ (5,405.92)	$ (4,803.99)

Table 36. Philadelphia, PA Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0059	$ 0.0062	$ 0.0066	$ 0.0069	$ 0.0073	$ 0.0077	$ 0.0082	$ 0.0086	$ 0.0091	$ 0.0096	$ 0.0101	$ 0.0107	$ 0.0113	$ 0.0119	$ 0.0126	$ 0.0133	$ 0.0140	$ 0.0148	$ 0.0156	$ 0.0165	$ 0.0174
400 GPD CPG	$ 0.0062	$ 0.0066	$ 0.0069	$ 0.0073	$ 0.0077	$ 0.0081	$ 0.0086	$ 0.0091	$ 0.0096	$ 0.0101	$ 0.0107	$ 0.0113	$ 0.0119	$ 0.0125	$ 0.0132	$ 0.0140	$ 0.0147	$ 0.0156	$ 0.0164	$ 0.0173	$ 0.0183
200 GPD CPG	$ 0.0068	$ 0.0071	$ 0.0075	$ 0.0079	$ 0.0084	$ 0.0088	$ 0.0093	$ 0.0099	$ 0.0104	$ 0.0110	$ 0.0116	$ 0.0122	$ 0.0129	$ 0.0136	$ 0.0144	$ 0.0152	$ 0.0160	$ 0.0169	$ 0.0179	$ 0.0189	$ 0.0199
Benefits:																					
Precip.(in)		41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636	64,636
Benefits(yr):	Capture %:																				
600GPD	30%	$ 403.15	$ 425.54	$ 449.18	$ 474.13	$ 500.46	$ 528.26	$ 557.60	$ 588.57	$ 621.26	$ 655.76	$ 692.18	$ 730.63	$ 771.21	$ 814.04	$ 859.26	$ 906.98	$ 957.36	$ 1,010.53	$ 1,066.65	$ 1,125.90
400GPD	44%	$ 423.60	$ 447.13	$ 471.96	$ 498.18	$ 525.85	$ 555.05	$ 585.88	$ 618.42	$ 652.77	$ 689.02	$ 727.29	$ 767.69	$ 810.33	$ 855.33	$ 902.84	$ 952.99	$ 1,005.92	$ 1,061.79	$ 1,120.76	$ 1,183.01
200GPD	89%	$ 460.61	$ 486.19	$ 513.20	$ 541.70	$ 571.79	$ 603.55	$ 637.07	$ 672.45	$ 709.80	$ 749.22	$ 790.84	$ 834.76	$ 881.13	$ 930.07	$ 981.72	$ 1,036.25	$ 1,093.80	$ 1,154.55	$ 1,218.68	$ 1,286.37
Costs:																					
Above Ground:																					
Tank 7k Gal	$ (4,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,335)	$ 53.15	$ 75.54	$ 99.18	$ 124.13	$ 150.46	$ 178.26	$ 207.60	$ 238.57	$ 271.26	$ 305.76	$ 342.18	$ 380.63	$ 421.21	$ 464.04	$ 509.26	$ 556.98	$ 607.36	$ 660.53	$ 716.65	$ 775.90
NPV:	($4,802.34)																				
IRR:	-2.6%																				
Payback Period:	$ (10,335)	$(10,281.85)	$(10,206.31)	$(10,107.13)	$ (9,983.00)	$ (9,832.54)	$ (9,654.28)	$ (9,446.69)	$ (9,208.12)	$ (8,936.86)	$ (8,631.10)	$(8,288.92)	$(7,908.29)	$(7,487.08)	$(7,023.04)	$(6,513.78)	$(5,956.80)	$(5,349.44)	$(4,688.92)	$ (3,972.26)	$ (3,196.36)
400GPD:																					
Net Benefit:	$ (10,335)	$ 73.60	$ 97.13	$ 121.96	$ 148.18	$ 175.85	$ 205.05	$ 235.88	$ 268.42	$ 302.77	$ 339.02	$ 377.29	$ 417.69	$ 460.33	$ 505.33	$ 552.84	$ 602.99	$ 655.92	$ 711.79	$ 770.76	$ 833.01
NPV:	($4,247.38)																				
IRR:	-1.9%																				
Payback Period:	$ (10,335)	$(10,261.40)	$(10,164.27)	$(10,042.31)	$ (9,894.13)	$ (9,718.29)	$ (9,513.24)	$ (9,277.36)	$ (9,008.94)	$ (8,706.17)	$ (8,367.14)	$(7,989.85)	$(7,572.16)	$(7,111.83)	$(6,606.50)	$(6,053.66)	$(5,450.67)	$(4,794.76)	$(4,082.97)	$ (3,312.21)	$ (2,479.21)
200GPD:																					
Net Benefit:	$ (10,335)	$ 110.61	$ 136.19	$ 163.20	$ 191.70	$ 221.79	$ 253.55	$ 287.07	$ 322.45	$ 359.80	$ 399.22	$ 440.84	$ 484.76	$ 531.13	$ 580.07	$ 631.72	$ 686.25	$ 743.80	$ 804.55	$ 868.68	$ 936.37
NPV:	($3,242.99)																				
IRR:	-0.9%																				
Payback Period:	$ (10,335)	$(10,224.39)	$(10,088.19)	$ (9,925.00)	$ (9,733.29)	$ (9,511.51)	$ (9,257.96)	$ (8,970.89)	$ (8,648.44)	$ (8,288.64)	$ (7,889.41)	$(7,448.57)	$(6,963.81)	$(6,432.68)	$(5,852.62)	$(5,220.90)	$(4,534.65)	$(3,790.84)	$(2,986.29)	$ (2,117.61)	$ (1,181.24)

Table 37. Phoenix, AZ Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0039	$ 0.0040	$ 0.0041	$ 0.0042	$ 0.0042	$ 0.0043	$ 0.0044	$ 0.0045	$ 0.0046	$ 0.0047	$ 0.0047	$ 0.0048	$ 0.0049	$ 0.0050	$ 0.0051	$ 0.0052	$ 0.0053	$ 0.0054	$ 0.0055	$ 0.0056	$ 0.0057
400 GPD CPG	$ 0.0033	$ 0.0034	$ 0.0035	$ 0.0035	$ 0.0036	$ 0.0037	$ 0.0037	$ 0.0038	$ 0.0039	$ 0.0040	$ 0.0040	$ 0.0041	$ 0.0042	$ 0.0043	$ 0.0043	$ 0.0044	$ 0.0045	$ 0.0046	$ 0.0047	$ 0.0048	$ 0.0049
200 GPD CPG	$ 0.0020	$ 0.0020	$ 0.0021	$ 0.0021	$ 0.0022	$ 0.0022	$ 0.0023	$ 0.0023	$ 0.0023	$ 0.0024	$ 0.0024	$ 0.0025	$ 0.0025	$ 0.0026	$ 0.0026	$ 0.0027	$ 0.0027	$ 0.0028	$ 0.0028	$ 0.0029	$ 0.0029
Benefits:																					
Precip.(in)		8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507
Benefits(yr):	Capture %:																				
600GPD	6%	$ 50.00	$ 50.96	$ 51.94	$ 52.93	$ 53.95	$ 54.99	$ 56.04	$ 57.12	$ 58.22	$ 59.33	$ 60.47	$ 61.63	$ 62.82	$ 64.02	$ 65.25	$ 66.51	$ 67.79	$ 69.09	$ 70.41	$ 71.77
400GPD	9%	$ 42.47	$ 43.29	$ 44.12	$ 44.97	$ 45.83	$ 46.71	$ 47.61	$ 48.52	$ 49.46	$ 50.41	$ 51.37	$ 52.36	$ 53.37	$ 54.39	$ 55.44	$ 56.50	$ 57.59	$ 58.69	$ 59.82	$ 60.97
200GPD	17%	$ 25.61	$ 26.10	$ 26.60	$ 27.11	$ 27.63	$ 28.16	$ 28.70	$ 29.25	$ 29.82	$ 30.39	$ 30.97	$ 31.57	$ 32.17	$ 32.79	$ 33.42	$ 34.06	$ 34.72	$ 35.38	$ 36.06	$ 36.76
Costs:																					
Above Ground:																					
Tank 1.6k Gal	$ (670)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (6,705)	$ (300.00)	$ (299.04)	$ (298.06)	$ (297.07)	$ (296.05)	$ (295.01)	$ (293.96)	$ (292.88)	$ (291.78)	$ (290.67)	$ (289.53)	$ (288.37)	$ (287.18)	$ (285.98)	$ (284.75)	$ (283.49)	$ (282.21)	$ (280.91)	$ (279.59)	$ (278.23)
NPV:	($11,230.28)																				
IRR:	#NUM!																				
Payback Period:	$ (6,705)	$ (7,005.00)	$ (7,304.05)	$ (7,602.11)	$ (7,899.18)	$ (8,195.23)	$ (8,490.25)	$ (8,784.20)	$ (9,077.09)	$ (9,368.87)	$ (9,659.54)	$ (9,949.06)	$(10,237.43)	$(10,524.61)	$(10,810.59)	$(11,095.33)	$(11,378.82)	$(11,661.04)	$(11,941.95)	$(12,221.54)	$(12,499.77)
400GPD:																					
Net Benefit:	$ (6,705)	$ (307.53)	$ (306.71)	$ (305.88)	$ (305.03)	$ (304.17)	$ (303.29)	$ (302.39)	$ (301.48)	$ (300.54)	$ (299.59)	$ (298.63)	$ (297.64)	$ (296.63)	$ (295.61)	$ (294.56)	$ (293.50)	$ (292.41)	$ (291.31)	$ (290.18)	$ (289.03)
NPV:	($11,373.83)																				
IRR:	#NUM!																				
Payback Period:	$ (6,705)	$ (7,012.53)	$ (7,319.24)	$ (7,625.12)	$ (7,930.15)	$ (8,234.32)	$ (8,537.60)	$ (8,839.99)	$ (9,141.47)	$ (9,442.01)	$ (9,741.61)	$(10,040.23)	$(10,337.87)	$(10,634.51)	$(10,930.11)	$(11,224.68)	$(11,518.18)	$(11,810.59)	$(12,101.90)	$(12,392.08)	$(12,681.11)
200GPD:																					
Net Benefit:	$ (6,705)	$ (324.39)	$ (323.90)	$ (323.40)	$ (322.89)	$ (322.37)	$ (321.84)	$ (321.30)	$ (320.75)	$ (320.18)	$ (319.61)	$ (319.03)	$ (318.43)	$ (317.83)	$ (317.21)	$ (316.58)	$ (315.94)	$ (315.28)	$ (314.62)	$ (313.94)	$ (313.24)
NPV:	($11,695.70)																				
IRR:	#NUM!																				
Payback Period:	$ (6,705)	$ (7,029.39)	$ (7,353.30)	$ (7,676.70)	$ (7,999.59)	$ (8,321.96)	$ (8,643.80)	$ (8,965.10)	$ (9,285.84)	$ (9,606.03)	$ (9,925.64)	$(10,244.67)	$(10,563.10)	$(10,880.93)	$(11,198.14)	$(11,514.72)	$(11,830.65)	$(12,145.94)	$(12,460.55)	$(12,774.49)	$(13,087.74)

Table 38. Salt Lake City, UTAH Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0024	$ 0.0025	$ 0.0027	$ 0.0028	$ 0.0029	$ 0.0030	$ 0.0031	$ 0.0032	$ 0.0034	$ 0.0035	$ 0.0037	$ 0.0038	$ 0.0040	$ 0.0041	$ 0.0043	$ 0.0045	$ 0.0047	$ 0.0048	$ 0.0050	$ 0.0053	$ 0.0055
400 GPD CPG	$ 0.0026	$ 0.0027	$ 0.0028	$ 0.0030	$ 0.0031	$ 0.0032	$ 0.0033	$ 0.0035	$ 0.0036	$ 0.0038	$ 0.0039	$ 0.0041	$ 0.0043	$ 0.0044	$ 0.0046	$ 0.0048	$ 0.0050	$ 0.0052	$ 0.0054	$ 0.0057	$ 0.0059
200 GPD CPG	$ 0.0033	$ 0.0034	$ 0.0035	$ 0.0037	$ 0.0038	$ 0.0040	$ 0.0042	$ 0.0043	$ 0.0045	$ 0.0047	$ 0.0049	$ 0.0051	$ 0.0053	$ 0.0055	$ 0.0058	$ 0.0060	$ 0.0062	$ 0.0065	$ 0.0068	$ 0.0070	$ 0.0073
Benefits:																					
Precip.(in)		16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076
Benefits(yr):	Capture %:																				
600GPD	11%	$ 63.84	$ 66.46	$ 69.19	$ 72.04	$ 75.00	$ 78.08	$ 81.28	$ 84.62	$ 88.10	$ 91.72	$ 95.49	$ 99.41	$ 103.49	$ 107.75	$ 112.17	$ 116.78	$ 121.58	$ 126.57	$ 131.77	$ 137.19
400GPD	17%	$ 68.64	$ 71.46	$ 74.40	$ 77.45	$ 80.63	$ 83.95	$ 87.40	$ 90.99	$ 94.72	$ 98.61	$ 102.67	$ 106.88	$ 111.27	$ 115.85	$ 120.60	$ 125.56	$ 130.72	$ 136.09	$ 141.68	$ 147.50
200GPD	34%	$ 85.44	$ 88.95	$ 92.61	$ 96.41	$ 100.37	$ 104.49	$ 108.79	$ 113.26	$ 117.91	$ 122.75	$ 127.79	$ 133.04	$ 138.51	$ 144.20	$ 150.12	$ 156.29	$ 162.71	$ 169.40	$ 176.36	$ 183.60
Costs:																					
Above Ground:																					
Tank 4.1k Gal	$ (2,289)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (8,324)	$ (286.16)	$ (283.54)	$ (280.81)	$ (277.96)	$ (275.00)	$ (271.92)	$ (268.72)	$ (265.38)	$ (261.90)	$ (258.28)	$ (254.51)	$ (250.59)	$ (246.51)	$ (242.25)	$ (237.83)	$ (233.22)	$ (228.42)	$ (223.43)	$ (218.23)	$ (212.81)
NPV:	($12,270.67)																				
IRR:	#NUM!																				
Payback Period:	$ (8,324)	$ (8,610.16)	$ (8,893.69)	$ (9,174.50)	$ (9,452.46)	$ (9,727.47)	$ (9,999.39)	$(10,268.10)	$(10,533.48)	$(10,795.38)	$(11,053.66)	$(11,308.17)	$(11,558.76)	$(11,805.27)	$(12,047.52)	$(12,285.35)	$(12,518.57)	$(12,746.99)	$(12,970.42)	$(13,188.65)	$(13,401.46)
400GPD:																					
Net Benefit:	$ (8,324)	$ (281.36)	$ (278.54)	$ (275.60)	$ (272.55)	$ (269.37)	$ (266.05)	$ (262.60)	$ (259.01)	$ (255.28)	$ (251.39)	$ (247.33)	$ (243.12)	$ (238.73)	$ (234.15)	$ (229.40)	$ (224.44)	$ (219.28)	$ (213.91)	$ (208.32)	$ (202.50)
NPV:	($12,157.85)																				
IRR:	#NUM!																				
Payback Period:	$ (8,324)	$ (8,605.36)	$ (8,883.90)	$ (9,159.50)	$ (9,432.05)	$ (9,701.42)	$ (9,967.47)	$(10,230.07)	$(10,489.09)	$(10,744.37)	$(10,995.75)	$(11,243.08)	$(11,486.20)	$(11,724.93)	$(11,959.08)	$(12,188.48)	$(12,412.92)	$(12,632.20)	$(12,846.11)	$(13,054.43)	$(13,256.94)
200GPD:																					
Net Benefit:	$ (8,324)	$ (264.56)	$ (261.05)	$ (257.39)	$ (253.59)	$ (249.63)	$ (245.51)	$ (241.21)	$ (236.74)	$ (232.09)	$ (227.25)	$ (222.21)	$ (216.96)	$ (211.49)	$ (205.80)	$ (199.88)	$ (193.71)	$ (187.29)	$ (180.60)	$ (173.64)	$ (166.40)
NPV:	($11,762.86)																				
IRR:	#NUM!																				
Payback Period:	$ (8,324)	$ (8,588.56)	$ (8,849.61)	$ (9,107.00)	$ (9,360.59)	$ (9,610.22)	$ (9,855.73)	$(10,096.94)	$(10,333.69)	$(10,565.78)	$(10,793.02)	$(11,015.23)	$(11,232.19)	$(11,443.67)	$(11,649.47)	$(11,849.35)	$(12,043.06)	$(12,230.35)	$(12,410.95)	$(12,584.59)	$(12,750.99)

Table 39. San Antonio, TX Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0061	$ 0.0065	$ 0.0069	$ 0.0073	$ 0.0078	$ 0.0083	$ 0.0088	$ 0.0093	$ 0.0099	$ 0.0105	$ 0.0112	$ 0.0119	$ 0.0126	$ 0.0134	$ 0.0142	$ 0.0151	$ 0.0161	$ 0.0171	$ 0.0181	$ 0.0193	$ 0.0204
400 GPD CPG	$ 0.0055	$ 0.0058	$ 0.0062	$ 0.0066	$ 0.0070	$ 0.0074	$ 0.0079	$ 0.0084	$ 0.0089	$ 0.0094	$ 0.0100	$ 0.0106	$ 0.0113	$ 0.0120	$ 0.0127	$ 0.0135	$ 0.0144	$ 0.0153	$ 0.0162	$ 0.0172	$ 0.0183
200 GPD CPG	$ 0.0050	$ 0.0054	$ 0.0057	$ 0.0061	$ 0.0064	$ 0.0068	$ 0.0073	$ 0.0077	$ 0.0082	$ 0.0087	$ 0.0092	$ 0.0098	$ 0.0104	$ 0.0111	$ 0.0117	$ 0.0125	$ 0.0132	$ 0.0141	$ 0.0149	$ 0.0159	$ 0.0169
Benefits:																					
Precip.(in)		32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152	50,152
Benefits(yr):	Capture %:																				
600GPD	23%	$ 326.23	$ 346.50	$ 368.03	$ 390.90	$ 415.19	$ 440.99	$ 468.40	$ 497.50	$ 528.41	$ 561.25	$ 596.12	$ 633.16	$ 672.51	$ 714.30	$ 758.68	$ 805.82	$ 855.90	$ 909.08	$ 965.57	$ 1,025.57
400GPD	34%	$ 291.98	$ 310.12	$ 329.39	$ 349.86	$ 371.60	$ 394.69	$ 419.22	$ 445.27	$ 472.93	$ 502.32	$ 533.53	$ 566.69	$ 601.90	$ 639.30	$ 679.03	$ 721.22	$ 766.03	$ 813.63	$ 864.19	$ 917.89
200GPD	69%	$ 269.00	$ 285.71	$ 303.46	$ 322.32	$ 342.35	$ 363.62	$ 386.22	$ 410.21	$ 435.70	$ 462.78	$ 491.53	$ 522.08	$ 554.52	$ 588.97	$ 625.57	$ 664.44	$ 705.73	$ 749.58	$ 796.16	$ 845.63
Costs:																					
Above Ground:																					
Tank 8k Gal	$ (4,680)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (10,715)	$ (23.77)	$ (3.50)	$ 18.03	$ 40.90	$ 65.19	$ 90.99	$ 118.40	$ 147.50	$ 178.41	$ 211.25	$ 246.12	$ 283.16	$ 322.51	$ 364.30	$ 408.68	$ 455.82	$ 505.90	$ 559.08	$ 615.57	$ 675.57
NPV:	($6,650.24)																				
IRR:	-4.5%																				
Payback Period:	$ (10,715)	$(10,738.77)	$(10,742.26)	$(10,724.23)	$(10,683.33)	$(10,618.13)	$(10,527.14)	$(10,408.74)	$(10,261.24)	$(10,082.83)	$ (9,871.58)	$ (9,625.46)	$ (9,342.29)	$ (9,019.79)	$(8,655.49)	$(8,246.81)	$(7,790.99)	$(7,285.09)	$(6,726.01)	$ (6,110.44)	$ (5,434.88)
400GPD:																					
Net Benefit:	$ (10,715)	$ (58.02)	$ (39.88)	$ (20.61)	$ (0.14)	$ 21.60	$ 44.69	$ 69.22	$ 95.27	$ 122.93	$ 152.32	$ 183.53	$ 216.69	$ 251.90	$ 289.30	$ 329.03	$ 371.22	$ 416.03	$ 463.63	$ 514.19	$ 567.89
NPV:	($7,644.04)																				
IRR:	-5.9%																				
Payback Period:	$ (10,715)	$(10,773.02)	$(10,812.90)	$(10,833.50)	$(10,833.64)	$(10,812.04)	$(10,767.35)	$(10,698.13)	$(10,602.86)	$(10,479.93)	$(10,327.61)	$(10,144.07)	$ (9,927.39)	$ (9,675.49)	$(9,386.19)	$(9,057.16)	$(8,685.94)	$(8,269.91)	$(7,806.28)	$ (7,292.09)	$ (6,724.20)
200GPD:																					
Net Benefit:	$ (10,715)	$ (81.00)	$ (64.29)	$ (46.54)	$ (27.68)	$ (7.65)	$ 13.62	$ 36.22	$ 60.21	$ 85.70	$ 112.78	$ 141.53	$ 172.08	$ 204.52	$ 238.97	$ 275.57	$ 314.44	$ 355.73	$ 399.58	$ 446.16	$ 495.63
NPV:	($8,310.95)																				
IRR:	-7.0%																				
Payback Period:	$ (10,715)	$(10,796.00)	$(10,860.30)	$(10,906.83)	$(10,934.51)	$(10,942.16)	$(10,928.54)	$(10,892.33)	$(10,832.11)	$(10,746.41)	$(10,633.63)	$(10,492.10)	$(10,320.02)	$(10,115.51)	$(9,876.53)	$(9,600.96)	$(9,286.52)	$(8,930.79)	$(8,531.21)	$ (8,085.05)	$ (7,589.42)

Table 40. San Diego, CA Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0109	$ 0.0116	$ 0.0124	$ 0.0132	$ 0.0140	$ 0.0150	$ 0.0159	$ 0.0170	$ 0.0181	$ 0.0193	$ 0.0205	$ 0.0219	$ 0.0233	$ 0.0248	$ 0.0265	$ 0.0282	$ 0.0301	$ 0.0320	$ 0.0341	$ 0.0364	$ 0.0387
400 GPD CPG	$ 0.0097	$ 0.0103	$ 0.0110	$ 0.0117	$ 0.0125	$ 0.0133	$ 0.0142	$ 0.0151	$ 0.0161	$ 0.0172	$ 0.0183	$ 0.0195	$ 0.0208	$ 0.0221	$ 0.0236	$ 0.0251	$ 0.0267	$ 0.0285	$ 0.0304	$ 0.0324	$ 0.0345
200 GPD CPG	$ 0.0107	$ 0.0114	$ 0.0122	$ 0.0130	$ 0.0138	$ 0.0147	$ 0.0157	$ 0.0167	$ 0.0178	$ 0.0190	$ 0.0202	$ 0.0216	$ 0.0230	$ 0.0245	$ 0.0261	$ 0.0278	$ 0.0296	$ 0.0315	$ 0.0336	$ 0.0358	$ 0.0382
Benefits:																					
Precip.(in)		10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042	16,042
Benefits(yr):	Capture %:																				
600GPD	7%	$ 186.22	$ 198.42	$ 211.41	$ 225.25	$ 240.00	$ 255.72	$ 272.47	$ 290.31	$ 309.32	$ 329.57	$ 351.15	$ 374.15	$ 398.65	$ 424.75	$ 452.57	$ 482.20	$ 513.78	$ 547.42	$ 583.27	$ 621.47
400GPD	11%	$ 165.72	$ 176.57	$ 188.13	$ 200.45	$ 213.58	$ 227.57	$ 242.47	$ 258.35	$ 275.26	$ 293.29	$ 312.49	$ 332.96	$ 354.76	$ 377.99	$ 402.74	$ 429.12	$ 457.22	$ 487.16	$ 519.06	$ 553.05
200GPD	22%	$ 183.42	$ 195.43	$ 208.23	$ 221.87	$ 236.39	$ 251.87	$ 268.37	$ 285.94	$ 304.67	$ 324.62	$ 345.87	$ 368.52	$ 392.65	$ 418.37	$ 445.76	$ 474.95	$ 506.05	$ 539.19	$ 574.50	$ 612.12
Costs:																					
Above Ground:																					
Tank 3.5k Gal	$ (1,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (7,335)	$ (163.78)	$ (151.58)	$ (138.59)	$ (124.75)	$ (110.00)	$ (94.28)	$ (77.53)	$ (59.69)	$ (40.68)	$ (20.43)	$ 1.15	$ 24.15	$ 48.65	$ 74.75	$ 102.57	$ 132.20	$ 163.78	$ 197.42	$ 233.27	$ 271.47
NPV:	($7,210.73)																				
IRR:	-10.5%																				
Payback Period:	$ (7,335)	$ (7,498.78)	$ (7,650.36)	$ (7,788.95)	$ (7,913.70)	$ (8,023.70)	$ (8,117.98)	$ (8,195.51)	$ (8,255.20)	$ (8,295.89)	$ (8,316.31)	$(8,315.16)	$(8,291.01)	$(8,242.36)	$(8,167.61)	$(8,065.04)	$(7,932.84)	$(7,769.06)	$(7,571.63)	$ (7,338.36)	$ (7,066.90)
400GPD:																					
Net Benefit:	$ (7,335)	$ (184.28)	$ (173.43)	$ (161.87)	$ (149.55)	$ (136.42)	$ (122.43)	$ (107.53)	$ (91.65)	$ (74.74)	$ (56.71)	$ (37.51)	$ (17.04)	$ 4.76	$ 27.99	$ 52.74	$ 79.12	$ 107.22	$ 137.16	$ 169.06	$ 203.05
NPV:	($7,826.29)																				
IRR:	-13.1%																				
Payback Period:	$ (7,335)	$ (7,519.28)	$ (7,692.71)	$ (7,854.57)	$ (8,004.12)	$ (8,140.54)	$ (8,262.97)	$ (8,370.50)	$ (8,462.16)	$ (8,536.89)	$ (8,593.61)	$(8,631.11)	$(8,648.16)	$(8,643.40)	$(8,615.40)	$(8,562.66)	$(8,483.55)	$(8,376.33)	$(8,239.17)	$ (8,070.12)	$ (7,867.07)
200GPD:																					
Net Benefit:	$ (7,335)	$ (166.58)	$ (154.57)	$ (141.77)	$ (128.13)	$ (113.61)	$ (98.13)	$ (81.63)	$ (64.06)	$ (45.33)	$ (25.38)	$ (4.13)	$ 18.52	$ 42.65	$ 68.37	$ 95.76	$ 124.95	$ 156.05	$ 189.19	$ 224.50	$ 262.12
NPV:	($7,294.81)																				
IRR:	-10.8%																				
Payback Period:	$ (7,335)	$ (7,501.58)	$ (7,656.15)	$ (7,797.92)	$ (7,926.05)	$ (8,039.66)	$ (8,137.78)	$ (8,219.41)	$ (8,283.47)	$ (8,328.81)	$ (8,354.19)	$(8,358.32)	$(8,339.79)	$(8,297.14)	$(8,228.77)	$(8,133.01)	$(8,008.06)	$(7,852.01)	$(7,662.81)	$ (7,438.31)	$ (7,176.19)

Table 41. San Francisco, CA Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0115	$ 0.0128	$ 0.0143	$ 0.0160	$ 0.0178	$ 0.0199	$ 0.0222	$ 0.0248	$ 0.0276	$ 0.0308	$ 0.0344	$ 0.0384	$ 0.0428	$ 0.0478	$ 0.0533	$ 0.0595	$ 0.0664	$ 0.0741	$ 0.0827	$ 0.0922	$ 0.1029
400 GPD CPG	$ 0.0116	$ 0.0129	$ 0.0144	$ 0.0161	$ 0.0179	$ 0.0200	$ 0.0223	$ 0.0249	$ 0.0278	$ 0.0310	$ 0.0346	$ 0.0386	$ 0.0431	$ 0.0481	$ 0.0537	$ 0.0599	$ 0.0668	$ 0.0746	$ 0.0832	$ 0.0929	$ 0.1036
200 GPD CPG	$ 0.0118	$ 0.0132	$ 0.0147	$ 0.0164	$ 0.0183	$ 0.0204	$ 0.0228	$ 0.0254	$ 0.0284	$ 0.0317	$ 0.0353	$ 0.0394	$ 0.0440	$ 0.0491	$ 0.0548	$ 0.0611	$ 0.0682	$ 0.0761	$ 0.0849	$ 0.0947	$ 0.1057
Benefits:																					
Precip.(in)		20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240	32,240
Benefits(yr):	Capture %:																				
600GPD	15%	$ 413.39	$ 461.28	$ 514.73	$ 574.36	$ 640.90	$ 715.15	$ 798.00	$ 890.45	$ 993.61	$ 1,108.73	$ 1,237.17	$ 1,380.50	$ 1,540.44	$ 1,718.90	$ 1,918.04	$ 2,140.26	$ 2,388.21	$ 2,664.89	$ 2,973.63	$ 3,318.13
400GPD	22%	$ 416.18	$ 464.40	$ 518.20	$ 578.23	$ 645.22	$ 719.97	$ 803.38	$ 896.46	$ 1,000.32	$ 1,116.21	$ 1,245.52	$ 1,389.82	$ 1,550.83	$ 1,730.50	$ 1,930.99	$ 2,154.70	$ 2,404.32	$ 2,682.87	$ 2,993.69	$ 3,340.52
200GPD	44%	$ 424.55	$ 473.73	$ 528.62	$ 589.86	$ 658.20	$ 734.45	$ 819.54	$ 914.48	$ 1,020.43	$ 1,138.65	$ 1,270.57	$ 1,417.76	$ 1,582.02	$ 1,765.30	$ 1,969.81	$ 2,198.02	$ 2,452.67	$ 2,736.82	$ 3,053.88	$ 3,407.68
Costs:																					
Above Ground:																					
Tank 7k Gal	$ (4,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	2%																				
600GPD:																					
Net Benefit:	$ (10,335)	$ 63.39	$ 111.28	$ 164.73	$ 224.36	$ 290.90	$ 365.15	$ 448.00	$ 540.45	$ 643.61	$ 758.73	$ 887.17	$ 1,030.50	$ 1,190.44	$ 1,368.90	$ 1,568.04	$ 1,790.26	$ 2,038.21	$ 2,314.89	$ 2,623.63	$ 2,968.13
NPV:	$5,514.06																				
IRR:	5.2%																				
Payback Period:	$ (10,335)	$(10,271.61)	$(10,160.32)	$ (9,995.60)	$ (9,771.24)	$ (9,480.34)	$ (9,115.19)	$ (8,667.19)	$ (8,126.74)	$ (7,483.13)	$ (6,724.40)	$(5,837.23)	$(4,806.73)	$(3,616.29)	$(2,247.38)	$ (679.34)	$ 1,110.92	$ 3,149.13	$ 5,464.02	$ 8,087.64	$11,055.77
400GPD:																					
Net Benefit:	$ (10,335)	$ 66.18	$ 114.40	$ 168.20	$ 228.23	$ 295.22	$ 369.97	$ 453.38	$ 546.46	$ 650.32	$ 766.21	$ 895.52	$ 1,039.82	$ 1,200.83	$ 1,380.50	$ 1,580.99	$ 1,804.70	$ 2,054.32	$ 2,332.87	$ 2,643.69	$ 2,990.52
NPV:	$5,657.49																				
IRR:	5.2%																				
Payback Period:	$ (10,335)	$(10,268.82)	$(10,154.42)	$ (9,986.22)	$ (9,757.99)	$ (9,462.77)	$ (9,092.79)	$ (8,639.41)	$ (8,092.95)	$ (7,442.63)	$ (6,676.43)	$(5,780.90)	$(4,741.09)	$(3,540.25)	$(2,159.75)	$ (578.76)	$ 1,225.93	$ 3,280.26	$ 5,613.13	$ 8,256.82	$11,247.34
200GPD:																					
Net Benefit:	$ (10,335)	$ 74.55	$ 123.73	$ 178.62	$ 239.86	$ 308.20	$ 384.45	$ 469.54	$ 564.48	$ 670.43	$ 788.65	$ 920.57	$ 1,067.76	$ 1,232.02	$ 1,415.30	$ 1,619.81	$ 1,848.02	$ 2,102.67	$ 2,386.82	$ 2,703.88	$ 3,057.68
NPV:	$6,087.78																				
IRR:	5.4%																				
Payback Period:	$ (10,335)	$(10,260.45)	$(10,136.72)	$ (9,958.10)	$ (9,718.24)	$ (9,410.04)	$ (9,025.59)	$ (8,556.06)	$ (7,991.57)	$ (7,321.14)	$ (6,532.49)	$(5,611.93)	$(4,544.16)	$(3,312.15)	$(1,896.85)	$ (277.04)	$ 1,570.98	$ 3,673.65	$ 6,060.46	$ 8,764.35	$11,822.03

Table 42. San Jose, CA Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0062	$ 0.0067	$ 0.0073	$ 0.0080	$ 0.0087	$ 0.0095	$ 0.0104	$ 0.0113	$ 0.0123	$ 0.0134	$ 0.0147	$ 0.0160	$ 0.0174	$ 0.0190	$ 0.0207	$ 0.0226	$ 0.0246	$ 0.0268	$ 0.0293	$ 0.0319	$ 0.0348
400 GPD CPG	$ 0.0069	$ 0.0075	$ 0.0082	$ 0.0089	$ 0.0098	$ 0.0106	$ 0.0116	$ 0.0126	$ 0.0138	$ 0.0150	$ 0.0164	$ 0.0179	$ 0.0195	$ 0.0212	$ 0.0232	$ 0.0252	$ 0.0275	$ 0.0300	$ 0.0327	$ 0.0357	$ 0.0389
200 GPD CPG	$ 0.0091	$ 0.0099	$ 0.0108	$ 0.0118	$ 0.0129	$ 0.0140	$ 0.0153	$ 0.0167	$ 0.0182	$ 0.0198	$ 0.0216	$ 0.0235	$ 0.0257	$ 0.0280	$ 0.0305	$ 0.0333	$ 0.0363	$ 0.0396	$ 0.0431	$ 0.0470	$ 0.0513
Benefits:																					
Precip.(in)		15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609	24,609
Benefits(yr):	Capture %:																				
600GPD	11%	$ 165.57	$ 180.52	$ 196.83	$ 214.60	$ 233.98	$ 255.11	$ 278.15	$ 303.27	$ 330.65	$ 360.52	$ 393.07	$ 428.57	$ 467.27	$ 509.47	$ 555.48	$ 605.64	$ 660.33	$ 719.97	$ 784.98	$ 855.87
400GPD	17%	$ 185.20	$ 201.92	$ 220.16	$ 240.04	$ 261.72	$ 285.35	$ 311.12	$ 339.22	$ 369.85	$ 403.25	$ 439.67	$ 479.37	$ 522.66	$ 569.86	$ 621.32	$ 677.43	$ 738.61	$ 805.31	$ 878.04	$ 957.33
200GPD	34%	$ 244.08	$ 266.12	$ 290.15	$ 316.36	$ 344.93	$ 376.07	$ 410.04	$ 447.07	$ 487.44	$ 531.46	$ 579.45	$ 631.78	$ 688.83	$ 751.04	$ 818.86	$ 892.81	$ 973.44	$ 1,061.35	$ 1,157.19	$ 1,261.69
Costs:																					
Above Ground:																					
Tank 5.1k Gal	$ (2,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	2%																				
600GPD:																					
Net Benefit:	$ (8,335)	$ (184.43)	$ (169.48)	$ (153.17)	$ (135.40)	$ (116.02)	$ (94.89)	$ (71.85)	$ (46.73)	$ (19.35)	$ 10.52	$ 43.07	$ 78.57	$ 117.27	$ 159.47	$ 205.48	$ 255.64	$ 310.33	$ 369.97	$ 434.98	$ 505.87
NPV:	($7,334.10)																				
IRR:	-7.5%																				
Payback Period:	$ (8,335)	$ (8,519.43)	$ (8,688.90)	$ (8,842.08)	$ (8,977.48)	$ (9,093.50)	$ (9,188.38)	$ (9,260.24)	$ (9,306.97)	$ (9,326.31)	$ (9,315.80)	$(9,272.73)	$(9,194.16)	$(9,076.89)	$(8,917.42)	$(8,711.94)	$(8,456.30)	$(8,145.97)	$(7,776.00)	$ (7,341.02)	$ (6,835.14)
400GPD:																					
Net Benefit:	$ (8,335)	$ (164.80)	$ (148.08)	$ (129.84)	$ (109.96)	$ (88.28)	$ (64.65)	$ (38.88)	$ (10.78)	$ 19.85	$ 53.25	$ 89.67	$ 129.37	$ 172.66	$ 219.86	$ 271.32	$ 327.43	$ 388.61	$ 455.31	$ 528.04	$ 607.33
NPV:	($6,569.73)																				
IRR:	-5.9%																				
Payback Period:	$ (8,335)	$ (8,499.80)	$ (8,647.88)	$ (8,777.72)	$ (8,887.68)	$ (8,975.96)	$ (9,040.61)	$ (9,079.49)	$ (9,090.27)	$ (9,070.42)	$ (9,017.17)	$(8,927.50)	$(8,798.13)	$(8,625.47)	$(8,405.61)	$(8,134.29)	$(7,806.85)	$(7,418.24)	$(6,962.93)	$ (6,434.90)	$ (5,827.57)
200GPD:																					
Net Benefit:	$ (8,335)	$ (105.92)	$ (83.88)	$ (59.85)	$ (33.64)	$ (5.07)	$ 26.07	$ 60.04	$ 97.07	$ 137.44	$ 181.46	$ 229.45	$ 281.78	$ 338.83	$ 401.04	$ 468.86	$ 542.81	$ 623.44	$ 711.35	$ 807.19	$ 911.69
NPV:	($4,276.60)																				
IRR:	-2.4%																				
Payback Period:	$ (8,335)	$ (8,440.92)	$ (8,524.80)	$ (8,584.65)	$ (8,618.29)	$ (8,623.36)	$ (8,597.29)	$ (8,537.25)	$ (8,440.19)	$ (8,302.75)	$ (8,121.29)	$(7,891.84)	$(7,610.06)	$(7,271.23)	$(6,870.19)	$(6,401.32)	$(5,858.51)	$(5,235.08)	$(4,523.73)	$ (3,716.54)	$ (2,804.84)

Table 43. Santa Fe, NM Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0156	$ 0.0160	$ 0.0165	$ 0.0170	$ 0.0176	$ 0.0181	$ 0.0187	$ 0.0192	$ 0.0198	$ 0.0204	$ 0.0211	$ 0.0217	$ 0.0224	$ 0.0231	$ 0.0238	$ 0.0245	$ 0.0253	$ 0.0260	$ 0.0268	$ 0.0277	$ 0.0285
400 GPD CPG	$ 0.0126	$ 0.0130	$ 0.0134	$ 0.0138	$ 0.0143	$ 0.0147	$ 0.0152	$ 0.0156	$ 0.0161	$ 0.0166	$ 0.0171	$ 0.0176	$ 0.0182	$ 0.0187	$ 0.0193	$ 0.0199	$ 0.0205	$ 0.0211	$ 0.0218	$ 0.0225	$ 0.0231
200 GPD CPG	$ 0.0090	$ 0.0093	$ 0.0096	$ 0.0099	$ 0.0102	$ 0.0105	$ 0.0108	$ 0.0111	$ 0.0115	$ 0.0118	$ 0.0122	$ 0.0126	$ 0.0129	$ 0.0133	$ 0.0138	$ 0.0142	$ 0.0146	$ 0.0151	$ 0.0155	$ 0.0160	$ 0.0165
Benefits:																					
Precip.(in)		14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085	22,085
Benefits(yr):	Capture %:																				
600GPD	10%	$ 354.36	$ 365.25	$ 376.46	$ 388.02	$ 399.94	$ 412.22	$ 424.88	$ 437.93	$ 451.38	$ 465.24	$ 479.53	$ 494.26	$ 509.44	$ 525.08	$ 541.21	$ 557.83	$ 574.96	$ 592.61	$ 610.81	$ 629.57
400GPD	15%	$ 287.72	$ 296.56	$ 305.66	$ 315.05	$ 324.73	$ 334.70	$ 344.98	$ 355.57	$ 366.49	$ 377.75	$ 389.35	$ 401.30	$ 413.63	$ 426.33	$ 439.42	$ 452.92	$ 466.83	$ 481.16	$ 495.94	$ 511.17
200GPD	30%	$ 204.98	$ 211.28	$ 217.77	$ 224.46	$ 231.35	$ 238.45	$ 245.78	$ 253.32	$ 261.10	$ 269.12	$ 277.39	$ 285.91	$ 294.69	$ 303.74	$ 313.07	$ 322.68	$ 332.59	$ 342.80	$ 353.33	$ 364.18
Costs:																					
Above Ground:																					
Tank 5.1k Gal	$ (2,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (8,335)	$ 4.36	$ 15.25	$ 26.46	$ 38.02	$ 49.94	$ 62.22	$ 74.88	$ 87.93	$ 101.38	$ 115.24	$ 129.53	$ 144.26	$ 159.44	$ 175.08	$ 191.21	$ 207.83	$ 224.96	$ 242.61	$ 260.81	$ 279.57
NPV:	($6,245.97)																				
IRR:	-7.5%																				
Payback Period:	$ (8,335)	$ (8,330.64)	$ (8,315.39)	$ (8,288.93)	$ (8,250.90)	$ (8,200.96)	$ (8,138.74)	$ (8,063.85)	$ (7,975.92)	$ (7,874.54)	$ (7,759.30)	$(7,629.77)	$(7,485.51)	$(7,326.08)	$(7,151.00)	$(6,959.79)	$(6,751.96)	$(6,527.01)	$(6,284.39)	$ (6,023.58)	$ (5,744.01)
400GPD:																					
Net Benefit:	$ (8,335)	$ (62.28)	$ (53.44)	$ (44.34)	$ (34.95)	$ (25.27)	$ (15.30)	$ (5.02)	$ 5.57	$ 16.49	$ 27.75	$ 39.35	$ 51.30	$ 63.63	$ 76.33	$ 89.42	$ 102.92	$ 116.83	$ 131.16	$ 145.94	$ 161.17
NPV:	($7,663.32)																				
IRR:	-11.9%																				
Payback Period:	$ (8,335)	$ (8,397.28)	$ (8,450.73)	$ (8,495.06)	$ (8,530.01)	$ (8,555.29)	$ (8,570.59)	$ (8,575.61)	$ (8,570.04)	$ (8,553.55)	$ (8,525.81)	$(8,486.46)	$(8,435.16)	$(8,371.53)	$(8,295.20)	$(8,205.78)	$(8,102.86)	$(7,986.03)	$(7,854.87)	$ (7,708.93)	$ (7,547.76)
200GPD:																					
Net Benefit:	$ (8,335)	$ (145.02)	$ (138.72)	$ (132.23)	$ (125.54)	$ (118.65)	$ (111.55)	$ (104.22)	$ (96.68)	$ (88.90)	$ (80.88)	$ (72.61)	$ (64.09)	$ (55.31)	$ (46.26)	$ (36.93)	$ (27.32)	$ (17.41)	$ (7.20)	$ 3.33	$ 14.18
NPV:	($9,422.87)																				
IRR:	#NUM!																				
Payback Period:	$ (8,335)	$ (8,480.02)	$ (8,618.74)	$ (8,750.97)	$ (8,876.51)	$ (8,995.16)	$ (9,106.71)	$ (9,210.93)	$ (9,307.61)	$ (9,396.50)	$ (9,477.38)	$(9,549.99)	$(9,614.08)	$(9,669.40)	$(9,715.66)	$(9,752.59)	$(9,779.91)	$(9,797.32)	$(9,804.52)	$ (9,801.19)	$ (9,787.01)

Table 44. Seattle, WA Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0088	$ 0.0092	$ 0.0096	$ 0.0100	$ 0.0104	$ 0.0109	$ 0.0114	$ 0.0119	$ 0.0124	$ 0.0129	$ 0.0135	$ 0.0141	$ 0.0147	$ 0.0154	$ 0.0160	$ 0.0167	$ 0.0175	$ 0.0182	$ 0.0190	$ 0.0199	$ 0.0207
400 GPD CPG	$ 0.0086	$ 0.0090	$ 0.0094	$ 0.0098	$ 0.0102	$ 0.0106	$ 0.0111	$ 0.0116	$ 0.0121	$ 0.0126	$ 0.0132	$ 0.0138	$ 0.0144	$ 0.0150	$ 0.0157	$ 0.0164	$ 0.0171	$ 0.0178	$ 0.0186	$ 0.0194	$ 0.0203
200 GPD CPG	$ 0.0097	$ 0.0102	$ 0.0106	$ 0.0111	$ 0.0116	$ 0.0121	$ 0.0126	$ 0.0132	$ 0.0137	$ 0.0143	$ 0.0150	$ 0.0156	$ 0.0163	$ 0.0170	$ 0.0178	$ 0.0186	$ 0.0194	$ 0.0202	$ 0.0211	$ 0.0220	$ 0.0230
Benefits:																					
Precip.(in)		37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718	58,718
Benefits(yr):	Capture %:																				
600GPD	27%	$ 538.51	$ 562.14	$ 586.80	$ 612.54	$ 639.41	$ 667.46	$ 696.74	$ 727.31	$ 759.21	$ 792.52	$ 827.29	$ 863.58	$ 901.46	$ 941.01	$ 982.29	$ 1,025.38	$ 1,070.37	$ 1,117.32	$ 1,166.34	$ 1,217.51
400GPD	40%	$ 526.60	$ 549.71	$ 573.82	$ 599.00	$ 625.27	$ 652.70	$ 681.34	$ 711.23	$ 742.43	$ 775.00	$ 809.00	$ 844.49	$ 881.53	$ 920.21	$ 960.57	$ 1,002.71	$ 1,046.70	$ 1,092.62	$ 1,140.55	$ 1,190.59
200GPD	80%	$ 597.49	$ 623.70	$ 651.06	$ 679.62	$ 709.44	$ 740.56	$ 773.05	$ 806.96	$ 842.36	$ 879.31	$ 917.89	$ 958.16	$ 1,000.19	$ 1,044.07	$ 1,089.87	$ 1,137.68	$ 1,187.59	$ 1,239.69	$ 1,294.07	$ 1,350.84
Costs:																					
Above Ground:																					
Tank 10k Gal	$ (5,990)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (12,025)	$ 188.51	$ 212.14	$ 236.80	$ 262.54	$ 289.41	$ 317.46	$ 346.74	$ 377.31	$ 409.21	$ 442.52	$ 477.29	$ 513.58	$ 551.46	$ 591.01	$ 632.29	$ 675.38	$ 720.37	$ 767.32	$ 816.34	$ 867.51
NPV:	($4,388.80)																				
IRR:	-1.6%																				
Payback Period:	$ (12,025)	$(11,836.49)	$(11,624.35)	$(11,387.56)	$(11,125.02)	$(10,835.61)	$(10,518.15)	$(10,171.41)	$ (9,794.10)	$ (9,384.89)	$ (8,942.37)	$(8,465.08)	$(7,951.51)	$(7,400.04)	$(6,809.03)	$(6,176.74)	$(5,501.36)	$(4,780.99)	$(4,013.67)	$ (3,197.33)	$ (2,329.82)
400GPD:																					
Net Benefit:	$ (12,025)	$ 176.60	$ 199.71	$ 223.82	$ 249.00	$ 275.27	$ 302.70	$ 331.34	$ 361.23	$ 392.43	$ 425.00	$ 459.00	$ 494.49	$ 531.53	$ 570.21	$ 610.57	$ 652.71	$ 696.70	$ 742.62	$ 790.55	$ 840.59
NPV:	($4,676.47)																				
IRR:	-1.9%																				
Payback Period:	$ (12,025)	$(11,848.40)	$(11,648.69)	$(11,424.87)	$(11,175.87)	$(10,900.60)	$(10,597.90)	$(10,266.56)	$ (9,905.33)	$ (9,512.91)	$ (9,087.91)	$(8,628.91)	$(8,134.43)	$(7,602.89)	$(7,032.69)	$(6,422.11)	$(5,769.40)	$(5,072.70)	$(4,330.08)	$ (3,539.53)	$ (2,698.94)
200GPD:																					
Net Benefit:	$ (12,025)	$ 247.49	$ 273.70	$ 301.06	$ 329.62	$ 359.44	$ 390.56	$ 423.05	$ 456.96	$ 492.36	$ 529.31	$ 567.89	$ 608.16	$ 650.19	$ 694.07	$ 739.87	$ 787.68	$ 837.59	$ 889.69	$ 944.07	$ 1,000.84
NPV:	($2,963.85)																				
IRR:	-0.3%																				
Payback Period:	$ (12,025)	$(11,777.51)	$(11,503.81)	$(11,202.75)	$(10,873.13)	$(10,513.70)	$(10,123.14)	$ (9,700.09)	$ (9,243.13)	$ (8,750.77)	$ (8,221.46)	$(7,653.57)	$(7,045.42)	$(6,395.23)	$(5,701.16)	$(4,961.29)	$(4,173.61)	$(3,336.02)	$(2,446.33)	$ (1,502.25)	$ (501.41)

Table 45. Tucson, AZ Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0077	$ 0.0084	$ 0.0092	$ 0.0101	$ 0.0110	$ 0.0121	$ 0.0132	$ 0.0144	$ 0.0158	$ 0.0173	$ 0.0189	$ 0.0207	$ 0.0226	$ 0.0247	$ 0.0271	$ 0.0296	$ 0.0324	$ 0.0354	$ 0.0388	$ 0.0424	$ 0.0464
400 GPD CPG	$ 0.0060	$ 0.0065	$ 0.0071	$ 0.0078	$ 0.0085	$ 0.0093	$ 0.0102	$ 0.0112	$ 0.0122	$ 0.0134	$ 0.0146	$ 0.0160	$ 0.0175	$ 0.0191	$ 0.0209	$ 0.0229	$ 0.0250	$ 0.0274	$ 0.0300	$ 0.0328	$ 0.0359
200 GPD CPG	$ 0.0058	$ 0.0063	$ 0.0069	$ 0.0076	$ 0.0083	$ 0.0091	$ 0.0099	$ 0.0109	$ 0.0119	$ 0.0130	$ 0.0142	$ 0.0155	$ 0.0170	$ 0.0186	$ 0.0203	$ 0.0223	$ 0.0243	$ 0.0266	$ 0.0291	$ 0.0319	$ 0.0349
Benefits:																					
Precip.(in)		11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051	18,051
Benefits(yr):	Capture %:																				
600GPD	8%	$ 152.02	$ 166.30	$ 181.93	$ 199.03	$ 217.73	$ 238.19	$ 260.57	$ 285.06	$ 311.84	$ 341.14	$ 373.20	$ 408.27	$ 446.63	$ 488.60	$ 534.51	$ 584.74	$ 639.69	$ 699.80	$ 765.56	$ 837.49
400GPD	12%	$ 117.53	$ 128.57	$ 140.65	$ 153.87	$ 168.33	$ 184.15	$ 201.45	$ 220.38	$ 241.09	$ 263.74	$ 288.53	$ 315.64	$ 345.30	$ 377.75	$ 413.24	$ 452.07	$ 494.55	$ 541.02	$ 591.86	$ 647.48
200GPD	25%	$ 114.27	$ 125.00	$ 136.75	$ 149.60	$ 163.66	$ 179.04	$ 195.86	$ 214.26	$ 234.40	$ 256.42	$ 280.52	$ 306.88	$ 335.71	$ 367.26	$ 401.77	$ 439.52	$ 480.82	$ 526.01	$ 575.43	$ 629.51
Costs:																					
Above Ground:																					
Tank 5.1k Gal	$ (2,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (8,335)	$ (197.98)	$ (183.70)	$ (168.07)	$ (150.97)	$ (132.27)	$ (111.81)	$ (89.43)	$ (64.94)	$ (38.16)	$ (8.86)	$ 23.20	$ 58.27	$ 96.63	$ 138.60	$ 184.51	$ 234.74	$ 289.69	$ 349.80	$ 415.56	$ 487.49
NPV:	($7,625.02)																				
IRR:	-8.1%																				
Payback Period:	$ (8,335)	$ (8,532.98)	$ (8,716.68)	$ (8,884.75)	$ (9,035.72)	$ (9,167.99)	$ (9,279.80)	$ (9,369.23)	$ (9,434.18)	$ (9,472.34)	$ (9,481.19)	$ (9,457.99)	$ (9,399.72)	$ (9,303.09)	$ (9,164.49)	$ (8,979.97)	$ (8,745.23)	$(8,455.55)	$(8,105.75)	$ (7,690.19)	$ (7,202.70)
400GPD:																					
Net Benefit:	$ (8,335)	$ (232.47)	$ (221.43)	$ (209.35)	$ (196.13)	$ (181.67)	$ (165.85)	$ (148.55)	$ (129.62)	$ (108.91)	$ (86.26)	$ (61.47)	$ (34.36)	$ (4.70)	$ 27.75	$ 63.24	$ 102.07	$ 144.55	$ 191.02	$ 241.86	$ 297.48
NPV:	($9,022.03)																				
IRR:	-12.4%																				
Payback Period:	$ (8,335)	$ (8,567.47)	$ (8,788.90)	$ (8,998.25)	$ (9,194.37)	$ (9,376.05)	$ (9,541.90)	$ (9,690.45)	$ (9,820.07)	$ (9,928.98)	$(10,015.23)	$(10,076.71)	$(10,111.07)	$(10,115.77)	$(10,088.02)	$(10,024.78)	$ (9,922.71)	$(9,778.16)	$(9,587.13)	$ (9,345.27)	$ (9,047.79)
200GPD:																					
Net Benefit:	$ (8,335)	$ (235.73)	$ (225.00)	$ (213.25)	$ (200.40)	$ (186.34)	$ (170.96)	$ (154.14)	$ (135.74)	$ (115.60)	$ (93.58)	$ (69.48)	$ (43.12)	$ (14.29)	$ 17.26	$ 51.77	$ 89.52	$ 130.82	$ 176.01	$ 225.43	$ 279.51
NPV:	($9,154.17)																				
IRR:	-13.0%																				
Payback Period:	$ (8,335)	$ (8,570.73)	$ (8,795.73)	$ (9,008.98)	$ (9,209.38)	$ (9,395.73)	$ (9,566.69)	$ (9,720.83)	$ (9,856.57)	$ (9,972.17)	$(10,065.75)	$(10,135.23)	$(10,178.35)	$(10,192.64)	$(10,175.38)	$(10,123.61)	$(10,034.09)	$(9,903.26)	$(9,727.26)	$ (9,501.82)	$ (9,222.32)

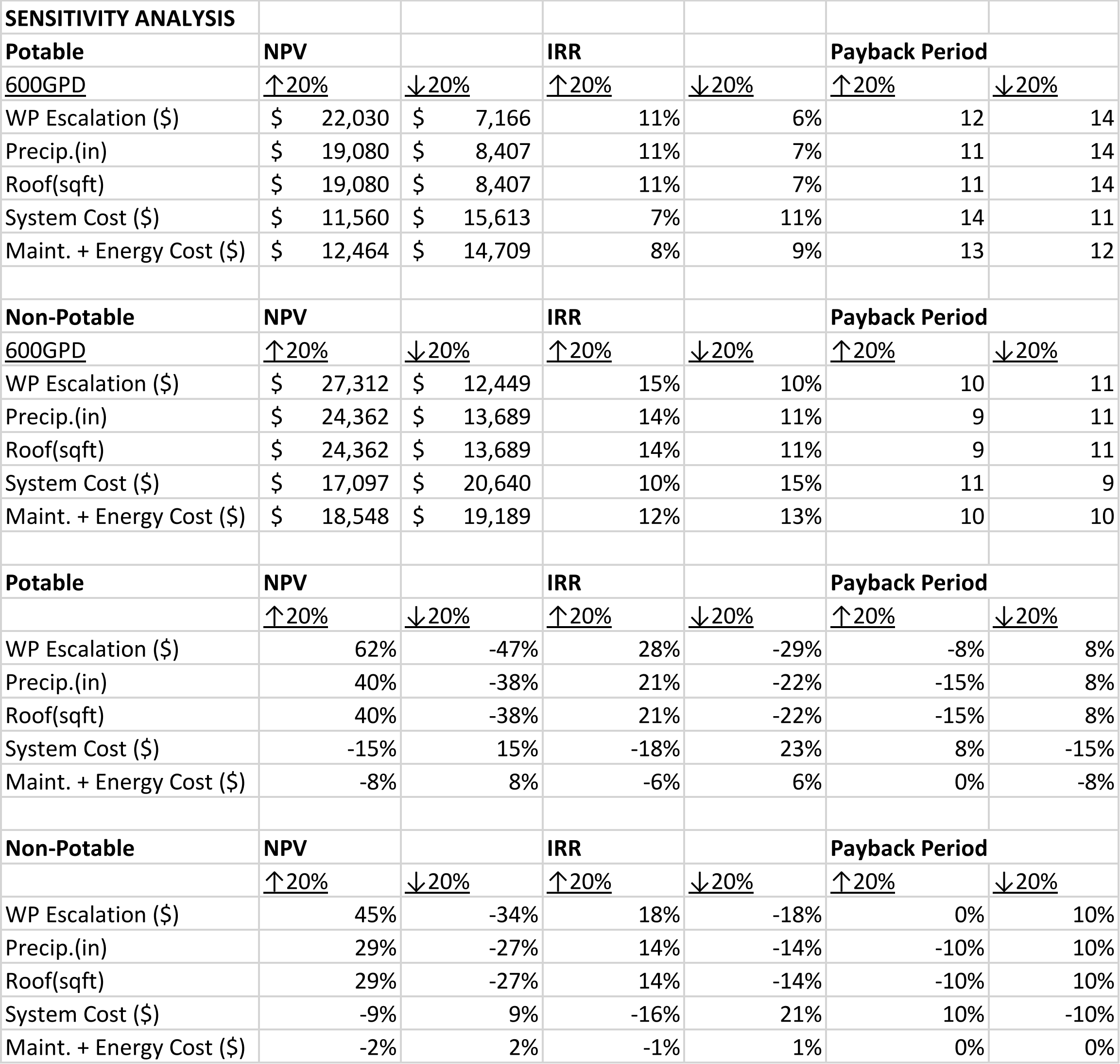
Table 46. Fresno, CA Potable CBA

Year	0(2018)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Usage Cost:																					
600 GPD CPG	$ 0.0026	$ 0.0029	$ 0.0031	$ 0.0034	$ 0.0037	$ 0.0040	$ 0.0044	$ 0.0047	$ 0.0052	$ 0.0056	$ 0.0061	$ 0.0066	$ 0.0072	$ 0.0079	$ 0.0086	$ 0.0093	$ 0.0101	$ 0.0110	$ 0.0120	$ 0.0130	$ 0.0142
400 GPD CPG	$ 0.0030	$ 0.0032	$ 0.0035	$ 0.0038	$ 0.0041	$ 0.0045	$ 0.0049	$ 0.0053	$ 0.0058	$ 0.0063	$ 0.0069	$ 0.0075	$ 0.0081	$ 0.0088	$ 0.0096	$ 0.0105	$ 0.0114	$ 0.0124	$ 0.0135	$ 0.0146	$ 0.0159
200 GPD CPG	$ 0.0039	$ 0.0043	$ 0.0047	$ 0.0051	$ 0.0055	$ 0.0060	$ 0.0065	$ 0.0071	$ 0.0077	$ 0.0084	$ 0.0091	$ 0.0099	$ 0.0108	$ 0.0118	$ 0.0128	$ 0.0139	$ 0.0151	$ 0.0165	$ 0.0179	$ 0.0195	$ 0.0212
Benefits:																					
Precip.(in)		12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Roof(sqft)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Max Capture(gal/yr)		19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936	19,936
Benefits(yr):	Capture %:																				
600GPD	9%	$ 57.13	$ 62.15	$ 67.60	$ 73.54	$ 80.00	$ 87.02	$ 94.66	$ 102.97	$ 112.01	$ 121.84	$ 132.54	$ 144.17	$ 156.83	$ 170.60	$ 185.57	$ 201.86	$ 219.59	$ 238.86	$ 259.83	$ 282.64
400GPD	14%	$ 64.20	$ 69.84	$ 75.97	$ 82.64	$ 89.89	$ 97.79	$ 106.37	$ 115.71	$ 125.87	$ 136.92	$ 148.94	$ 162.01	$ 176.24	$ 191.71	$ 208.54	$ 226.85	$ 246.76	$ 268.42	$ 291.99	$ 317.62
200GPD	27%	$ 85.41	$ 92.91	$ 101.07	$ 109.94	$ 119.59	$ 130.09	$ 141.51	$ 153.94	$ 167.45	$ 182.15	$ 198.14	$ 215.54	$ 234.46	$ 255.04	$ 277.43	$ 301.79	$ 328.28	$ 357.10	$ 388.45	$ 422.55
Costs:																					
Above Ground:																					
Tank 5.1k Gal	$ (2,300)																				
Gutters	$ (1,000)																				
Stage-1 Filter	$ (35)																				
Stage-2 UV Filter	$ (1,300)																				
3-way backup valve	$ (450)																				
Pump 1.5HP	$ (550)																				
System Controller	$ (700)																				
Install + Plumbing Costs	$ (2,000)																				
Maint. + Energy	$ -	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)	$ (350.00)
Profitability:																					
Discount Rate:	*2%*																				
600GPD:																					
Net Benefit:	$ (8,335)	$ (292.87)	$ (287.85)	$ (282.40)	$ (276.46)	$ (270.00)	$ (262.98)	$ (255.34)	$ (247.03)	$ (237.99)	$ (228.16)	$ (217.46)	$ (205.83)	$ (193.17)	$ (179.40)	$ (164.43)	$ (148.14)	$ (130.41)	$ (111.14)	$ (90.17)	$ (67.36)
NPV:	($11,616.25)																				
IRR:	#NUM!																				
Payback Period:	$ (8,335)	$ (8,627.87)	$ (8,915.72)	$ (9,198.11)	$ (9,474.58)	$ (9,744.58)	$(10,007.56)	$(10,262.90)	$(10,509.94)	$(10,747.93)	$(10,976.09)	$(11,193.55)	$(11,399.38)	$(11,592.56)	$(11,771.96)	$(11,936.39)	$(12,084.52)	$(12,214.94)	$(12,326.07)	$(12,416.24)	$(12,483.60)
400GPD:																					
Net Benefit:	$ (8,335)	$ (285.80)	$ (280.16)	$ (274.03)	$ (267.36)	$ (260.11)	$ (252.21)	$ (243.63)	$ (234.29)	$ (224.13)	$ (213.08)	$ (201.06)	$ (187.99)	$ (173.76)	$ (158.29)	$ (141.46)	$ (123.15)	$ (103.24)	$ (81.58)	$ (58.01)	$ (32.38)
NPV:	($11,348.19)																				
IRR:	#NUM!																				
Payback Period:	$ (8,335)	$ (8,620.80)	$ (8,900.96)	$ (9,174.99)	$ (9,442.35)	$ (9,702.45)	$ (9,954.67)	$(10,198.29)	$(10,432.58)	$(10,656.72)	$(10,869.80)	$(11,070.86)	$(11,258.85)	$(11,432.61)	$(11,590.91)	$(11,732.37)	$(11,855.52)	$(11,958.76)	$(12,040.34)	$(12,098.35)	$(12,130.73)
200GPD:																					
Net Benefit:	$ (8,335)	$ (264.59)	$ (257.09)	$ (248.93)	$ (240.06)	$ (230.41)	$ (219.91)	$ (208.49)	$ (196.06)	$ (182.55)	$ (167.85)	$ (151.86)	$ (134.46)	$ (115.54)	$ (94.96)	$ (72.57)	$ (48.21)	$ (21.72)	$ 7.10	$ 38.45	$ 72.55
NPV:	($10,544.00)																				
IRR:	#NUM!																				
Payback Period:	$ (8,335)	$ (8,599.59)	$ (8,856.67)	$ (9,105.60)	$ (9,345.66)	$ (9,576.07)	$ (9,795.98)	$(10,004.46)	$(10,200.53)	$(10,383.08)	$(10,550.92)	$(10,702.78)	$(10,837.24)	$(10,952.78)	$(11,047.74)	$(11,120.31)	$(11,168.52)	$(11,190.24)	$(11,183.14)	$(11,144.69)	$(11,072.13)

Ancillary Appendix 2

Sensitivity Analysis Data

Table 47. Sensitivity analysis data conducted for Austin, TX



SENSITIVITY ANALYSIS						
Potable	**NPV**		**IRR**		**Payback Period**	
600GPD	↑20%	↓20%	↑20%	↓20%	↑20%	↓20%
WP Escalation ($)	$ 22,030	$ 7,166	11%	6%	12	14
Precip.(in)	$ 19,080	$ 8,407	11%	7%	11	14
Roof(sqft)	$ 19,080	$ 8,407	11%	7%	11	14
System Cost ($)	$ 11,560	$ 15,613	7%	11%	14	11
Maint. + Energy Cost ($)	$ 12,464	$ 14,709	8%	9%	13	12
Non-Potable	**NPV**		**IRR**		**Payback Period**	
600GPD	↑20%	↓20%	↑20%	↓20%	↑20%	↓20%
WP Escalation ($)	$ 27,312	$ 12,449	15%	10%	10	11
Precip.(in)	$ 24,362	$ 13,689	14%	11%	9	11
Roof(sqft)	$ 24,362	$ 13,689	14%	11%	9	11
System Cost ($)	$ 17,097	$ 20,640	10%	15%	11	9
Maint. + Energy Cost ($)	$ 18,548	$ 19,189	12%	13%	10	10
Potable	**NPV**		**IRR**		**Payback Period**	
	↑20%	↓20%	↑20%	↓20%	↑20%	↓20%
WP Escalation ($)	62%	-47%	28%	-29%	-8%	8%
Precip.(in)	40%	-38%	21%	-22%	-15%	8%
Roof(sqft)	40%	-38%	21%	-22%	-15%	8%
System Cost ($)	-15%	15%	-18%	23%	8%	-15%
Maint. + Energy Cost ($)	-8%	8%	-6%	6%	0%	-8%
Non-Potable	**NPV**		**IRR**		**Payback Period**	
	↑20%	↓20%	↑20%	↓20%	↑20%	↓20%
WP Escalation ($)	45%	-34%	18%	-18%	0%	10%
Precip.(in)	29%	-27%	14%	-14%	-10%	10%
Roof(sqft)	29%	-27%	14%	-14%	-10%	10%
System Cost ($)	-9%	9%	-16%	21%	10%	-10%
Maint. + Energy Cost ($)	-2%	2%	-1%	1%	0%	0%