

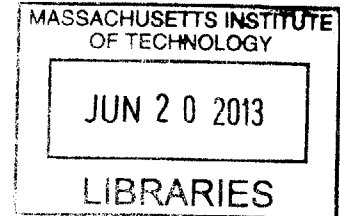
Social Marketing, Financial, and Regulatory Mechanisms for  
Adoption of Water Conservation and Stormwater Management Practices  
by Single-Family Households

By

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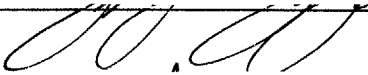
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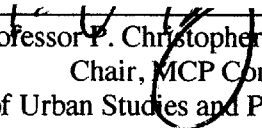
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## **Abstract**

Since the latter half of the nineteenth century, water delivery and stormwater removal have been managed largely by engineering staff at water utilities, municipal departments and multi-jurisdiction authorities. In recent decades, a number of factors have challenged the traditional operation of these entities. In arid regions particularly, withdrawals to meet the demands of growing populations have been restricted by environmental and legal limitations. After amendments to the Clean Water Act, municipalities have been charged with improving the quality of stormwater discharged into lakes, rivers, and oceans. Perhaps most formidable have been financial and budgetary constraints.

Without the ability to upgrade and even maintain infrastructure through conventional means, agencies and water departments have instead sought to change how people use that infrastructure. While these efforts include land use planning, regulations on new development, and partnerships with industrial, commercial, and institutional stakeholders, this study looks specifically at single-family households. Their high percentage as a portion of the population and the impact of their yards on water resources make them a particularly critical group for involvement in management.

Generally, three methods are used, often in tandem, to motivate residents to adopt different behaviors and landscape practices: regulations, which include enforcement; pricing, including incentives; and community-based social marketing. This study reviews those methods in the context of water conservation and stormwater management to evaluate how effective they are.

Regulations are problematic in both water conservation and stormwater management, in the former because of the need for enforcement, in the latter because most codes were written during a period of centralized management. As for financing mechanisms, the underlying model of pricing is strong, particularly for water. However, for stormwater, the rates are too low to motivate change. Other methods for funding projects, raising revenue and sharing costs have great potential. Community-based social marketing (CBSM) is a powerful methodology grounded in research about audience values and behaviors. Its impact is greatly determined by the relative strength of communities in which it is used and by the level of personal interaction with staff. Coordination among if not unification by water and stormwater departments holds additional potential.





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*The challenge of managing the environments in which people live becomes more complex and difficult as human populations increase, demands on the natural resource base increase and new technologies are developed that let people, willingly or unknowingly, destroy their environment at a more rapid rate and with less effort than in the past. – H.M. Gregersen et al., “Integrated Watershed Management.”*

*More than any other single element besides trees and gardens, water has the greatest potential to forge an emotional link between man and nature in the city. Water is an element of wondrous qualities. – Anne Whiston Spirn, “The Granite Garden.”*

*Lasting change will only happen when thousands of individual residents and property owners begin to think about stormwater differently, and adopt good stewardship practices daily. –Anne Arundel County Watershed Stewards Academy Annual Report 2012.*



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## Chapter 1, Introduction

The provision and management of water are essential urban services. Necessary for population growth and dense habitation, they are critical to city building. In North American cities, local government throughout the late nineteenth and early twentieth centuries spent considerable resources on water management for basic needs, public health, sanitation, and fire-containment. It is difficult to imagine these projects being accomplished without centralized governments and their financial resources or the capabilities of banks. “Water carriage, with its economies of scale, created the need for central administration, and thus was an important factor in facilitating government integration,” writes MIT professor Eran Ben-Joseph.<sup>1</sup> Across American and Canadian cities, technical and medical professionals, land speculators, real estate developers, charitable aid societies, and old-money politicians allied to develop rationalist administrative bureaucracies.<sup>2</sup> Their interests ranged from achieving status to reducing poverty to blunting the political power of burgeoning immigrant groups, but their joint realm of action was the urban environment and in particular, its water.

These new commissions and departments operated extra-politically in their management of drinking water supply, stormwater, sanitation, and with the primacy of water-carriage for excrement, sewerage. Their responses to contamination or depletion of localized water sources were to construct dams, aqueducts, pumping towers, reservoirs, and treatment plants. Aqueducts brought water from pristine watersheds outside of the city. Treatment plants were typically located at the furthest point upstream of a city on a river or simply on the outskirts of a city on a lake. Meanwhile stormwater, sewerage, and even garbage removal relied on the purported diffusing and self-purifying properties of flowing water, either fluvial or tidal. The technological achievements of conveying and treating drinking water contrasted with the scientifically and economically cheap methods of stormwater disposal. Dr. Andrew Karvonen describes the stormwater system as a “jumble of natural and technical elements.”<sup>3</sup> The distinction between these two systems, drinking water and storm water, one “upstream” and the other “downstream,” was both physical and psychological. As wells and cisterns gave way to pipes and drains, local,

personal, and cyclical understandings of water in daily life were disrupted. Today, there is little connection between the water in one's sink and the street puddle one has to jump across on a rainy day.

The Clean Water Act, the Safe Drinking Water Act, and subsequent amendments represented monumental changes in the human relationship with the natural environment. Yet they also served to further codify the gross socio-technical bifurcation of the water cycle epitomized in 19<sup>th</sup> century city-building. These laws define in large part how the EPA, state environmental departments, and local entities manage water.

### Our Waters



- [Wetlands](#)
- [Oceans, Coasts, Estuaries and Beaches](#)
- [Watersheds](#)

### Drinking Water



- [Learn About Drinking Water](#)
- [Consumer Confidence Reports](#)
- [Private Drinking Water Wells](#)

Figure 1.1 Part of a screenshot of the EPA's "Learn About Water" webpage. Source: Learn about Water<sup>4</sup>

Out of the social and environmental movements which advanced this set of national legislation, actors have also involved themselves in solving locally the many water problems which have either been inherited from earlier eras or are emerging. These tremendous grassroots organizations like those of the Water Keeper Alliance are actively taking on policy creation and natural resources management roles once guarded by government.

By organizing constituents around long-ignored environmental units like watersheds, rivers, and bays, these organizations are challenging the political geographies and technical boundaries of water management. This study does not examine their organizing efforts or disputations in the spheres of institutional legitimacy. Nor does it aim explicitly to highlight the re-integration of water supply, stormwater, and wastewater management, although there are clear benefits to such a path. Instead, it considers the activism of environmental groups as one of several drivers that are changing the approach of



agencies in fulfilling their missions and in engaging with stakeholders. In the last two decades, there has been a proliferation of new strategies of outreach and revisions to existing strategies. The engagement has been multi-faceted, too: increasing fees for water services, developing huggable toilet mascots for public events, restricting irrigation to nights and mornings, training residents in construction of rainbarrels, paying homeowners to remove turf grass and helping community members host raingarden parties. This study looks at these different methods as a whole and analyzes their effectiveness for changing the behaviors and private landscapes of households.

For water utilities, while some of the strategies focusing on customers are new, many utilities have historically engaged customers in conservation. As an example, in the 1920s, Denver Water mailed advertisements to ratepayers with the reminder “water is furnished for use and not for waste.”<sup>5</sup> In the early 1980s, an employee at Denver Water coined the term xeriscaping to help build awareness for dry climate horticulture.<sup>6</sup>

For centralized stormwater agencies rooted in engineering, this readjustment of relationships with customers represents more of a landmark shift and it is not necessarily an easy one. According to Chris Kloss, Green Infrastructure Coordinator with the EPA’s Office of Water, “It is kind of a brave new world in the sense that water infrastructure has been in the public domain ever since its inception.”<sup>7</sup> Yet, cash-strapped environmental agencies are enlisting citizens and customers to assume an expanded role in problem-solving and management of water infrastructure. Stormwater department managers are learning from their peers in water conservation and their peers in rural extension programs who have more experience working with landowners to address trans-boundary environmental issues.<sup>8</sup> Increasingly, agencies use campaigns that focus on customers’ adoption of practices and behaviors as part of the toolbox to meet stormwater quality goals.

Not surprisingly, these agency efforts to change people’s uses of and impacts on water, which are so heavily mediated by infrastructure, have been challenging on the outreach side. Mae A. Davenport and Christopher A. Bridges, both formerly in the Department of

Forestry at Southern Illinois University, write “While agencies typically have standardized institutional structures, policies, and procedures and commonly a defined mission, communities themselves are often quite heterogeneous and individuals, interest groups, and organizations within communities commonly have very diverse perspectives.”<sup>9</sup> Bluntly, working with communities in the management of resources is incredibly different from managing projects internally or even coordinating across agencies. To understand why water utilities and departments have been motivated to undertake such transformations, one needs to explain the biophysical, financial, and regulatory conditions these agencies have faced in recent decades.

### **Stressors On Water Supply Infrastructure**

The acquisition, conveyance, and treatment of water have been critical to population expansion and urbanization in the U.S. It is part of the stories of cities like New York, Philadelphia, and Los Angeles. Particularly in the western U.S., the damming and diversion of rivers for agricultural, hydropower, industrial and population needs has been monumental. This “appropriation of huge volumes of waters from...ecosystems,” inter-basin transfers, and extraction from aquifers has created widespread environmental damage.<sup>10</sup>

If the environmental consequences weren't enough to spur a rethinking, competition with agricultural interests in the West is fierce. The adherence to division of water rights is carefully monitored, if also continually battled in various courts. Especially in the sunbelt, locales are having to devise how to distribute the same acre-feet of water rights to growing populations. As J.C. Davis, the Conservation Director at the Southern Nevada Water Authority said, “We're up on a high-wire and we have no net. People don't realize that most of the water in the Colorado River goes to crop irrigation, and they think we're the bad guy.”<sup>11</sup>

One of the greatest emerging threats to water supply in existing arid regions of the U.S. and Canada is climate disruption.<sup>12</sup> The patterns of precipitation and evapotranspiration on which ecosystems, and, in turn, water infrastructure have developed are changing as a

result of anthropogenic greenhouse gasses.<sup>13</sup> Shifts in climate patterns and more extreme weather events translate to more variability, while warmer winters are projected to decrease snowpack and reduce available snowmelt. Relating any single event to climatic disruptions is challenging, but human activities are affecting the climate extremes in the U.S., particularly heat and precipitation.<sup>14</sup> Some of the results have boggled expectations about how the natural world behaves. Lake Powell which supplies water to Las Vegas fell to levels 75% below average in 2002 after several years of drought.<sup>15</sup> As a more recent example, the Mississippi River at St. Louis, draining millions of acres of the Upper Mississippi and Missouri Watersheds, yo-yoed 45 feet between a near-record low at the beginning of 2013 and a near record high in mid-April.<sup>16</sup> In urban areas, there is evidence that weather-related “anomalies” are compounded: a reduction in vegetation and surface water reduces evaporation and transpiration, increasing the urban heat island effect and leading to reductions in total precipitation.<sup>17</sup>

Some of the effects of climate disruption are hard to predict, though. During the historic drought of 2012, New Orleans’ Sewerage & Water Board was confronted by an unusual condition. Despite being located along one of the major rivers of the world, freshwater flow was so low that a “saltwater tongue” from the Gulf of Mexico was moved upstream and threatened the water intake pipes. Points further south had to rely on shipments of water. The threat of saltwater intrusion is, of course, primarily applicable to coastal communities. However, inland communities may face other threats. The rate of replenishment of groundwater aquifers presents a real constraint to municipalities that rely on them, making them akin to fossil deposits like oil and gas.

At the same time, conservation is needed to preserve the often-fragile 170,000 drinking water systems across the country.<sup>18</sup> Using less water means lengthening the life-span of pipes and mains that have long-ago passed their design life. Annually, nearly a quarter million water mains break.<sup>19</sup> The 2013 *Report Card for America’s Infrastructure*, produced quadrennially by the American Society of Civil Engineers (ASCE), gives a “D+” grade to drinking water.<sup>20</sup>

The environmental constraints on new water supplies and physical limits of existing water infrastructure are compounded by financial difficulties. Even more so than other types of industry or utilities, water utilities are particularly capital intensive. The ratio of fixed assets to annual operating revenue is as high as 5 to 1.<sup>21</sup> Yet it is difficult for utilities to raise adequate capital, leading to delayed projects. The 2009 *Report Card for America's Infrastructure* estimated a shortfall of \$100-billion plus in drinking water and wastewater infrastructure over the years 2010-2015. Meanwhile, the State Revolving Loan Fund has decreased from a recent 2009 peak of \$2.83 billion in 2009 to \$917 million in 2012.<sup>22</sup> The 2009 *Report Card* tries to put these deficiencies in perspective with other spending on infrastructure. Funding "Clean and safe water is no less a national priority than are national defense, an adequate system of interstate highways, and a safe and efficient aviation system. These latter infrastructure programs enjoy sustainable, long-term federal grant programs; under current policy, water and wastewater infrastructure do not."<sup>23</sup>

Thus, for water utilities, the drive to conserve water and promote conservation among customers is at least partly financial. It is cheaper to save water than find "new" water and more reliable, given the potential for expansion of water supply to face legal hurdles under the National Environmental Policy Act. Much of the savings of water utilities is achieved through internal audits that identify leaks through sonar technology. As contributors of "non-revenue water," leaks are a high priority for action: excessive water use on the part of consumers may stress the built and environmental systems, but at least it represents revenue for the utility. Water that is lost in transport is not compensated. Despite the shocking backlog of investment needed according to the ASCE, water utilities are making investments as best they can. In addition to conservation measures, the tactics of utilities are broad and include challenging pressure levels mandated for fire-fighting, improving pump efficiencies, and optimizing water transfers among reservoirs and storage tanks.

Nevertheless, for water utilities to be able to meet current and future needs, they need to raise revenue and reduce consumption. Especially in the West and sunbelt cities,

residential customers are the largest class of water users and outdoor water use is one of the highest single category of water use. As a result, water utilities are directing conservation campaigns at households and the landscaping companies that serve their yards and lawns. Utilities rely on private action. Doug Bennett, Conservation Manager at the Southern Nevada Water Association describes the reasons for and benefits of working with different private sector actors:

If a golf-course goes and does 40 acres, that's 40 acres attributed to one customer, it would take 400 homeowners to do the same project because they have much smaller properties. Some programs will only cater to homeowners and in my opinion that's a mistake if you're truly trying to get water savings. It's politically appealing because the single-family homeowner is the voter, and so a lot of programs if they have limited funds, they'll steer it to single family homeowners because they're most likely to vote. If you're truly trying to get water savings, I'd much rather deal with golf courses, homeowners associations and apartment complexes.

Then again, if you're talking about how to get people to participate, to have ownership, you gotta have single-family homeowners in there. You have to have those 40,000 people because now you're starting to build momentum in the community where these people say that conserving water is one of their values, and they've actually touched it and done it and have it. So going out and dealing with a tiny minority of the population in specialized fields is not necessarily going to create a community movement.<sup>24</sup>

For Las Vegas, targeting high outdoor water users is particularly important because outdoor water almost all evapotranspires, whereas indoor water use is treated and discharged into Lake Mead, which is also the water supply source.

### **Stormwater Problems**

The preface to the National Research Council (NRC) study on Urban Stormwater Management in the United States begins, "stormwater runoff from the built environment remains one of the great challenges of modern water pollution control."<sup>25</sup> The fundamental hydrologic problem of the post-development scenario is the truncating of the water cycle (processes like interception, infiltration, and evapotranspiration) such that large volumes of water move quickly as surface runoff. Pre-development "vegetative layers, litter, duff accumulations," and soils made porous by micro and macrobiotic

creatures all absorb rainfall and reduce surface flow.<sup>26</sup> The NRC report describes the “transformation of the hydrologic regime” after development as a “wholesale reorganization of the process of runoff generation.”<sup>27</sup>

The increase in runoff from pre-development to post-development conditions can be as high as 200%, leading to areal flooding. A study from the Center for Neighborhood Technology which cross-referenced FEMA and private insurance claims in Cook County against federal flood plain boundaries found that there was no correlation between number of payouts in a ZIP code and location within a floodplain, suggesting that development conditions and not underlying hydrologic features were to blame.<sup>28</sup> As part of their Hazard Mitigation Grant Program, FEMA has given out more than \$200 million for flooding mitigation between 1989 and 2012. While that number includes grants for non-urban areas, it excludes amounts given for other precipitation-related events including severe storms (\$2.3B) and hurricanes (\$4.2B).<sup>29</sup> According to the Insurance Bureau of Canada, water-related losses caused by “sewer backup, urban flooding, and water damage” comprise 40% of “personal property insurance claims.”<sup>30</sup> Disruption of climate patterns is expected to lead to more intense rainfall events across eastern North America, exaggerating these patterns.<sup>31</sup>

In more topographically varied urban areas, the force of surface flows can have deleterious effects on private property, life, infrastructure, and habitat. The most extreme versions of these events are landslides and debris flows, however, “permanently increased stormwater volume is only one aspect of an urban-altered hydrograph,” according to the National Resource Council report. Increased volume also “contributes to high in-stream velocities which in turn increase streambank erosion.”<sup>32</sup> The consequent alterations in the geomorphology of streams are mirrored both in decreased aquatic and riparian diversity and also in biophysical alterations in downstream lakes, rivers, and estuaries. Meanwhile, the ironic but logical corollary to destructive wet-weather flows are reduced groundwater levels and flows and low dry-weather flows, which also degrade habitat.

Volume is not the only deleterious impact of water in the urban environment. Water is the universal conveyor, dissolving salts, suspending flocs, and moving debris.

Waterbodies that receive urban runoff suffer from organic and inorganic pollutant loading, high biochemical oxygen demand, microbial pathogens, increased turbidity and higher water temperatures. While eutrophication of lakes and estuaries has historically been caused by industrial agriculture and livestock runoff, increasingly, fertilizer from lawns and yards is the culprit.<sup>33</sup> Emerging contaminants, including pharmaceuticals and pesticides, are creating toxic cocktails of hormones, anti-depressants, and antibiotics in waterways.

In combined sewer systems, of which the U.S. has a shocking 772, overflow of untreated sewage causes not only significant ecological harm, but also public health threats and loss of economic activity.<sup>34</sup> These overflow events are not rare; some are triggered by as little as a tenth of an inch of rainfall.

The U.S. EPA has increasingly regulated stormwater since amendments to the Clean Water Act in 1987. However, the costs of compliance to individual cities with stormwater regulations have often risen well over \$1 billion. Kansas City has agreed to spend the equivalent of \$100million per year over the next 25 years as a settlement with the Justice Department and the EPA. St. Louis has agreed to spend \$4.7 billion over two decades as part of its consent decree.<sup>35</sup> While the original Clean Water Act included funding, the amendments did not, creating an “unfunded mandate.”<sup>36</sup> The National Research Council lambasts the EPA: “The lack of a meaningful level of investment in addressing the more complex and technologically challenging problem of cleaning up stormwater has left states and municipalities in the difficult position of scrambling for financial support in an era of multiple infrastructure funding challenges.”<sup>37</sup> The picture painted by the American Society of Civil Engineers in their 2009 national scorecard was equally ugly: “The nation’s wastewater systems are not resilient in terms of current ability to properly fund and maintain, prevent failure, or reconstitute services.”<sup>38</sup> This despite roughly \$20 billion per decade of federal investment in publicly owned treatment works and \$841 billion of non-federal spending on sewer and water infrastructure between 1991 and 2005.<sup>39</sup> A

number of interviewees talked about contributing to a fund shared among localities or about relying on completely external efforts to address certain aspects of stormwater management.<sup>40</sup> Amber Clayton, Stormwater Retrofit Program Manager in Portland, cited funding as a significant driver for a more distributed and landscape-oriented approach.

Given the lack of federal funding for sewer and stormwater projects, given the general economic climate, we know we need to be smarter with our money. And over the last number of years our bureau has been really engaged in an asset management approach. So instead of looking at expected useful life of our sewers and pipes and whatnot we are trying to replace things only where they need to be replaced, not just because some manual says that this type of pipe has an 80-year lifespan. Once you have that condition assessment, you can really start determining where the risk is in your system. We know where the capacity risk is because we've done modeling and monitoring so we know where the pipes are that aren't big enough. We can do that given today's conditions and in projections, a 2040 scenario, i.e., a full build-out given our land-use and zoning. So we can know where our problems are going to be in the future given today's infrastructure. Given the assessment work we've been doing, we know where the structural problems are; we know where our sewers are falling apart. So once you combine that, we know here's the areas we need completely new sewers, here's the areas that are fine but with stormwater projects we could leave the sewer in place for the next 10 to 15 years. It's a balance of trying to be as conservative as possible with spending the Bureau's money. So you invest a little bit up front in the research and you can reduce the amount of construction that you need to do.<sup>41</sup>

Meanwhile, population loss in many older cities has reduced the available capital that municipalities have to spend on aging infrastructure. In declining cities, the physical form of many neighborhoods may have reverted to a partially-developed landscape as plants re-inhabit blighted properties, but not at a rate fast enough to reduce the diameters of pipes needed for stormwater. Concurrently, suburbanization has led to water quality problems on an expanding and cross-jurisdictional scale.

In addition to being expensive, so-called “grey” or constructed infrastructure of pipes, tunnels and tanks take many years to be constructed, often decades. Nor is it clear that they solve more than a single issue related to stormwater management. The NRC authors write that “Urban municipal separate stormwater conveyance systems have been designed for flood control to protect life and property from extreme rainfall events, but they have



generally failed to address the more frequent rain events (<2.5cm) that are key to recharge and baseflow in most areas.”<sup>42</sup>

As part of legal agreements with the EPA or simply as best practices, many cities are investing in landscape-based stormwater control strategies that manage stormwater at the source. These practices go by several names: green infrastructure, high performance landscapes, best management practices, regenerative stormwater conveyances, non-point source pollution prevention strategies, low-impact design or low-impact development, soft stormwater control mechanisms, and aquatic resources conservation design. The differences in name belie their origins from different fields of practice, predilection for retrofit or new development, varying scope from site to watershed, and degree of focus from water to ecosystem. Yet all emphasize restoration or mimicry of the natural hydrological cycle. Inherently, they are distributed. Generally they tend to be small – the size of a tree pit or back yard – and vegetation-oriented, though they can be several acres and contain a mix of living and constructed systems. Proponents of green infrastructure tout improved bio-diversity and air quality, lower-ambient temperatures, slowed traffic speeds, reduced stress and crime, increased adjacent property values, compelling aesthetic experiences, and increased environmental awareness among the numerous co-benefits that are missing from conventional grey infrastructure systems.

However, there are a number of difficulties with the distributed approach. Managing water above ground and all over a city requires significant inter-agency coordination. Publicly-owned property is limited, the ability to achieve reductions in pollution loads or volume is also minor on a relative scale. Green infrastructure consists of living dynamic components which require both performance monitoring and significant maintenance. Finally, green infrastructure may be less expensive than grey infrastructure, but it is not without financial costs including increased difficulty of raising capital.

As a result of these pressures and considerations, local governments and agencies in charge of stormwater have started to partner with private institutions, engage with private property owners, and cajole developers to achieve their EPA- or State-mandated water

quality goals.<sup>43</sup> Achieving independent, private reductions in stormwater not only reduces the burden on the public system, but it costs less than using exclusively public funding.<sup>44</sup> Tim Kurtz, an engineer with the Sustainable Stormwater Management Program, describes Portland's downspout disconnection program, "The cost effectiveness was huge...For the amount of effort and materials that it took to make happen, it removed a huge amount of water and that really got the attention of not only residents but also policy makers, and people on the City Council, and folks here at the City."<sup>45</sup> Simply put, environmental departments and water utilities either cannot achieve stormwater quality goals alone, or are much more effective when working in partnership with the private sector.

These partners have included industrial, commercial and institutional entities. The large land area of factories, hospitals, university campuses and office parks owned by a single entity make them ripe for intervention. However, larger organizations also have their setbacks. Amber Clayton with Portland's Bureau of Environmental Services found that with national grocery chains or large developments, the internal bureaucracy led to difficulties. "It's a little bit of a round robin to try to find the right person to make this decision."

The local or regional contact may have to check with somebody else and they may not have an incentive to change, because the utility bills go to somebody in finance/accounting in some other state. So when the facility management doesn't have any direct relationship to the bills, that's a harder argument about financial incentives. The people paying the bills are just paying the bills. The people managing the facility want low maintenance, low risk. They may not be the right person to talk about changing practices or allowing stormwater facilities to make an impact on the bill. You may need to bring together the facilities people and the finance people to make an argument about financial benefits of stormwater management.<sup>46</sup>

This was true for multi-family residences as well.

Landlords or out-of-town property owners, they're just more difficult to engage. You need to invest more time doing outreach, trying to get in touch with, even finding out who the right person to talk to is, especially if there's a property management company in between tenants and the property owner. Often there's a lot of finger pointing "I don't know if I can make that decision, let me talk to this person." They're in the business – and this goes for multifamily as well – they're in the business of reducing risk, of reducing maintenance hassles.

We're asking this new thing of them and no one wants to take responsibility for changing what's currently working, there's a lot of "Ahhh, I don't know about that."<sup>47</sup>

By contrast, people who live in their own houses "are usually more engaged," according to Clayton. Fortunately, the majority of residents in the U.S. live in households with a homeowner. Homeownership peaked in the second and fourth quarter of 2004 at 69.2%, declining since then to a still large majority of 65.0% as of the first quarter of 2013.<sup>48</sup> In Canada, the homeownership rate for 2011, the latest year for which figures are available, is 66.8%.<sup>49</sup> The everyday activities people do in and around their homes produce the fertilizers, auto-related products, "bacteria and organic matter from pet waste," and sediment from construction which are the greatest sources of run-off pollution in urban and suburban areas.<sup>50</sup> These manifold small actions on individual properties accumulate as water moves down stream, creating a significant cumulative affect.<sup>51</sup> Yet according to an EPA guide for conducting outreach, "polluted runoff...is not being addressed by permits, laws, and regulations...most people don't realize that many of the things they do every day in and around their homes contribute to polluted runoff. Those individual behaviors need to be changed."<sup>52</sup> The diffuse quality of stormwater problems, the discrepancies between current regulatory mechanisms and daily activities and again between behaviors and environmental consciousness all recommend policy responses that specifically address the properties and households of single-family homes. Furthermore, the less intense use of land area of single-family homes as compared with highly urban, commercial land makes single-family households good candidates for stormwater management interventions. Single-family homeowners also tend to have more financial assets to contribute than renters. For whatever combination of reasons, "many of the most innovative stormwater management programs around the country are found in the suburbs of large cities," according to the National Research Council.<sup>53</sup>

At the same time, decentralized problem-solving is in vogue: from green infrastructure, which works to treat water at the source, to new online platforms for creating content and exchanging which put control in the hands of the user. Meanwhile, the green movement, while fraught with a vein of consumerism, has awakened an individual responsibility for

personal habits vis-a-vis the environment. Since the 1960s, a new tradition of public engagement has created an understanding that, according to sociologist Lois Wright Morton, the “multiple interests of the public are insufficiently represented through the managerial model” of watershed management.<sup>54</sup>

She writes that harnessing the collective potential of individuals to manage water is now the pertinent question and “the most intractable problem for watershed management.”<sup>55</sup> The brave new world entails the promotion of new behaviors by individuals and the adoption of new devices and landscapes on their properties through the use of different types of motivational mechanisms. Lessons from marketing and political campaigns have led to sophisticated outreach practices. On the whole, these practices fall into three categories: participatory and behavior-based mechanisms, regulatory and enforcement mechanisms, and financial mechanisms.<sup>56</sup> The goal of undertaking this research was to understand what mechanisms are most effective. “Water resource managers and other professionals are increasingly investing often scarce resources in communication, education, and outreach programs that promote citizen and landowner adoption of conservation practices. However, as environmental practitioners and social scientists have long known, changing human behavior can be a daunting task,” reflects associate professor Mae A. Davenport.<sup>57</sup> This study reviews the three different methods for motivating customers to adopt different behaviors and landscape practices as a way, in turn, to manage water resources and infrastructure. As with any new policy, the question is: How well does it work and under what conditions?

## **Methodology**

To identify best practices and case studies, the author reviewed existing conference proceedings of professional associations, water and environmental advocacy organizations, and the EPA. Agencies and entities were identified through these publications as well as through searching key terms on the Internet. Appropriate individuals at these entities were also identified through publications, conference presentations, and searches of staff on organization websites. Informants included staff from the EPA, as well as from national environmental organizations, professional water

associations, stormwater advocacy organizations, and policy entities. Forty-two people were contacted at 24 different organizations. Interviews were conducted with 17 of those initial 42 contacts, while email exchanges transpired among several more. The interviews were conducted during spring 2013 to identify both the various types of levers for adoption of practices, as well as those places where efforts already undertaken were highly regarded and could serve as case studies. Additionally, a request for information and interviews was distributed through a list-serve with the American Public Works Association. Through this entire process, 43 potential case studies were identified. Final case studies were chosen based on the frequency with which the cases emerged from written materials and conversations with informants. Two exceptions to this logic were made. First, in order to focus on generating new knowledge rather than reviewing existing research, Philadelphia, which has been widely studied, was excluded. Second, Given the historical, climatological, and ideological similarities between Portland and Seattle, the author decided to exclude Seattle. Ultimately, 19 informants were interviewed about 11 case studies. Appendix A lists the names and organizations of people contacted and interviewed.

### **Study Scope**

The introduction has attempted to describe the development of water utilities and municipal water departments within centralized municipal government. It has also explained how the challenges faced by these entities – environmental, fiscal, legal, socio-political, and technical – have caused them to change course. If they were once run within various shields of exclusion, today they are seeking partnerships with environmental organizations, businesses, institutions, and individuals in meeting their goals.

Chapter 2 discusses the current usage and effectiveness of regulatory mechanisms to alter private water consumption and stormwater management. While watering restrictions and other mandatory watering practices are widespread, they are always accompanied by other measures, including enforcement and outreach. Furthermore, they are enacted as a

strategy to respond to drought conditions, linking them to temporary phenomena and potentially undermining long-term behavior change. Coercion requires reinforcement; it is not internalized. This resource-intensive but externally-oriented approach represents a sort of half-shift toward adoption of best practices by customer.

The effectiveness of regulations to manifest stormwater management best practices on private property seems to be disappointingly low due to a mismatch among federal water regulations, local building codes and landscape ordinances, and the general character of stormwater problems. Tackling regulations is an important step to improving stormwater, but as much if not more so from a planning perspective than from a personal behavior perspective.

Chapter 3 discusses the use of price signals and financial levers to incent different private practices. Water block rates increase the price per gallon of water as a customer uses more water, attempting to separate the individual's personal water market for different uses. This has been an effective mechanism at reducing water consumption. Stormwater utilities are also charging private property owners, though on the whole, at a price level that is too low to incent a single-family homeowner to manage stormwater on site. Financial reward programs for landscape practices that are attuned to climatic conditions have been successful. Potential for expanding these cost-share programs which provide rebates or subsidize the cost of landscape actions lies in innovative finance structures.

Chapter 4 begins by defining the limits of conventional outreach campaigns. Then it describes components of behavior campaign strategies that entail careful demographic analysis of the audience in question and readjust the balance of barriers and incentives that determine whether those audience members perform the targeted activity. Instead of utilizing financial incentives, this campaign method, called community based social-marketing, relies on psychological and social incentives.

Chapter 5 provides a summary of the different strategies in comparison with another. It also gives recommendations for agencies and water utilities to increase the effectiveness of the strategies described.





## **Chapter 2: Regulatory and Enforcement Mechanisms**

Regulations are legal directives issued by an executive office or an authority having jurisdiction over an issue or group of people. In theory and often in practice, regulations compel people with the threat of punishment to engage in or refrain from activities which they otherwise would not. The definition carries the potency of its etymological origin, *rex*, the Latin word for king. Regulations are pertinent to water conservation and stormwater management as a method of creating a baseline of expected action – a mandated norm. As a lever to induce conservation behaviors, the degree to which regulations are, in practice, accompanied by other levers like outreach suggests they are not particularly effective on their own. As for stormwater management, regulations currently seem to work as a barrier to adoption rather than a pathway. Even if single-family households are rarely punished for pursuing illegal stormwater management, practices that are illegal under existing codes present individuals with, at the least, a perception of risk. It also limits the ways in which agencies and environmental advocates can promote personal responsibility in stormwater management.

### **Water Supply**

The intention of watering restrictions is to ensure an adequate water supply to meet critical needs like health, hygiene, and fire-fighting over a long time period. Restrictions are typical tools of water utilities in arid areas especially during times of drought.<sup>1</sup> Municipalities or water agencies may also choose to pass laws restricting water during the summer when there is the greatest mismatch between demand and supply. Additionally, the rights of competing water users including federally-protected species may limit withdrawals from water bodies.

Despite the seeming stringency of mandating against behaviors like watering a lawn or washing a car, water use restrictions are indirect. They are not based on a certain absolute volume limit. Instead they curb the most voluminous and conspicuous segment of residential water use, outdoor usage, during the least efficient time of use, mid-day.

But someone could wash their vehicle in the garage or run a bath all day long without legal ramifications.

The study on residential end uses of water which is most widely cited, including by the EPA's WaterSense program website, found that roughly 145% more water was used outside the house than inside.<sup>2</sup> A 2005 estimate by California's Natural Resources Agency Department of Water Resources pegged outdoor residential water use at 120% of indoor residential use.<sup>3</sup> Additionally, outdoor water use restrictions are the least likely to cause hardship or reduction to well-being. Finally, outdoor water use can be monitored with minimal technology in real time by water department staff and neighbors. These factors make outdoor water a good target for rationing.

When an agency does restrict outdoor water use, it is typically done on a gradual level. For instance, day-time outdoor water use may be prohibited but water use may be allowed at night. Or certain neighborhoods, sides of the street, or residences with odd address numbers may be limited to certain days of the week. Below is a table of outdoor summertime water use restrictions for the region of Waterloo, Ontario. During higher stages of drought, the types and frequency of uses become increasingly prohibited and the fine for illegal water use increases correspondingly.

**STAGE 2 OUTDOOR WATER USE RESTRICTIONS  
EFFECTIVE MAY 31 – SEPTEMBER 30, 2006**

REGION OF WATERLOO OUTDOOR WATER USE BY-LAW SUMMARY OF RESTRICTIONS			
Program Levels	Status Quo Stage 1 (on all time, voluntary 10% reduction)	Stage 2 (voluntary 20% reduction)	Stage 3 (mandatory 20% reduction)
Wasting Water	Local Municipalities' Odd-Even By-Laws	Prohibited	Prohibited
Watering Lawns		Once Per Week With Time Restrictions*	Prohibited
Watering Treated Lawns		Water Within 24 Hours	Prohibited
Watering New Lawns		7 days with time restrictions*	Prohibited
Watering Trees, Shrubs, Flowers, Gardens		Alternate Day With Time Restrictions*	Hand Watering Devices Only
Water Sports Fields		No Restrictions	Once Per Week With Time Restrictions
Top-Ups, Permanent Residential Swimming Pools		Alternate Day With Time Restrictions*	Limited or Prohibited
Residential Vehicle Washing		Alternate Days With Time Restrictions*	Prohibited
Decorative Fountains		Must Recirculate Water	Prohibit Filling
Washing Streets, Driveways, Walkways, Buildings		Prohibited	Prohibited
Fines		\$150 per offence	\$225 per offence

DOCS#266255

\*Time restrictions are 7:00-10:00 a.m. and 7:00-11:00 p.m.

\*Alternate days means addresses with even numbers can water on even-numbered dates and odd-numbered addresses water on odd dates.

Figure 2.1 Outdoor Water Use Restrictions for Waterloo Ontario

Source: *Water Efficiency: A Guidebook for Small & Medium-sized Municipalities in Canada*

The Ontario Low Water Response Program gives conservation authorities the responsibility to establish teams to monitor drought conditions based on a number of variables, including precipitation, stream flow, and stored water. When conditions reach the middle of a three-tiered scale, municipalities are encouraged to pass by-laws to restrict non-essential water use. Emergency restrictions are applied during a limited period and lifted when conditions improve.

A guidebook on municipal water efficiency published by the Ontario Water Works Association found a number of successful cases of water restrictions. The Greater

Victoria Water District achieved a 20% reduction by enacting watering restrictions, while watering restrictions implemented in Ottawa-Carleton during a drought lowered use by almost a third.<sup>4</sup> Without knowing anything about the contexts of each of the restrictions, one might infer that compliance with restrictions is higher during a drought, when media - and the natural environment – relay signals about the need for reduced water use. Adoption of water conservation practices during an emergency seems like an easy message to sell precisely because it is temporary. In contrast, mandatory reductions based on, say, accommodating future population growth, seems bound to face opposition.

From a policy standpoint, voluntary compliance is the ideal response of a population to a regulation, with obedience based on the threat of enforcement an acceptable situation. In this way, restrictions always rely on compliance or enforcement. If commands are not obeyed, their compliance is enforced. Practically carrying out enforcement can be a drain on resources. Enforcement is minimally difficult with a single entity, such as one's own child, but is much more difficult with a diffuse audience, such as an entire town. The report by the Ontario Water Works Association concedes as much:

The effectiveness of watering restrictions in curbing peak demand depends on the manner of their implementation. Restrictions that are well publicized, that are accompanied by public education explaining the reason for the restriction and describing effective watering practices, and which are enforced, if necessary, have greater chance of success.<sup>5</sup>

To restate, regulations, as one lever intended to change individual behavior, also have to rely on some other type of lever, such as outreach, financial dis/incentive, or punishment. Oddly, regulations have to be promoted or enforced. They are not effective in and of themselves but require a certain additional level of engagement with the public and, therefore, resources.

The necessity of promoting regulations was described in detail by Melissa Elliot, Manager of Conservation at Denver Water.

We always, even in times of non-drought, have water-waste rules that we enforce. We have a team of what we call our water savers. We hire 9-10

temporary employees during the irrigation season and they work for us for about 6 months, and they actually patrol, and they are in branded cars, they wear branded uniforms. We have a group that rides bikes on Saturdays. Our rules are that you can't water more than three days per week, you cannot water between 10 am and 6 pm because of evaporation, you can't let water run off your lawn, you can't have broken heads.

We actually have a hotline that people can call and report waste as well. And then we'll send a crew out. So they are constantly in motion. We talked to over 6,000 customers last year about their water usage, but their primary goal is to stop and talk to people first, explain what we're doing, be nice. They're not there to ticket people – although we do have the ability to do that if it's egregious and continues

....

The vehicles that they're in are orange. They've got "waste is out." We drive fuel-efficient vehicles; they're wearing a specific uniform. We hand out, like if we see someone doing the right thing, like if we see someone washing a car with a shut-off nozzle, we'll stop and say thank you. So there's a lot of positive re-enforcement that comes about. We'll actually hear from people who've talked to our water savers and hopefully hear that it's a positive experience, rather than "stop doing that." In drought it's a little different because we're really trying to up the ante.<sup>6</sup>

What Elliot describes is an effort to alter the method of enforcing compliance. Chapter Three discusses norms in more detail. However, it is worth quoting briefly from environmental psychologist Doug McKenzie Mohr who has written extensively on the subject, most notably in *Fostering Sustainable Behavior*. He writes that compliance creates a change in behavior that lasts only as long as the threat of enforcement remains tangible.<sup>7</sup> "Once the rewards and punishments are removed, the gains made by using compliance tactics are often lost. While compliance techniques can have substantial impacts upon behavior, often they are not cost-effective to administer."<sup>8</sup>

The attempt at a more friendly exchange by the Denver Water staff is an attempt to transform compliance into what McKenzie-Kohr calls "conformity," or adherence to norms of behavior based on a belief that it's "the right thing to do." The tone and tenor of the communication serves this end, although distinguishing between the two forms of behavior change may be difficult to assess.

In San Antonio, Texas, as well, it is unlawful to have water from an irrigation system exiting a lawn and flowing down the street. The San Antonio Water System (SAWS) hires off-duty officers to patrol and enforce water regulations. Of course, “You can only get a ticket if an officer catches you violating the rules...[and SAWS] can only hire so many officers on a part-time basis and they can only work so many hours a week.”<sup>9</sup>

The San Antonio Water System assigns officers targeted patrol areas based on knowledge of irrigation system locations (based in turn on water use) and from apparently thousands of citizens calling to report wasteful behavior of their neighbors.<sup>10</sup> This citizen-based policing of norms suggests that some residents have internalized the restrictions or desire fair implementation of the law. However, it is difficult to analyze or predict the degree to which such community enforcement can be expected. Suffice it to say that regulation without enforcement is potentially ineffective. The enforcement that does exist functions like outreach, calling into question the usefulness of having regulations at all.

Robert Glennon, author of *Unquenchable*, describes disparagingly the current methods of regulating water use:

Conservation standards fraught with complexity, thereby requiring elaborate monitoring programs, may not be cost-effective or achieve meaningful results. Mandatory programs require the government to allocate resources to enforce the rules. This demands either ‘sprinkler police,’ a questionable use of trained law-enforcement personnel, or a second class of administrative officers who write tickets for violations.<sup>11</sup>

Lois Wright, a sociologist at Iowa State University is even more severe in her assessment: “Sanctions are costly to monitor and enforce and often do not motivate people to voluntarily engage in practices that lead to better water outcomes. Further, they do not create or reaffirm a conservation ethic nor reproduce values or reasons for maintaining high water quality.”<sup>12</sup>

And finally Doug Bennett, Conservation Manager at the Southern Nevada Water Association had a special perspective about the helpfulness of enforcing the plant selections of recipients of a turf-replacement rebate:

The average participant in our program saves 75% of the water they were using on their lawn before. Obviously I want to take those who didn't do very well and find ways to make them perform better. But it's not worth chasing, not worth policing every tree plant bush shrub, "oh you used a high water use plant, you don't qualify." Over time, what you create instead of having 50,000 advocates for the program that recommend it to their peers, you wind up having 8,000 people who say how horribly hard it was to comply with the bureaucratic regulations and they can do a lot of damage to the program. You want someone to do it, to be proud of what they did and to maintain it, and to recommend to their next door neighbor that "it's really easy, you should do it, too."<sup>13</sup>

In Bennett's opinion, enforcement runs the risk of alienating the customer base. To be successful, enforcement must operate in a narrow realm of behavior response. Without any negative response, the regulations will be undermined. Too strong a response will create resentment and motivate people to disobey with verve.

### **Stormwater**

In some ways, regulations might be the most obvious avenue for making individual actors accountable for the volume and quality of stormwater discharged from their property. Under the Clean Water Act, the EPA regulates discharges to waterbodies across the country. The 1987 Water Quality Act amended the law, legislating that the existing National Pollutant Discharge Elimination System (NPDES) issue permits for Municipal Separate Storm Sewer System (MS4s) discharges. That is, stormwater runoff conveyed and collected in city pipes and discharged at discrete locations to waterbodies fell under the regulatory purview of the EPA.

However, the historic (pre-1987) regulations directed at point-source polluters are and were relatively easy to implement. The pollution at the end of a pipe comes from a single entity. In this setting, regulation has been effective, says Becky Hammer, attorney at the Natural Resources Defense Council.

Point sources are fairly well managed through the current regulatory system. The whole NPDES permitting program was designed for traditional source – a treatment plant, a facility with a pipe that is dumping pollution into a waterbody as opposed to stormwater which is a whole bunch of sources each with a small impact individually but cumulatively a huge impact. The current permitting program is less well able to manage that.<sup>14</sup>

To begin with, there are roughly 7,000 MS4 permittees, of which 1,000 are for population centers of 100,000 people or more.<sup>15</sup> The discharges from those entities comprise runoff from many square miles and thousands if not tens of thousands of distinct property owners. The 1987 amendment to the Clean Water Act worked nicely from a legal standpoint: it grafted new authority onto an existing law. However, that stratagem has resulted in a misfit between the newer program's goals and its authority. It has failed to accommodate the vastly different circumstances by which point source and non-point (but-discharged-at-a-single-point) water pollution are created. It also has been "hampered by its association with a statute that focuses primarily on specific pollutants and ignores the volume of discharges."<sup>16</sup> The NPDES permitting system for MS4s does not necessarily create a model for those MS4 permittees in turn to regulate individual property owners to manage stormwater run-off. Rather it creates six minimum control measures which include outreach, public involvement, illicit discharge detection and elimination, pollution prevention, and two construction-related measures.<sup>17</sup> New or additional regulations on the performance of private properties are unlikely, according to Nathan Gardner-Andrews who serves as general counsel to the National Association of Clean Water Agencies:

Regulations are a land use issue, private property limitations. There's no one in this country whose council wants to [use regulations to manage stormwater]. That approach creates an immediate push back. You get a lot better response with the carrot approach than the stick approach.<sup>18</sup>

His assessment was echoed by another attorney, Becky Hammer, with the Water Program of the Natural Resources Defense Council.

Usually when we think of regulations being used for stormwater management, we think about new development and redevelopment, requiring developers to build this stuff into properties at the outset. But in terms of getting regulations



for properties with people already living in them, no one in 2013 America is going to pass any sort of law or regulation saying every homeowner in the city has to plant a raingarden. That's just not something that's politically feasible, or maybe even desirable.<sup>19</sup>

These opinions might be enough to suggest leaving the regulatory lever of municipal regulations in the “off” position, were it not for the unfortunate reality that the lever has already been turned “on.” Stormwater and drainage is part of existing plumbing codes like the Uniform Plumbing Code that have “been on the books” for many years. Owing to their objectives of creating standards of construction and their history originating from technical bodies, these codes work against a decentralized, green approach.<sup>20</sup> A report by the Natural Resources Defense Council found an array of regulatory impediments to adoption of stormwater best practices on private property.

Quite often there are legal, institutional, and political obstacles that reinforce status quo stormwater or sewage management practices and behavior — and even prohibit the use of certain [Low Impact Development] practices. Development standards, building codes, and zoning regulations are the most likely source of such legal impediments. Public health and safety regulations may also limit LID practices.<sup>21</sup>

According to the Clean Water Alliance, “municipal codes and ordinances have not evolved with the science of green infrastructure and historically favor gray over green infrastructure.”<sup>22</sup> The above study of the Washington, D.C. Plumbing Code found that Section 1101.2 required stormwater run-off to drain either to the sanitary or the storm sewer.<sup>23</sup> That requirement is typical to local plumbing codes and not without reasoning and good intention. Stormwater emptied from a downspout at the side of a building may lead to basement flooding and structural damage. Sheetflow race across properties, it can erode soil, and it presents a particular threat in steep areas for landslides and areal flooding. Poor site drainage creates attractive breeding habitat for mosquitoes.

Nor is preference for existing standards by municipalities and state boards terribly surprising. Like other laws, regulations rely heavily on precedent. They are not easily revised. In his book, *Code of the City*, Eran Ben-Joseph describes the weight of codes:

Because they emanate from and are endorsed by a professional source, considered by default to be an ultimate and indisputable authority, such standards are assumed to be accurate, scientific, and based on empirical research. At a minimum, beyond the question of their appropriateness for all situations, these standards are depended on and defended as the solutions to the problems of designing critical infrastructure.<sup>24</sup>

However, until restrictive regulations on stormwater management in a locale are changed, many privately-employed stormwater best management practices are beyond the pale. Simply put, no government-led public outreach campaign can promote downspout disconnections or rainwater harvesting if they conflict with standing law. At present, national-level best practices often do conflict with state and local codes on stormwater harvesting and management.<sup>25</sup>

While it is rather unlikely that a city or state board would prosecute single-family homeowners for being in violation of a code on a whim, there is nevertheless a risk in certain practices which homeowners might find unacceptable. Landscape changes that are unfamiliar can draw the scrutiny and ire of neighbors. Real estate agents often analyze home improvements under the lens of their impact on resale value. Certain modifications or amenities are seen as highly valuable, while others are seen as eccentric and thereby limit the pool of potential buyers. Additionally, modifications that are out of compliance may prevent a future owner from receiving loans or insurance unless they are resolved. These type of risks would deter both current homeowners and future ones.

Certainly building codes and by-laws are changeable and do change. As an example, the 2006 Uniform Plumbing Code added language to its chapter on storm drainage which reverses previous editions. “1101.2 Storm Water Drainage to Sanitary Sewer Prohibited. Storm water shall not be drained into sewers intended for sanitary drainage.”<sup>26</sup> Like other standards, plumbing codes refer to multiple sets of regulations: those set by a professional association, the International Association of Plumbing and Mechanical Officials, and those set by government entities. Often locales are regulated both by State and municipal plumbing codes. In 2012, the Uniform Plumbing Code

added an entire new chapter, “Nonpotable Rainwater Catchment Systems.” Plumbing codes related to re-use and grey-water use are also evolving. Like other indoor plumbing codes, these are more applicable to contractors and builders. They determine the baseline of impact possible through customers’ everyday behavior. But they do not motivate customers to change their actions.

In Portland, Oregon, the downspout disconnection program disconnected 54,000 downspouts on 26,000 properties over a roughly twenty-year span.<sup>27</sup> The program is part of an ordinance that includes an enforcement component: “Any property whose downspouts have not been granted an exception and remain connected to the combined sewer system in violation of Subsection 17.37.030 B.3. is hereby declared a nuisance and subject to abatement or correction.”<sup>28</sup>

According to the ordinance, failure on the part of the property owner to take action may include the city “abating this nuisance on subject property,” suing the property owner, or withholding Bureau of Environmental Services services, including permitting. The city is entitled to charge a \$300 administrative fee that can be made a lien on the property after 90 days.<sup>29</sup> While the ordinance did include a control or enforcement measure, the program provided free technical assistance to property owners in disconnecting their downspouts – or offered a \$53 rebate for any property owners who disconnected downspouts themselves.<sup>30</sup> In this way, the regulation was a final resort rather than the primary lever through which adoption of the practice occurred. Nevertheless, without the regulatory change, downspout disconnection would have remained illegal and the program would have been impossible.

Another type of code that often works against stormwater management is a landscaping ordinance. Landscaping ordinances are particularly strong in gated communities who use covenants to ensure property value through standards of design and appearance. However, they are common in cities as well where messy vegetation becomes associated with rodents, crime, and the Broken Windows theory. Vegetative hegemony was one of the dilemmas cited in Clean Water Alliance’s “Barriers and Gateways to

Green Infrastructure. “Native plantings can be in conflict with local weed ordinance (i.e. mowing grass at 8” height). A notification to Code Enforcement is needed to avoid citation of native planting as weeds.”<sup>31</sup>

Regulations to manage stormwater on private property have been most successful beyond the realm of most residential households: new construction. Assuming population growth and a certain replacement rate or densification of housing stock, regulations on development may be an effective long-term strategy for improving stormwater management on private property in existing urban areas. For instance, Chicago’s Stormwater Management Ordinance applies to new development or redevelopment above 15,000 square feet, too large for single-family homes but applicable to many multi-family projects. In urbanizing areas, land use regulations are the most powerful tools for maintaining hydrologic function. Though both important planning tools, such types of regulations are beyond the scope of residents’ daily lives.

## **Conclusions**

Generally, regulations related to stormwater have been a hindrance to participation in new types of behaviors and landscape best practices by single-family households. Although they have been effectively employed at the land use and new construction scale, their application to residential settings under current building codes represents a severe limitation. While there are both water conservation and stormwater regulations that determine new construction – for instance turf is banned in front yards of new houses in Las Vegas - by and large watering restrictions and regulations for existing households work in very different ways from each other. Watering restrictions aim to control behavior. Stormwater regulations aim to control physical elements of a property. The enforcement component of regulations and the staff needed makes regulations better suited to a sub-sect of the population than the entirety of the population. As an analog, it is easier to regulate bars than it is to regulate every drinker. One option might be to make compliance with watering restrictions the responsibility of homeowners associations or private security districts.

## **Chapter 3, Financial Levers: Rates and Incentives**

Pricing water use and stormwater runoff is an excellent first step at encouraging behavior change and property modification. The financial costs represent a sort of penalty, the impact of which grows as pricing increases. Currently, water conservation pricing is both much more sophisticated than and also attuned to the individual household market than stormwater runoff pricing, which needs to be raised and strengthened as a policy lever in order to motivate action. Finally, there is a tension between using price to achieve behavior change among a population and using it to generate revenue. Depending on the elasticity of demand, raising the price of water may lead to one or the other.

Financial incentives for implementing landscape practices seem to be quite successful for both conservation and stormwater management programs. A number of methods can help to determine what price people are willing to pay or be paid for landscape services, although several psychological factors indicate that these price-points are flexible.

### **Water Supply Rates**

From the viewpoint of the customer, water can be assumed to be a good like other economic goods. Micro-economic theory teaches that price is “an essential incentive mechanism” because it involves trade-offs.<sup>1</sup> The degree to which purchasing responds to a change in price is called price elasticity, expressed mathematically as the percentage change in quantity demanded over the percentage change in price. One of the aspects that determines elasticity is the degree to which substitute goods are available. Water is generally considered to be inelastic because there are no good substitutes.

However, when water use is divided among the variety of different actual uses, one can begin to see that there is a range of substitutes. An increase in price leads to reduced water use when there are substitutes, but only to increased revenue and not water conservation when there are no good substitutes. Broadly, water use falls into two categories: indoor water, composed of personal hygiene and food preparation, and outdoor, comprising landscape. Using a baseline study called “Residential End Uses of Water,” one can break

down each of those categories by average usage in gallons per capita per day.<sup>2</sup> By gallons, indoor water use includes shower, 11.6; clothes washer, 15.0; toilet, 18.5; bath 1.2; faucet, 10.9; dishwasher, 1.0; other domestic and leaks, 11.1. The total water use indoors is 69.3 gallons. But the outdoor water use is significantly more: 100.8 gallons. A recent, but smaller survey, of locales in the southwestern U.S. found water used indoors and outdoors more evenly split (Figure 3.2).

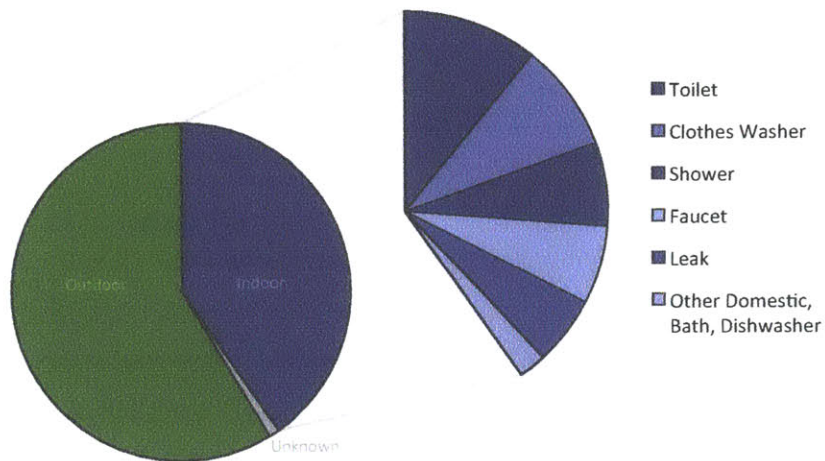


Figure 3.1. Breakdown of Indoor and Outdoor Water use<sup>3</sup>  
 Source: Residential End Uses of Water

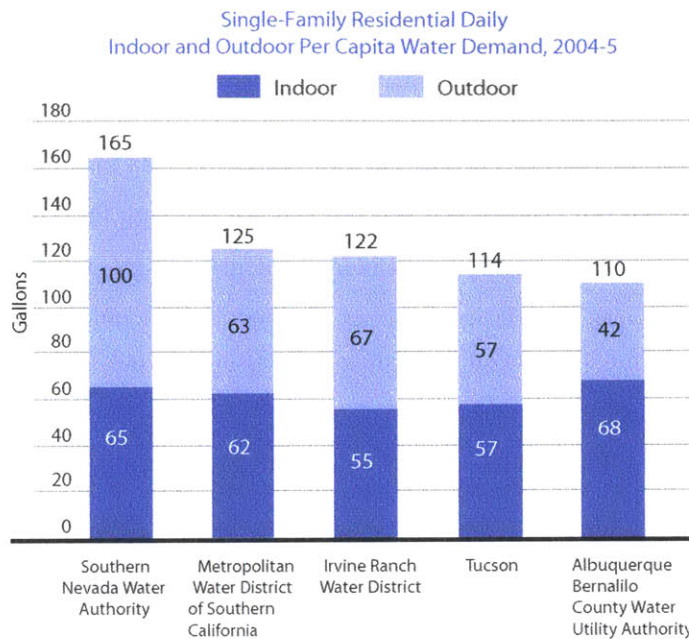


Figure 3.2. Comparison of Indoor and Outdoor Water use in the Southwest<sup>4</sup>  
 Source: Arizona Water Meter, a Comparison of Water Conservation Programs in 15 Arizona Communities

Given that outdoor water use seems to be the highest single category of water used by households, it is wise to assess the degree to which there are substitutes for that water. That is, how elastic or inelastic is outdoor water demand? Assuming outdoor water is used for landscaping, there is a near perfect substitute for outdoor water: rain. While weather is not entirely predictable and much of the western U.S. has an arid climate, precipitation is evenly distributed across a property, requires no effort and is free. When it rains, irrigating a lawn is not necessary and perhaps even damaging, though far too many sprinklers continue to run in the rain. In theory and in practice, rainwater harvesting can provide irrigation between precipitation events. While outdoor water composes the largest use category for a utility, there is a near-perfect substitute, rain, that quickly reduces the demand for piped water and are relatively fair substitutes.

Additionally, there are numerous substitutes for the service provided by water: an attractive symbolic and recreational landscape. Astro-turf, alternative ground covers, a more crab-grass filled lawn, spray-painted dead grass, or a meadow of native plants are all substitutes,

some better than others depending on one's individual preferences. All of these outcomes are achievable without using treated and piped water.

Outdoor water use is highly discretionary and therefore also very elastic. What about leaks, are there substitutes for the water used? What services do leaking faucets provide? None. However, water is priced so cheaply that it is less expensive to pay for a leak than it is to pay for plumbing services. For leaks, the price elasticity can be imagined to be rather elastic. As the price per gallon of water increases, hiring a plumber to fix the leaks becomes more and more cost-efficient.

Even the water used in food preparation is not completely inelastic: as the price of water rises, at a certain point, it becomes cheaper to eat out, consume dry foods, order delivery, or eat pre-packaged meals with disposable plates. Personal hygiene can also be sub-divided based, in part, on substitutability. Hand washing can be replaced with hand sanitizing. Showering could be replaced with bucket showering. Water used for toilet flushing and clothes washing could be replaced with harvested rainwater, though many current plumbing regulations limit this.

All of this is to say that water use contains vastly different types of utility or services, and therefore markets, range of substitutes, and price elasticities. The price per gallon that someone would be willing to pay to water their lawn is different from the price per gallon that that same person would be willing to pay to run their dishwasher, which is different, in turn, from the price per gallon they would be willing to pay to take a shower.

While utility companies cannot create different markets for each of these uses, pricing water is a first step. Pricing mechanisms make water conservation in the personal best interest of households. Additionally, and in contrast to prescriptive conservation measures, price signals also allow households the freedom to conserve "according to their own preferences."<sup>5</sup> On the market-wide scale, pricing creates "heterogeneous responses...across households, resulting in substitution of scarce water from those households who value it less, to those who value it more."<sup>6</sup>



This market-based approach is often advanced as a more effective conservation strategy than command and control approaches. What is difficult about it is to determine how to price the water to achieve conservation goals. On average for urban households, the price elasticity of the price of water is such that a 10% increase in price will decrease demand by 3-4%.<sup>7</sup> However, price elasticity is not constant along a demand curve, it is determined for a marginal increase. In plain language, raising the price of water decreases its use. Yet at a high starting price, raising the price of water will decrease its use a lot; at a low starting price, raising the price will only decrease it a bit.

Mathematically or technically, a utility with a cheap price for water would have to raise the price of water a good deal to see a significant change in total demand, an action with the potential to generate “rate shock, with both economic and political consequences” for the utility.<sup>8</sup> Since they are monopolies, water utilities are heavily regulated and not permitted to raise rates of their own accord. Elected members of bodies that regulate water utilities are happy to resist efforts to raise prices as a show of protecting their constituents’ pocketbooks. “...[E]ven a well-justified increase in rates can be controversial.”<sup>9</sup> A presentation from a recent conference caustically titled the situation of political maneuvering to achieve rate increases “The Care and Feeding of Policy-Makers.” Different policy-makers were described as either labs, collies, or chihuahuas.<sup>10</sup> Essentially, water is seen as a right, so raising its price meets significant push-back. (As with other utilities, water utilities may defer or forgive charges of low-income rate-payers as a political tactic.) In summation, using pricing as a lever can be politically difficult, yet it is necessary to motivate consumers to conserve.

Graham Symonds, Chief Technology Officer and Senior Vice President of Regulatory Affairs & Compliance at Global Water Management, described the price problem succinctly: “the price of water does not effectively signal conservation.”<sup>11</sup> Water is provided at a very low rate compared to other necessities and services. For an average four-person household in 2011, only 1% of total expenditures went to water.<sup>12</sup> While nearly 7.5% of total household expenditures were for utilities generally, more than twice as much was spent

on electricity or telephone services than on water. The EPA considers affordability of water rates to be 2.5% of median household income.<sup>13</sup> On average, the four-person household spends \$53.42/month on water; a single person spends about half that.<sup>14</sup> If water is cheap but consumers are told to conserve, either through education or restrictions, the conservation message is diluted. Why treat as precious something that is financially cheap?

The best, though not perfect, solution is to charge users a higher price per gallon as they use more. The different rates at which consumers are charged are called block rates. For example, the first 10,000 gallons of water may be charged at a rate of \$0.20 per gallon while the next 10,000 is charged at a rate of \$0.35. A tiered rate assumes a certain baseline of indoor water use for hygiene and food preparation, so-called non-discretionary uses. Adjusting the price on non-discretionary water use “may have little effect except to increase bills and exacerbate concerns about the affordability and regressivity of utility costs of households,” writes Janice A. Beecher in *A Primer on Water Pricing*.<sup>15</sup> While revenue is an essential component of utility management, raising the price on water in an inelastic segment of the demand curve is not an effective way to reduce water usage.

However, discretionary outdoor water use is elastic, so a small price change will decrease water usage and a large price change will decrease water usage a lot. In reality, since the types of uses are not monitored, the block rate is based only on volume. Still, the tiered rate uses a pricing mechanism to encourage consumers to use less water, while preserving the affordability of basic, non-discretionary water uses. The block structure is the closest the utility can come to separating out the different types of markets and also assuages opposition to rate increases.

This conservation-oriented pricing mechanism also provides very important cost-recovery to the utility. Non-discretionary water demand is essentially guaranteed: people cook, flush the toilet, take a shower and do laundry with regularity. It is reliable. Discretionary water is problematic. Utilities have to find new supplies, treat, and build capacity to meet the large demand of discretionary water (being the largest category of usage). Yet precisely because it is discretionary, it is unreliable. Perhaps a summer is

particularly cool and wet, in which case no one will be watering their lawns. Or suddenly, taking care of the yard moves way down the list of life priorities, as Melissa Elliott encountered in Denver:

Unfortunately, we've seen some instances where people just abandon their yards. Which could also be a sign of the recession. I know when we see it happening typically, it's not just because they're saying 'hey, I'm going to save water,' it's families who are either going through a divorce or a job loss or they're elderly and they just can't maintain it anymore.<sup>16</sup>

These types of life and economic changes cannot easily be anticipated or budgeted for. Yet despite the fluctuation of outdoor water use, utilities are expected to have water available should everyone in a community want to water their lawns at the same time on a Saturday morning. While this capacity is "unneeded and unutilized in the off-season," the utility has to prepare for it. "The capacity to provide water is maintained regardless of whether a drop is used on any given day."<sup>17</sup> These conditions make discretionary water more expensive.

Yet many utilities do not have a rate that charges heavily for discretionary use. A 2008 study of 109 water providers in South Carolina found that 64% had a uniform rate, meaning there was no change in price based on amount used, while 17% had a decreasing rate, meaning the price per gallon actually decreased the more a customer used.<sup>18</sup> The biannual Water and Wastewater Rate Survey conducted for the American Water Works Association found somewhat more encouraging numbers. Of 308 water or combined water and wastewater utilities, 49% had inclining block rates as of 2010, up by 20% from just a decade ago.<sup>19</sup>

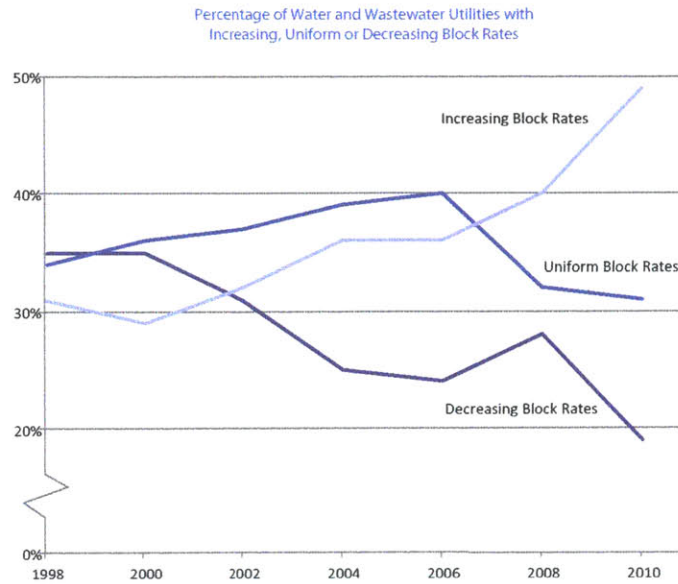


Figure 3.3. Percentage of Water and Wastewater Utilities by Block Type<sup>20</sup>  
 Source: 2010 Water and Wastewater Rate Survey

The chart below shows the water rates of four entities: Denver Water, The Las Vegas Valley Water District, San Antonio Water System, and Santa Cruz, one of 15 Arizona utilities owned and operated by Global Water Resources. Since the costs to a utility of providing water during the summer are much higher based on environmental availability and energy prices, utilities often charge residents a higher rate per gallon then. San Antonio’s seasonal rate does just that. While the summer rate stays the same for the first 6,000 gallons, the non-discretionary block, the summer rate increasingly diverges from the standard rate the more water is used.

**Water Rate Block Structures of Selected Water Utilities**

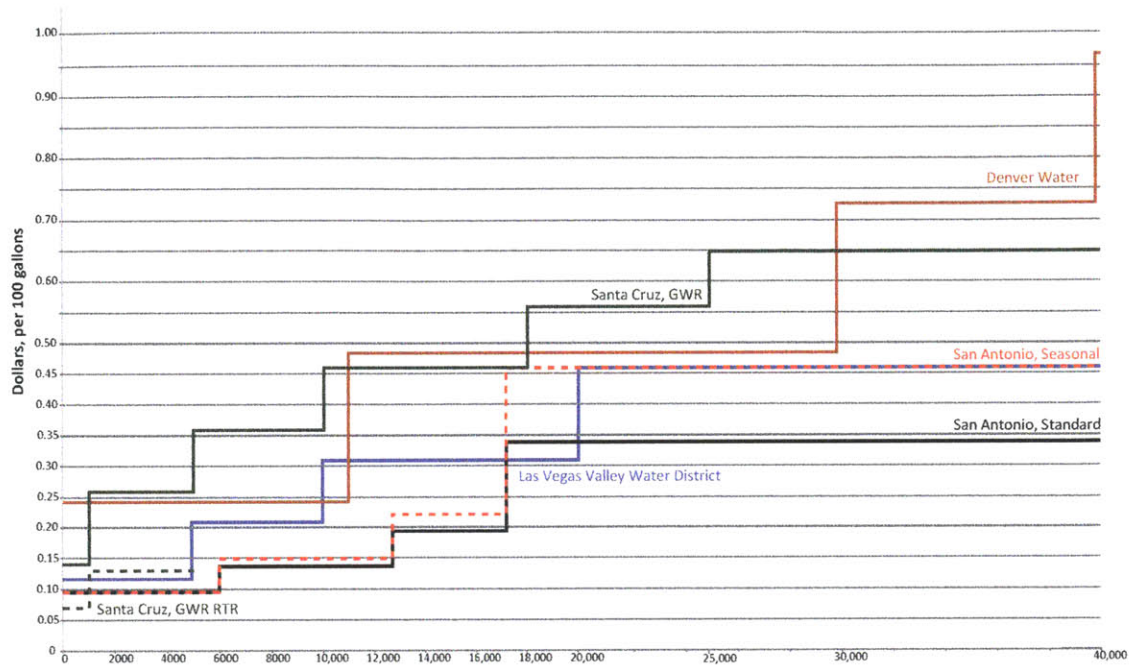


Figure 3.4. Comparison of Indoor and Outdoor Water use in the Southwest  
 Sources: Arizona Corporation Commission W-20446A-12-0314, Las Vegas Valley Metered Rates and Charges for Domestic Service, 2011 Cost-of-Service Rate Report, Residential Water Service<sup>21</sup>

One can understand a lot from the geometry of the blocks rates. They are all inclining and follow a similar angle of roughly a rise of fifteen cents for every 10,000 gallon increase. There is great variation among the volume of the first block or non-discretionary indoor water use. Santa Cruz provides only 1,000 gallons before a rate increase while Denver Water provides 11,000 at its lowest rate. These differences reflect different conservation goals, marginal costs of service, and expectations about demographic characteristics. The volume allowed for the first block is a balancing act between affordability and financial pressure. A block too narrow will make bills unaffordable, but blocks too wide will allow consumers to pay cheaply for discretionary outdoor water.

Geometry is important along the vertical axis as well. As explained by Western Resource Advocates, an environmental policy non-profit, “The change in price between blocks should be large enough to be noticed by customers when their usage bumps them into a higher rate

block.<sup>22</sup> By the same logic, a change in price should be large enough to be noticed by customers as a reward when their usage drops.

Writing in “Water and Society,” T. Hill and G. Symonds explain Global Water Resource’s Rebate Threshold Rate as applied to Santa Cruz in figure 3.4. The rebate structure provides an immediate financial return to consumers who achieve the highest level of conservation. Hill and Symonds argue that increasing the “number and granularity of tiers” allows consumers more opportunities “to manage themselves to a lower tier.”<sup>23</sup> The implication seems to be that the tier structure is a kind of fast positive reinforcement. Consumers need only make modest changes before they notice a decrease in their water bill. As the authors describe earlier in the article, consumers can make behavioral changes instantaneously which will bring them into a lower tier, while achieving significant reductions will require more expensive actions like retrofitting appliances and replacing landscaping. Both the human need for positive reinforcement and the high costs associated with achieving certain types of reduction suggest that a multi-tiered block rate is an effective lever of conservation. Alternatively, one could argue that the incremental approach of multiple tiers might cause customers to stop after having achieved only marginal changes in consumption.

To address this concern, Global Water Resources provides consumers with “near-real-time data” to give them a more immediate understanding of their own water use.<sup>24</sup> The platform for presenting and exploring this information is an iPhone and Android application called Fathom. It gives consumers access to current data about their water use and charges. Consumers can even create water use targets and receive alerts when they are approaching that usage threshold.

Typically, customers receive water bills some weeks, if not months, after charges occur, a time lapse that serves to disassociate the costs of using water with that action. Given the cultural priority of instant gratification as well as the fickleness of outdoor water use, this lapse dulls the power of pricing. (The tradeoff with timeliness is the sticker shock that happens with less frequent billing.<sup>25</sup>) Symonds writes “through the provision of instantaneous feedback on water consumption, average water consumption reductions in the order of 14% can be achieved.”<sup>26</sup>

The format as well as the frequency of information provided deserves notice. Though a

small digression, some designers talk about the difference between data and information. Data are unorganized collections of numbers, words, or images. Information is created when data is processed so as to be useful within specific contexts.<sup>27</sup> One way to re-articulate this idea is that the medium impacts the message. Another way is that human reactions are more complex than a mathematical formula in which an elasticity coefficient translates price into a predictable reduction in water use. Visual representation of data that are otherwise too complex or uninteresting to be useful is an important way to involve an audience. The use of an app rather than a paper bill as the information platform guarantees a higher level of impact and interactivity.

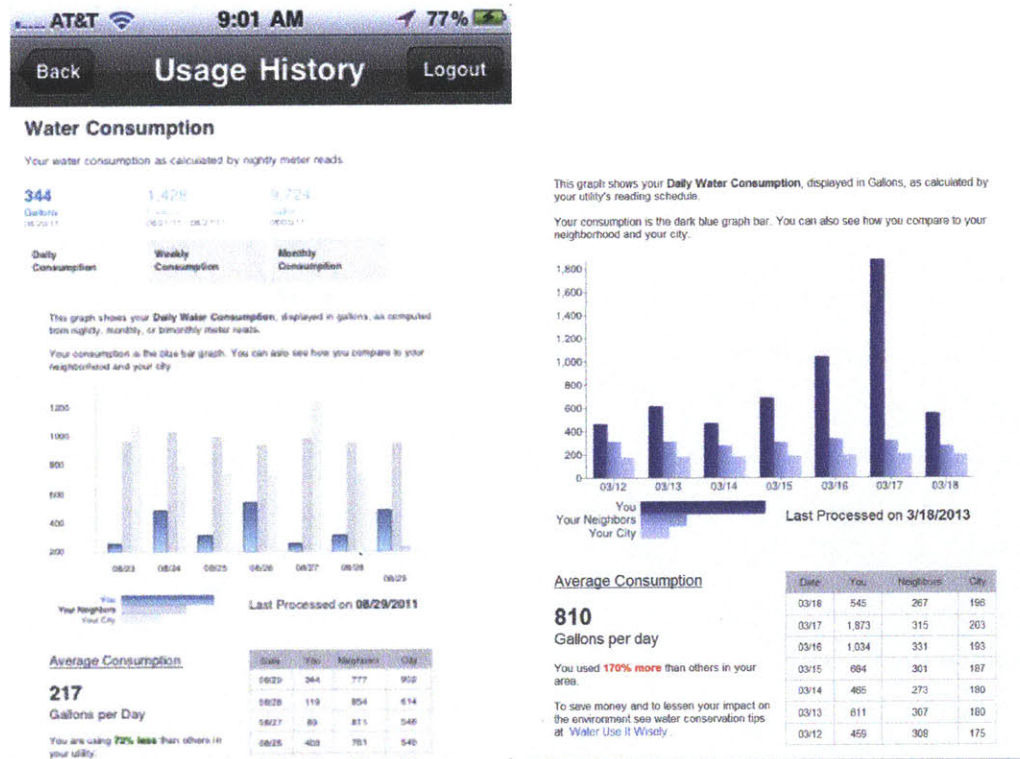


Figure 3.5 Two versions of a screenshot of Fathom. Source: Graham Symonds, Used with Permission.<sup>28</sup>

As seen above in a screenshot, the Fathom platform also provides information on the consumers water usage compared to a user's neighbors and the city average. This context adds the meaning to a consumer's consumption that takes it from data to information.

More importantly, it triggers behavioral responses. Symonds quotes Robert Cialdini,



Regents' Professor Emeritus of Psychology and Marketing at Arizona State University as saying: "People don't recognize how powerful the pull of the crowd is on them ... we move people to environmentally friendly behavior by simply telling them what those around them are doing."<sup>29</sup> Unfortunately, the opposite is true: we can move people away from environmentally friendly behavior by telling them about what other people are doing. In "Crafting Normative Messages to Protect the Environment," Cialdini writes that messaging involving the prevalence of a regrettable or undesired behavior includes "the powerful and undercutting normative message, 'many people are doing this.'<sup>30</sup>" His conclusion was borne out of experiments in which different messages were presented to participants whose behavioral responses were tracked. Thus, telling customers the average is an effective tool if they use more than the average and an ineffective tool if they use less than the average.

Behavioral levers are discussed in more detail in Chapter 4, but even at this point, it is clear that Fathom goes beyond pricing to change usage. Pricing is a good motivator for conservation behavior; it is personal and direct. But it isn't a foolproof mechanism. Janice Beecher writes "price is a necessary, though not always sufficient, means of inducing economic behavior. Information and persuasion can complement pricing in terms of encouraging efficiency....Monthly billing and customer education may be needed to ensure responsiveness."<sup>31</sup> Providing information about usage in a mobile way that can compete a bit more than a paper bill with ubiquitous entertainment options is a great complement. It helps to link price and use more closely.

### **Stormwater Rates**

While water use by an individual customer can be easily monitored (and therefore priced), stormwater runoff cannot. Soil compaction, existing water saturation in soil, vegetation type and age all will produce different volumes of runoff on the same or similar sites. A tree full of leaves will intercept rainfall and thereby reduce runoff to a large degree – something it cannot do in the winter when it has no leaves. Finally, variations in intensity and duration of rainfall events will produce different volumes of water and of pollution.



Nevertheless, the costs of pollution and flooding, created by runoff from private and public properties, are real. As a way to finance flood control and water quality projects, utilities charge property owners for runoff. A stormwater utility or any entity designed to collect revenue as a tax faces political and legal hurdles. Tax-exempt properties like a church or a federal building do not contribute to local taxes and so would not pay a stormwater tax. However, a stormwater fee is a service charge or user fee defined by an amendment to the Clean Water Act as a “fair approximation of the proportionate contributions of the property or facility to stormwater pollution (in terms of quantities or pollutants, or volume or rate or stormwater discharge or runoff from the property or facility).”<sup>32</sup> As such, owners of any land parcels must pay. In Washington, parking lots, which previously did not have an account with or pay at all to D.C. Water, are included under their new Impervious Area Charge.<sup>33</sup>

Broad assumptions about runoff produced on a site can be calculated from the presumed (or tested) runoff coefficient of different materials as well as the slope of surfaces. In general, though, utilities base fees on impervious and gross area of a parcel determined through a combination of property tax information, aerial ortho photography, and on-site visits.<sup>34</sup> More than half of stormwater utilities in the Western Kentucky Stormwater Utility Survey determined Equivalent Residential Units, or “the average impervious area on a single family residential parcel,” to produce a fee structure.<sup>35</sup> In Anne Arundel County, Maryland, a committee working to create a stormwater fee concluded that the amount of impervious surface area was strongly correlated to zoning. Depending on the zoning, a customer there will pay 0.4, 1, or 2 ERUs with a yearly ERU of \$85.<sup>36</sup>

Western Kentucky’s Stormwater Utility Survey defines a stormwater utility in the following way, “a funding approach requiring residents to pay a recurring charge that supports community stormwater initiatives. The fee is dedicated to the maintenance, design, construction, and administration of the stormwater system.”<sup>37</sup> The author writes that there are more than 1300 identified stormwater utilities in the U.S., with possibly as many as 2000. A regularly updated survey of stormwater utilities by Black & Veatch/B&V Management Consulting reports that utilities are often housed in Departments of Public

Works or existing wastewater utilities, making the total number of stormwater utilities difficult to identify.<sup>38</sup>

On the one hand, a fee structure makes sure that each polluter pays its “fair share.” On the other hand, it is designed to incent a reduction of runoff. Unfortunately, fees and credits across the country are so small that only the most egregious producers of runoff are motivated to action, according to several interviews, including Nathan Gardner-Anderson.

The utility will set a basic unit, a basic residential equivalency unit. They’re designed to be simple for homeowners and costly and complex for commercial entities. When you talk about larger properties, when their stormwater bill is \$10,000 a month that is a real incentive to reduce runoff. The greater economies of scale get more attention.<sup>39</sup>

Brian Seipp had a very similar understanding:

The State of Maryland passed a law [Watershed Protection and Restoration Program (HB987)] requiring the eight or nine largest municipalities to establish stormwater utility fees for upgrades and stormwater pollution prevention practices to be implemented. All of them will charge fees to homeowners and many of them will give discounts if you implement stormwater practices on your property voluntarily. So that’s an incentive that lessens your fee. So people who are already predisposed to doing “the right thing” will often take advantage of that, but it seems to me that it’s not enough to instigate a lot of action on that private side. I do believe that when these fees come out and the larger landowners with impervious areas like malls and big apartment complexes or office complexes have significant fees, it may be a much different economic question for them to do it. The pay-back period may be much less than it is for a homeowner. At this point, the incentives for smaller landowners are there, but I just in my personal opinion do not think they’re enough to get people [for whom] it’s not on their radar screen to get them to go ‘oh I’m going to get \$20 off my bill by installing a rain garden that cost me fifteen-hundred bucks.’ It’s just not there yet.<sup>40</sup>

While the fee structure is such that any fee is multiplied by area of impermeable surface, it is also true that the average fee of an equivalent residential unit is very low nationally. According to the Western Kentucky Stormwater Utility Survey, the average monthly fee for a single-family residential property was \$4.20. More than two-thirds of monthly fees were between \$1.60 and \$6.80. It is fair to say that this is not a significant portion of a household budget, certainly not enough to influence households to make physical alterations to reduce

the fee. The map below shows some utilities with rates as high as \$20 a month. (D.C. Water is rapidly raising its ERU from \$1.24 per month in 2009 to \$6.64 per month in 2012 and \$28.77 per month by 2019.<sup>41</sup>)

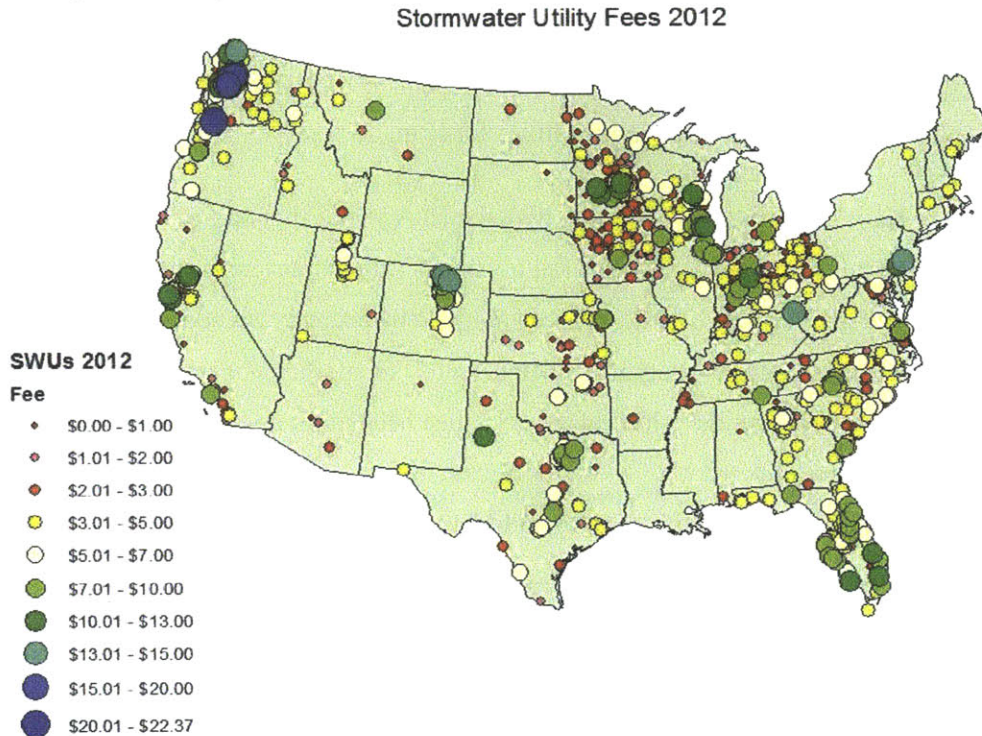


Figure 3.6 Monthly Stormwater Utility Fees. Source: C. Warren Campbell

In Portland, one of the cities with the oldest stormwater fee program and also the highest rates, the Bureau of Environmental Services offers up to a full discount on the on-site portion of a stormwater bill or up to 35% of the total sewer bill.<sup>42</sup> The average single family home-owner who participated in Portland's CleanRiver Rewards Program received a 93% reduction of the total on-site stormwater fee.<sup>43</sup> That translates to only about six or seven dollars a month off of a \$20 bill, with the possibility of additional retroactive credit. Tim Kurtz has worked with the Bureau of Environmental Services for many years. His assessment was mixed, at best. "They do have a chance to get a reduction on their stormwater fee, on their sewer bill, it's not a huge amount, I wouldn't say that it incentivizes it really all that much...It's often not enough to cover the costs of construction, but if they really look long term, it would cover maintenance."<sup>44</sup> Tens of thousands of property owners have registered for credits, though, suggesting another motivation other than financial gain.<sup>45</sup>

When stormwater fees are very low, the incentives for action are also low. Ginny Gaynor describes this phenomenon in Minnesota: “Our 2013 environmental utility fee for residential lots is \$83 per year. Residents with a rain garden or other approved stormwater BMP receive a 30% credit (about \$27/year). That’s equivalent to a couple of pizzas per year. We’re exploring ways to increase the incentives for homeowners.”<sup>46</sup>

Furthermore, Hale Thurston, an economist with the EPA writes that part of the problem is that fees used as an incentive mechanism fail to consider the opportunity cost of land. An “unwillingness to give up space” was one reason given by property owners who declined to participate in a free raingarden program in Minnesota.<sup>47</sup> In another Minnesota program, shoreline plantings to prevent erosion came up against behavioral considerations “People who live on the water, they want to be able to access their water. [They] can’t see kids if they’re down there at the water [blocked by tall plants].”<sup>48</sup> Price signals to incent landscape changes need to consider these opportunity costs in addition to the financial cost of installation.

Using a neighborhood of a sub-watershed in Ohio, Thurston calculated that a landscape system capable of detaining runoff generated by a 2-year design storm on a typical single-family lot would cost \$950 without considering the so-called hedonic price and \$1,337 with it.<sup>49</sup> Current fees and credits don’t come close to the price signal needed to “reflect the marginal costs of reducing the desired level of runoff.”<sup>50</sup>

An economic alternative to the fee system is a cap-and-trade market, which reaches the same quantity reduction with a different mechanism. It allows trade based on the relative ability, i.e., marginal costs, of different property-owners.<sup>51</sup> Unfortunately, the constitutionality of a cap and trade system is questionable, as the retro-active re-distribution of runoff rights may be viewed as a taking.<sup>52</sup> That is, new regulation arguably deprives existing owners of full use of their properties. Additionally, there is evidence that there is a better water quality outcome when stormwater management practices are distributed rather

than concentrated, which might be the result of cap and trade.<sup>53</sup> Areas of new development would typically be able to incorporate best management practices at the lowest cost.

### **Limits to Pricing**

This discussion is meant to illustrate the ways in which current pricing financial mechanisms fall far short of their intended goals or the potential theory suggests they would have. This is not entirely surprising given that the first stormwater utilities were created only in the 1970s. Broadly speaking there is less experience about the effectiveness of price as a mechanism for stirring private activity in the field of stormwater than in drinking water. Interestingly, Thurston writing with others predict that an appropriately priced runoff charge would face strong challenges: current fee structures use extremely crude hydrological models which fail to consider the critical vertical and temporal dimensions.<sup>54</sup>

In addition to legal and hydrologic difficulties, these pricing theories are premised on the notion that not only will people find the most affordable option, but also that different actors will have different costs. The problem with this premise is that the price/cost of an action may not be a good proxy for its value. Hedonic pricing is an example of the difficulty of translating value and price. Punham and Thurston write

...[T]he penalty for not getting the price right can be substantial. When the price is set below the actual marginal cost, too little abatement will be provided. When the price is set above the actual marginal costs, the control standard is set too stringently. Although this problem can be overcome by starting with a reliable estimate of total costs, and revising the charge based on observed compliance, it could take a considerable amount of time to adjust to the appropriate charge level.<sup>55</sup>

Restated, it is difficult for a utility to predict what combination of revenue and best practice implementation will result from a given stormwater fee and credit system. Evidence and opinions from several informants indicate that current stormwater pricing motivates only large property owners, not typical single family households.

The many ways in which humans are not completely or consistently rational actors mean that price/cost alone may not be an ideal mechanism to drive adoption of stormwater BMPs. What is the transaction cost of hiring a landscape contractor to install a best management

practice in comparison to the cost of having a fee automatically paid to the utility by a customer's checking account? What is the price of waiting until your neighbors install a raingarden before you try experimenting with one? Each type of irrationality or potential preference could be translated financially, but the more that is included in the price/cost of an action, the less certain is its approximation of value. Using price as a motivating mechanism is risky because it is so difficult to predict the outcomes.

The pricing perspective "assumes that individuals systematically evaluate choices, such as whether to install additional insulation to an attic or purchase a low-flow showerhead, and then act in accordance with their economic self-interest," criticize Doug McKenzie-Mohr and William Smith<sup>56</sup> Of course, people often do not, or worse, miscalculate. Howard Kunreuther, Professor of Decision Sciences and Business Economics and Public Policy at Wharton School of Business, outlines several ways in which people make irrational economic decisions.<sup>57</sup> People tend to be overly focused on short-term returns, greatly discount future costs, and mis-estimate the probability of events. Mckenzie-Mohr and Smith write that "messages which emphasize losses that occur as a result of inaction are consistently more persuasive than are messages that emphasize savings as a result of taking action."<sup>58</sup> This reaction is a form of discounting: a present loss is more powerful than a future loss or a future gain. While some stormwater practices will save money over the long-run, the natural discounting inclination makes people reluctant to invest upfront.

Even more importantly for the discussion of financial levers, attitudes about price are far from absolute. They are subject to social fads and pressures. Classically, psychologists and economists have demonstrated the fluidity of human understanding of numerical value through cognitive biases, including the anchoring-and-adjustment heuristic. In a context in which someone must estimate the value of an observation, a number presented as relevant becomes used as reference point, even when clearly inaccurate. The juxtaposition of prices is used all the time in marketing: one price is presented as the original, the suggested retail, or the competitor's price and a second lower price is presented as the special, discounted price. This anchoring and discounting phenomenon is even more powerful in an unfamiliar context. Familiarity, a sort of record of prior measurements, will be recalled as anchors and

so also influence an attitude about price. Asking a random group of Americans what a muffin costs is likely to get less variation than asking that same group how much a nightly slip costs for a yacht in the Bahamas. Raingardens and rainbarrels are much more akin to the latter.

Researchers at the University of Florida found another layer to this phenomenon.

“Adjustment away from a numerical anchor is smaller if the anchor is precise [i.e., unit based] than if it is rounded.”<sup>59</sup> In other words, estimation of a measurement will vary more if someone is first presented with an anchor measurement like 800 than 834, regardless of any other context. Whether these mis-judgments are purely cognitive failures or some sub-conscious attempts at social grace is not known.

Finally, as individuals and as part of social groups, people are influenced by many factors beyond numeric valuation, what one researcher called “the rich mixture of cultural practices, social interactions, and human feelings.”<sup>60</sup> These preferences are hard to capture. As an example, in Minnesota residents seemed to be unmotivated by a cost-share program to install stormwater management practices, despite robust financial incentives of 50% off a project up to \$2,500. “We did a follow-up survey back in ’09 and interestingly people said that having the on-site and design assistance was more important than the grant. For a lot of people, having the financial assistance wasn’t unimportant, but for a lot of people it was more so having someone come out to their yard and tell them what they could do and having that specialized knowledge.”<sup>61</sup> These dilemmas about financial valuation invite another mode of thinking, arising from marketing, which is described in Chapter 4.

### **Water Conservation Incentives**

While water pricing is a penalty for water use or stormwater runoff generation, rebates are like a commutation, and incentives are rewards for conservation and stormwater management practices. In some cases, the payments are less incentives and more a purchase of access to private property, approaching an easement.

The Southern Nevada Water Authority (SNWA) runs a turf grass replacement program which offers homeowners and commercial property owners \$1.50 per square foot of lawn removed and replaced with low water use landscaping. The total cost averages about \$4.00 a square foot. Combined with high water rates, the roughly 35-40% contribution by the SNWA is enough to have converted more than a hundred million square feet of lawn, resulting in annual water savings of 4.6 billion annually.<sup>62</sup> SNWA will also pay up to 50% of the cost of redesigning irrigation systems. There seems to be some notion of fairness or joint investment in outcomes when the customer and the utility share the costs. “The customer should have as much skin in the game as we do,” explains Doug Bennett, Conservation Manager at SNWA.<sup>63</sup>

The San Antonio Water System gives customers a rebate of up to \$800 for irrigation upgrades, \$250 for a high-efficiency pool filter, \$150 for approved on-demand hot water heaters, and up to \$400 for installing a “WaterSaver Landscape.”<sup>64,65</sup> Denver Water offers rebates for clothes washers, low-flow toilets, and irrigation systems with rain sensors.<sup>66</sup>

### **Stormwater Management Incentives**

If charging fees for stormwater runoff is one side of the coin, the other is paying for management at the source. Acknowledging the low cost of stormwater fees – and therefore the minor incentive to address the cause of those fees - many local government and stormwater utility programs are subsidizing or paying completely for the installation of BMPs on residential property.

In Portland, their downspout disconnection program which ran for twenty years included a \$53 incentive to property owners who performed the work themselves. Once downspouts were disconnected and inspected to meet safety, “then we would write them a check for however many downspouts they disconnected.” For homeowners who didn’t want to disconnect their own downspouts or for whom the disconnection involved more complex mechanical steps, the city paid non-profit organizations and contractors respectively to conduct the work. Homeowners paid no cost; they simply had to allow access to their



properties. Over roughly twenty years, 26,000 property owners disconnected about 54,000 downspouts.

In Minnesota, a 2008 voter referendum designated 1/8<sup>th</sup> of 1% of sales tax to be allocated for environmental programs. That funding stream has allowed relatively generous grants for water quality improvement projects, among others. Many Watershed Districts pay up to 50% of a project cost with a cap at \$2500. To ensure that the funding went directly to improvement and not simply to expensive raingarden elements, one district has tied payment to water quality improvements. In the South Washington Watershed District, property owners are paid based \$5,000 per pound of phosphorus sequestered. For a typical raingarden, that translates to about \$500.<sup>67</sup> Arlington County and the City of Falls Church offers cost-sharing grants as part of its StormwaterWise Landscapes Program for any of six actions, “green roofs, rain gardens, conservation landscaping, cisterns, replacing walkways or driveways with pervious surfaces, and an infiltration trench.”<sup>68</sup> For utilities, the true cost effectiveness of such programs are not in the upfront costs, but in the long-term savings from having homeowners perform maintenance.

The use of rebates assumes that residents would not pay full-price for raingardens, turf replacements, or rainbarrels. A silent auction is a way to differentiate the price-points of different residents. To test the price-point in the Shepherd Creek neighborhood of Cincinnati, the EPA’s Office of Research and Development sponsored a reverse auction for raingardens. In a reverse auction, sellers bid on the lowest price for which they would be willing to sell a good or service. In Shepherd Creek, homeowners were mailed flyers and received door hangers about raingardens and rainbarrels. Some weeks later, homeowners were mailed auction forms for them to place bids on how little they would need to be compensated in order to have a free rain garden or rain barrel installed on their property. The bids ranged from 0 to \$500 with an average closer to \$50. Those who bid 0 essentially needed no incentive to participate. Possibly, there would have been a number of people who would have paid some amount. The reverse auction technique was cost-effective compared to offering a flat price for installation, but it could have gone even further by allowing residents to pay as well.<sup>69</sup>

Another method for offsetting the financial dis-incentives of changing a landscape came from Bob Fraley with CleanRiver Rewards. That concept was for a financing or revolving loan program which would be competitive with the loans that someone could receive through a bank. Such a program called Pay As You Save (PAYS) already exists for energy in which a monthly charge less than the estimated savings is added on to a bill until the costs have been repaid.<sup>70</sup> By having an entity other than the homeowner pay the upfront costs, the financial rationality can overcome the human irrationality of discounting.

A related idea is a property-secured bond district, special assessment district, local improvement district (LID) or, in Canada, a local improvement charge (LIC). An LID is an authority formed by local or state government applying to a specific geographic area. One of the defining features of an LID is that it is employed for infrastructure improvements that create a public benefit, but give greater benefit to the individual property owners.<sup>71</sup> The other unique feature is that funding can come from a combination of locally assessed property taxes, government financing, and utility funds. The benefits occur upfront and the costs are repaid over time at a rate consistent with savings. Most typically, LIDs have been used for street upgrading. While such a program does not yet exist for private property water conservation or stormwater improvements, many areas in the U.S. have property-assessed clean energy districts which provide financing to households and commercial properties to improve the energy efficiency of their buildings.<sup>72</sup> Dan Vizzini, the former principal financial analyst at the Portland Bureau of Environmental Services, said that he advocated for adapting the LID model to stormwater for a quarter of a century. “The program is perfectly suited for the things that [BES] has been doing. In parts of neighborhoods where you can very clearly define a drainage problem, if you can understand the necessity of a collective action, it is the cost-effective way to go.”<sup>73</sup> The only problem is that property owners on a street who object can easily scuttle the project.

Many municipalities are providing incentives of a different scale: for new development. Developers are offered density bonuses for large scale private development in existing built-out areas. Philadelphia and New York City both have green roof tax credits, while the State

of Maryland has general tax credits.<sup>74</sup> Chicago's Green Permit Program and Philadelphia's Green Project Review fast-track green buildings through the permitting process, saving developers that much interest on construction loans.<sup>75, 76</sup> While these types of incentives are generally applied to large-scale new development, it is easy to imagine similar programs for single family households that fast-track some stage of permitting or reduce permit fees.

## **Conclusion**

Requiring payment is a fantastic way to get residents to pay attention to their impact on water resources, if slightly adversarial. However, it can only get people's attention if the rates are significant in comparison to other expenses. The methods of communicating rates can also improve residents' responsiveness to price.

Subsidies for action are strong because they combine financial motivations with the sense that the property owner and the utility or water department are sharing the burden. There are a number of innovative pricing and cost-sharing mechanisms that should be explored, including co-financing by stormwater and water utilities.



## **Chapter 4: Outreach, Community-Based Social-Marketing, and Behavior Modification**

### **SECTION 1: Educational Campaigns and Their Shortcomings**

Traditional voluntary campaigns to change environmental behaviors have long been preferred because they request citizens perform civic duties rather than punish them with fees or forcibly restrict their behaviors. The theoretical underpinning for adoption by audience members is usually that awareness and education is the missing component. Karen Guz, Conservation Director at the San Antonio Water System articulates it thus: “If people don’t understand what it is you’re asking them to do and have some scope of the problem, it’s not going to be possible to get them to comply with regulations or make changes with their behavior or equipment.”<sup>1</sup> At the same time, another informant stressed that education campaigns are only the first step. “Baseline awareness campaigns are important for overall conservation support, but generally ineffective in supporting action-oriented programs.”<sup>2</sup>

Americans desperately need to take these first steps of awareness. Most people know very little about infrastructure. Its invisibility – from the internet to natural gas to water - is part of its magic. David Macaulay’s wondrous drawing book about infrastructure is called *Underground*, playing with the literal and figurative meaning of that term.<sup>3</sup> Interaction specialists Paul Dourish and Genevieve Bell use a similar notion of a “technological substrate” and apply it sociologically, “the structures that lie below or beneath the surface of applications and interactions.”<sup>4</sup> From their standpoint, it is not just the physical infrastructure which is hidden, but also the techno-bureaucracy that manages it. Tap water comes from a tap. The stormwater and wastewater removal systems convey pollutants and sewage “away.” Until people understand the impacts of their actions and their roles in the water cycle, personal responsibility is difficult.

Unfortunately, some of the best tools for raising awareness about the state of water resources and related infrastructure are those over which humans have little control - droughts and floods. Sociologist Susan Leigh Star describes infrastructure as “visible

only upon breakdown.”<sup>5</sup> Pervasive, affecting a whole region, creating visible impacts across the landscape, a drought or a flood is a type of breakdown. Water levels dropping in a reservoir or rivers are visible evidence of vulnerability. Utilities that rely on groundwater sources are disadvantaged in that water levels are not visible, which probably made Karen Guz, Director of Conservation, San Antonio Water System, especially proud to talk about how aware residents in her district were of their water supply:

If you are in San Antonio and you ask an average room full of people “What is your source of water?” A lot of them can tell you, “oh, the Edwards Aquifer.” And then you ask them “Well how is the Edwards Aquifer.” Now, they probably don’t know why they’re saying this number, but they’ll probably say “I think we’re in some stage of restriction. The Aquifer is around 652”....My point is that we have a pretty high what’s often called a water IQ. If you don’t have that, it can be difficult to have a starting point. At this point, we’ve got new people coming in we’ve got to work with, but the community pulse is leaning toward understanding water as something that is important and we need to manage.

This awareness is commendable, and as Guz expresses, a jumping off point for management. The next step is getting people to understand their personal connection so that they equate their individual actions with improvement or deterioration of water resources. A book by the American Society of Civil Engineers, *Me Myself and Infrastructure*, attempts this task in a broad way. Its subtitle is “Private Lives, Public Works.” Like other types of consumption and property, the diffuse quality of water use and physical property makes it difficult to multiply one’s personal use to the impact of the collective scale. A poll by the water conservation alliance of Southern Arizona in 2007 found that 87% of respondents thought that their water use was average or below average. No surprise then that the tool discussed in Chapter 2 to communicate individual, neighborhood, and city-wide water use to customers is called Fathom.

Still, awareness about water consumption seems to be more advanced than awareness about personal contributions to stormwater problems. The Las Vegas Valley Water District has promoted a curt mantra “It’s a desert out there. Be Water Smart.” It’s hard to imagine a phrase so succinct and with such resonance that would connect one’s actions related to stormwater to the environment at large. Knowledge about stormwater and one’s

individual impact on it is downright murky. In a presentation titled “Selling Stormwater Protection Behaviors in MS4 [municipal separate storm sewer system] Communities,” Barbara Welch with Maine Department of Environmental Protection decries that “most individuals lack basic knowledge about where stormwater goes, and stormwater is not a concern for them.”<sup>6</sup> Many Americans do not understand that stormwater runoff is a problem. The right-wing blog, Drudge Report, recently ran the headline “City sets new tax on -- rain!” incredulous as many are that something that is free and happens naturally merits a policy response.<sup>7</sup> A National Geographic poll from the early 2000s found that only about 14% of respondents had heard of nonpoint source pollution.<sup>8</sup> A study on environmental literacy, though also years old wrote the following:

Few Americans understand that precipitation running off from farm fields, roads, parking lots, and lawns (called "non-point source" pollution) is the leading cause of water pollution in America today...[J]ust 22% of Americans know that runoff is the most common form of pollution of streams, rivers, and oceans, while nearly half of Americans (47%) think the most common form is waste dumped by factories...Many government programs acknowledge the importance of looking closely at run-off pollution... For these programs to be successful, however, there surely must be greater understanding of the run-off problem – how significant it is, where it comes from, and how to prevent it. Indeed, Americans routinely identify clean and safe water as a top priority, but they may be reluctant to accept that their own day-to-day actions and those of their neighbors have a substantial effect on water quality.<sup>9</sup>

There is an inherent incentive not to address the externalities of our actions because the problems occur “downstream” and are so widespread. Why make the sacrifice if others do not? Voluntary educational campaigns are akin to command and control strategies, but the enforcement component is internal: a combination of obedience to authority and a desire to work toward a collective good. Don Waye, Outreach Coordinator at the EPA says, “The Mother Earth thing doesn’t work.”<sup>10</sup> It doesn’t motivate people. That maxim was echoed by Angie Hong, Educator with the Washington Conservation District in Minnesota. “...People care about their lakes, but that in and of itself doesn’t usually motivate them to do a landscaping project that’s potentially time consuming and expensive.”<sup>11</sup> In this way, educational campaigns are better suited to neutralize the political response to an action an authority is planning to take or even to create pressure

for a candidate to promise action on an issue. Put another way, knowledge can change an attitude, but an attitude change is only enough to accept someone else's behavior, not to change one's own behavior.

The almost universal failure of Americans to fulfill New Years resolutions which they resolve out of strong desires bears this out. As other evidence, people forget anniversaries all the time and patients forget to take their pills, despite those actions being in their best interest. In a now-famous experiment of 500 people, 94% of participants expressed that individuals were personally responsible to manage litter, yet only 2% picked up litter that had been expressly planted outside the interview site.<sup>12</sup> Neither education, nor changing attitudes, or sometimes even personal best interest exclusively are effective at changing behavior.

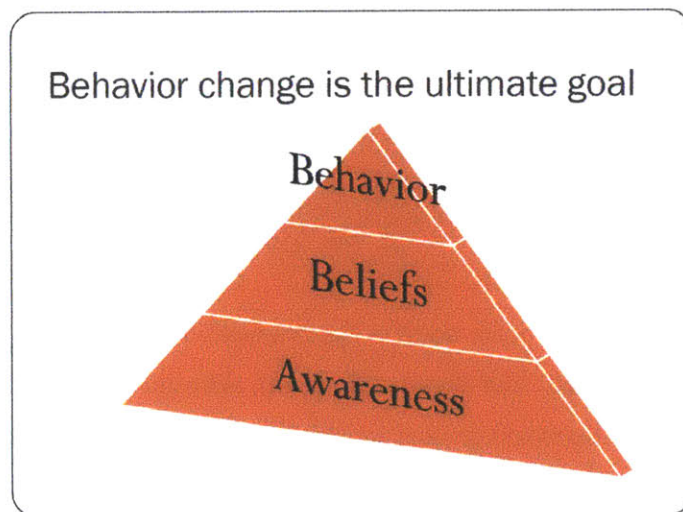


Figure 4.1 Behavior Change Pyramid

Source: Melissa Elliot



## **SECTION 2: Introduction to Community-Based Social Marketing**

Community-based social marketing, coined by Professor Doug McKenzie-Mohr, goes well beyond conventional outreach programs. It is a multi-step method of creating a very targeted campaign based on the analysis of a specific audience. Determining whether there is anyone who has already adopted a behavior or landscape practice is the first question, followed directly by the question “who hasn’t adopted the targeted behavior or practice?” With this information, a campaign can begin to identify different characteristics of the population and work to adjust the specific existing barriers and incentives which seem to differentiate those who “have” adopted a behavior from the “have nots.” Depending on those responses, different audiences receive different strategies and messages directed at them.

Just as water pricing block rates segment the market, a successful outreach campaign will segment people into different audiences. The Southern Nevada Water Authority (SNWA) used this method as an alternative to enforcement when reminding customers to comply with outdoor water use regulations, specifically changing their irrigation timers during different seasons:

You can't use the same message to one group that you do for another one. We followed the money to find out who's writing the check, who's the decision maker. We found out that our audience was mostly men, 35-54, mostly blue collar [fewer than 4 years of college].<sup>13</sup> We had a media buy before [for our previous conservation campaign] and the programs were skewing female, but the research was that 88% of our audience was male.<sup>14</sup>

SNWA researched not just who their audience was, but what they believed. The Authority found that the audience, dubbed “Joe Sixpack,” was supportive of the specific conservation regulations but had trouble remembering when they should change the timers. Enforcement would not have been an appropriate response. The barrier to compliance was minimal; it was not an issue of intentional avoidance or beliefs. (There was also an existing financial incentive in the form of a high water rate.) The campaign goal was to get the people who already performed the targeted behavior to do it with reliability more so than convincing people who had not ever used irrigation timers to begin monitoring them.

The message was conveyed through nearly wordless humorous television advertisements during Monday Night Football. In the ads, failure to change the irrigation timer leads to one of three results for the male resident: a kick to the groin from an old lady, a rabid attack on the neck from a seemingly harmless puppy, or a scantily-clad rotund man frolicking in a sprinkler. Additional ads appeared on bar coasters and at gas pumps. At its most basic, the campaign dubbed “Don’t Make Us Ask You Again,” was designed to capture the attention of the targeted audience and have them perform an existing practice with greater care. After the campaign was launched, consumption was reduced 15% during the targeted time period.<sup>15</sup>

The research about who was and who wasn’t performing the targeted conservation behavior provided information fundamental to the campaign. There are a number of quantitative and qualitative methods to gathering this information, including polling, literature reviews, observational studies, surveys, and focus groups. With water consumption, there is a lot of data (especially with advanced metering) about the customer which can be used to guess who is engaged in what type of behavior. As the fathers of social marketing wrote about marketing generally, “...the seller recognizes that it is easier to create products and services for existing wants than to try to alter wants and attitudes toward existing products.”<sup>16</sup> The goal of a social marketing campaign is to match a new behavior to existing behaviors, wants and worldviews, even as having a belief that seems to pre-dispose an individual to a certain action is not a guarantee of fulfilling a new behavior. Generally, framing adoption of a new practice as similar to or an extension of one that an audience already engages in will be more successful than marketing one that is entirely novel. In Las Vegas, men were performing the behavior sometimes, just not with adequate regularity. Extending existing irrigation behavior to include switching the automatic timer was a simpler campaign goal than convincing women to adopt a wholly new behavior.

## GENERAL THEORIES OF MOTIVATION

### Diffusion

One concept to help a campaign understand why certain people engage in a behavior and others don't is the Diffusion of Innovation model. Dr. Everett M. Rogers, who coined the phrase and spent his career researching the topic, describes five segments of the population which correspond with standard deviation sections of a normally distributed bell curve.

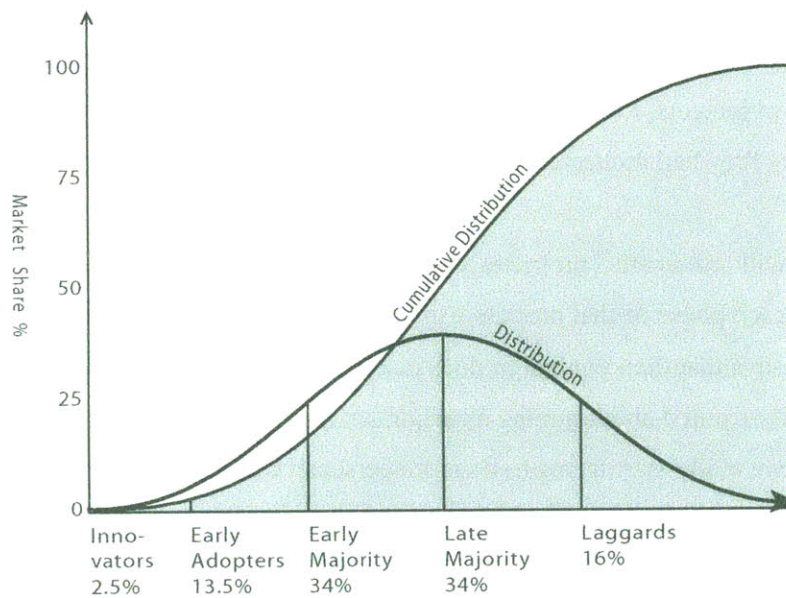


Figure 4.3 Market Share of Adoption According to the Social Diffusion Model

As one might expect from a new practice or technology, the leading “innovators” edge is comprised of young, wealthy, well-educated, and well-connected people – those who are both exposed to new ideas and can also bear the high risk. What is exciting about the model is that at about 16% of the total population, there is a tipping point. Diffusion continues automatically as a result of the ubiquity and proven-nature of the new practice as well as through the influence of the early adopters. “[P]eople just want to do it because other people are doing it.<sup>17</sup>” Bill Eyring with the Center for Neighborhood Technology in Chicago explained their Wetrofit program in those terms: “The objective will be to challenge people to talk to their neighbors so that we get clusters of people so that we

don't have to deal so much with the individual but deal with pioneers in the neighborhood but then have it be self-perpetuating.”<sup>18</sup> The practicality of the diffusion model is a bit unclear. One can gauge the level of adoption through polling, however one cannot determine the rate of adoption except longitudinally – longer than most campaigns care to be around.

What this does mean for a campaign, though, is that it can expect different types of people to adopt a practice at different stages. Ginny Gaynor, Open Space Coordinator for the city of Maplewood, Minnesota describes how there is a wave of acceptance and enthusiasm about participation in a raingardens project after the fact. “On many of our boulevard raingarden projects, I'll receive a call from a resident a year after the gardens are installed wishing they had requested a garden and asking if they can still get one.”<sup>19</sup>

A smart campaign will anticipate a progression of acceptance across the audience and target messages to each phase of that process. Amber Clayton, Stormwater Retrofit Program Manager, says that their campaign does just that. “Usually we'll find a couple of people who are really excited about getting a raingarden and we'll try to get those constructed before we really start trying to be more persuasive about people who are more in the fence. So that way they'll have someone in their neighborhood they can go talk to.”<sup>20</sup> In this model, the most effective way to motivate the bulk of an audience to adopt is to work first with the segment of the audience most likely to adopt. Based on polling or demographic analysis, a campaign might try to identify who are most similar to the current adopters and target that group.

### **Internal Diffusion: Adoption**

Just as the model of diffusion applies to acceptance of a behavior or technology for a population, there are stages of adoption for individuals, too. Seven distinct stages can be arrived at by combining Dr. Rogers stages with those from the self-help book, *Changing for Good*, as suggested by the EPA's *Getting in Step* guide.<sup>21</sup>

Step 1: Exposure. The first step of adoption is to have an individual understand that the idea exists at all. Amber Clayton, Stormwater Retrofit Program Manager with the City of Portland describes this step:

We would usually send everyone in the targeted area a letter saying “we are going to be doing assessment work, we’re going to be in your area pretty soon.” After that we’ll send another letter out saying “hi we want to do stormwater projects, we would like to contact you, we’d love to have a site visit, please call us with any questions.” And usually we get a fair amount of response with that. We include pictures in our letters.<sup>22</sup>

Step 2: Inquiry. The second stage is when an individual actively gathers more information about an idea. Of course, not everyone will be interested in learning about a new idea, however, a campaign can make the process of inquiry easier. One very common technique is to have a demonstration site where residents can learn about water conservation practices in the landscape, often called xeriscaping, or stormwater management best practices. Ginny Gaynor:

We wanted to have a home site where people could see a very high quality demonstration, a place we could tell residents, “Take a look at this front yard. This homeowner is doing native landscaping, has a trench drain in the driveway, and a rain garden.”<sup>23</sup>

Amber Clayton described a similar type of encouragement

Even with a picture – they’re just not sure, they’re not sure what it’s going to look like when we’re done, they’re not sure what we’re talking about. So if we can get a raingarden in, in a site in somebody’s neighborhood, that usually does wonders for getting people to understand what it is we’re talking about and to get participation.<sup>24</sup>

Step 3: Deliberation. The individual weighs the pros and cons of implementing a practice. At this step, a campaign can play an important role in convincing an individual.

If people are on the fence or they’re not really sure, we’ll usually offer to find them a reference site if there’s another target area where property owners were very happy. Especially on the commercial side, managers want some assurance that we’ll respect the use of the site and respect their hours of operation. They just want a peer to talk to, to talk through this. “What was it like working with the city, is this going to be a bureaucratic nightmare.” Luckily that has not been the case on any of our projects. We usually get pretty good feedback.<sup>25</sup>

Step 4: Preparation. At this step, the individual has decided to act and makes the necessary decisions to ensure that it will proceed accordingly. This step may include psychological, physical, and scheduling components. To help voters complete this step, political campaigns inform voters the location of their polling stations and ask them when during their day they plan on voting. This cognitive activity takes an abstract preference for an action and concretizes it, increasing the probability that it will occur.

Step 5: Action. The individual performs the behavior or implements the physical modification.

Step 6: Evaluation. During this step, which, depending on the length of time of the action can be nearly instantaneous or sometime after, the individual compares the experience or result with his or her expectations of the outcome.

Step 7: Continuation. At this phase, external reinforcement pushes the one-time action into a habit. The action or behavior is completely internalized. Doug Bennett, Conservation Manager with the Southern Nevada Water Association describes implementing a campaign strategy that serves this purpose:

We also have a newsletter that we send out to people after they finish their [landscape] project. We send them a 3-month, 6-month and 1-year newsletter of things they can and should be doing. Until we started this newsletter, we never had contact with them again [after processing their rebates]. Our thought was that people might need a little bit more hand-holding on what they should be doing as their landscape matures. Perhaps when they first installed it the landscaper was giving those plants water everyday, and making sure that that wasn't the case. Letting them know, "if you haven't changed the settings on your clock, your plants are now reasonably well established, you should go to longer durations but much less frequently and so forth."<sup>26</sup>

The seven steps described above are of course an abstraction of a complex process which may involve fewer or more steps or not be linear at all. The cognitive phases will also vary based on whether the action in question is a large one-time investment like replacing a lawn with xeriscaping or a repetitive smaller behavior like reducing the application of fertilizer. The pivotal concept is that audience members will be motivated by different

considerations at different stages of the process. There is not a single method which will be effective at achieving adoption but rather a series of methods.

### **Classification and Hierarchy of Human Motivation**

Another consideration in encouraging adoption of a behavior or landscape practices is the numerous competing feelings among which humans prioritize. Many social scientists have classified the motivations for the range of human behaviors. Drawing on previous sociological work, the two Dutch authors of *Green Households* developed fifteen categories which have been expanded to 17 below.<sup>27</sup>

1. Social relations with friends, family, neighbors and colleagues
2. Education and personal development
3. Comfort
4. Pleasure and Arousal
5. Material Beauty
6. Employment
7. Health
8. Personal freedom, autonomy, and property\*
9. Financial security
10. Status, identity and heritage
11. Safety from accidents, crime, and hazards. Control
12. The Environment, including clean air and water
13. Leisure
14. Social Justice/equal opportunity
15. Democracy
16. Spiritual meaning

It ought to be evident that a financial incentive for water conservation or stormwater management will not automatically arouse or address many of these motivations. It ought to be evident also that an environmental message may or may not align with some of the above motivations, but is probably not strong enough to elicit action without being associated to a number of the other motivators. For a campaign, the operational question is to determine what combination of motivators will be most relevant to which segments of an audience.

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\* Nooman and Uiterkamp separate “Privacy” and “Freedom/Control”

A campaign booklet called *A Guide for Engaging and Winning on Climate* employs three motivators to frame their request for action: patriotic pride, which aligns with number 10 above; responsibility to future generations, which highlights components of 1, 8, and 14; and government accountability, which is comprised of 14 and 15. The motivators are not conjectural. They were refined from responses of likely voters who participated in a national survey. The guide states that a campaign on climate and clean energy can be effective by “confidently and consistently championing American’s ability to step up to problems, drive solutions, and build a better future.”<sup>28</sup> In the context of climate, the health of the environment, employment, and health are irrelevant to voters at large, something which could only be known through polling.

Almost any water conservation or stormwater technique could be framed using the motivators above. At the same time, each reader will find different resonance with and relevance from each of the categories above pertaining to his or her own life. The heterogeneity of individuals’ hierarchization of these motivations is one reason for and method of distinguishing among different audiences. What motivates one audience may not motivate others.

Perhaps the most famous classification of motivations is the Theory of Human Motivation developed by psychologist Abraham Maslow, typically referred to as Maslow’s hierarchy of needs. While the theory has been superseded by understandings of cognitive development and criticized for its normative Western stance, the theory is helpful as an heuristic.



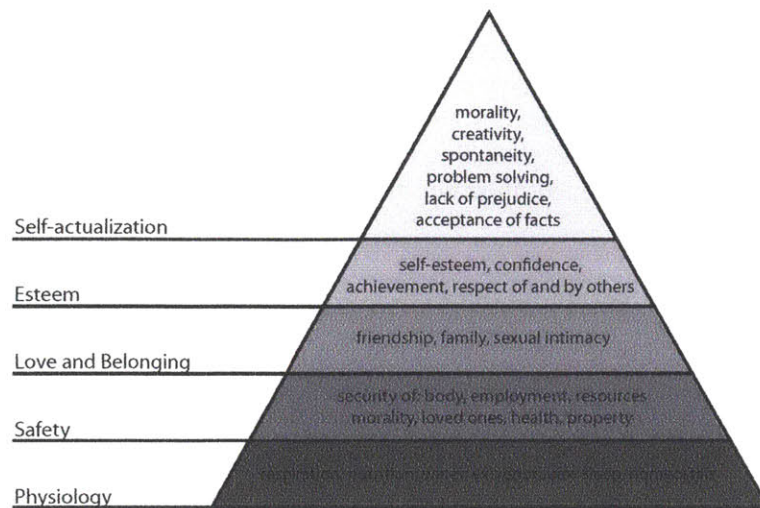


Figure 4.4 Maslow's Hierarchy of Needs.

Source: Neel Burton, "Our Hierarchy of Needs" <sup>29</sup>

The hierarchy of needs expresses a progression of satiation. A good campaign will identify which need will be satisfied by adoption of a practice and will avoid messaging which creates a mismatch between a need and a practice. That is, using a message that emphasizes the cost savings from a practice will not be meaningful or effective for someone concerned about status and personal creativity and vice versa.

### Demographic Analysis

Depending on the level of analysis, demographic analysis can ascertain very specific motivations and cultural touchstones, or it may merely allow for generalizations that are shallower but also faster than direct research. On a national scale, the white population is aging and being replaced with younger, ethnically diverse, and immigrant segments.<sup>30</sup> It is barely worth saying that population trends will be very different at local scales. More importantly, there may be groups with very different characteristics from one another in the same area. Immigrants, retirees, new families will all have different lifestyles, capabilities, and beliefs. Long-time residents will have different attitudes than newcomers. Household configurations and types of employment are also significant demographic categories. Members of the University of Minnesota Department of Forest Resources describe some types of demographic variation.

In the world of water, audiences can be quite diverse with varying socioeconomic backgrounds, land and water connections, environmental and cultural values, and beliefs about environmental problems, consequences, and solutions. Water resource programming aimed at engaging citizens and landowners should be shaped by a baseline understanding of who stakeholders are, how they relate to water, and what influences their decision - making around conservation practices.<sup>31</sup>

Determining the demographic characteristics and values of an audience can be accomplished in a number of ways using social science methodologies. One of the easiest baseline measures, though, is the PRIZM (or potential rating index for ZIP code markets) classification and segmentation system which “defines every U.S. household in terms of 66 demographically and behaviorally distinct types.”<sup>32</sup> The segments reflect socioeconomic rank, purchase behavior and media behavior and they can be grouped again into “11 Lifestage Groups and 14 Social Groups.” For instance, Segment “01 Upper Crust” is in Social Group Elite Suburbs and Lifestage Group Affluent Empty Nests. A household without kids, they frequent Saks Fifth Ave. and read Conde Nast Traveler. Meanwhile “66 Low-Rise Living” are “the most economically challenged urban segment.”<sup>33</sup> They travel by bus for trips and read Ebony. While these segments may be most recognizable – or stereotypical – the segments in between are more interesting. The overwhelming caveat to the PRIZM classification system is that the demographic information may not easily lead to an understanding of the motivations and barriers of a certain segment relative to a targeted behavior. Their power for the average campaign is that they have an easy ZIP Code Look-Up search engine available free of charge that includes the five most common segments for each ZIP code.

A sophisticated audience-analysis program that goes even further than PRIZM is from Ontario. The Canadian Urban Institute, where the author interned, developed a tool in association with market analysis firm Environics Analytics and several municipalities to pair demographic information, parcel information, and water use.

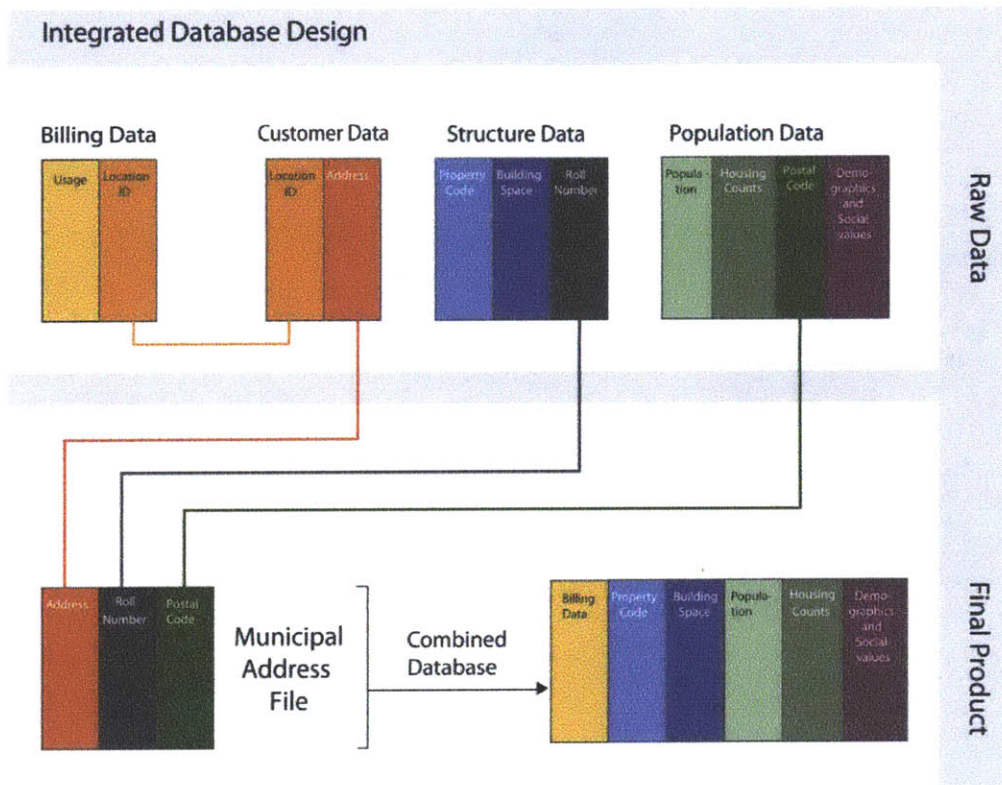


Figure 4.1 Integrated Database for Audience Segmentation.

Source: Canadian Urban Institute

As shown above, water use data were combined with customer data, population data, and building data. This integrated database is very powerful. While a typical utility will be able to determine which customers use what amount of water and where a customer is, Environics Analytics was able to develop rich profiles of customer classes using a PRIZM-like model. So-called psychographics segments the population based on these attitudinal attributes and lifestyles, including activities and resources uses. The integrated database grounds these segments in local spatial contexts. As an example, one of the high-water-use segments is the “Thirsty Blue Collar Families.” Population data indicates that they are relatively large households. Billing data indicates that they use liters per capita than the province average. Structure and geo-spatial data shows that they live in newer suburban developments on the southeastern edge of downtown Guelph. All of this information allows Guelph Water Services to be highly targeted in their outreach and messaging.

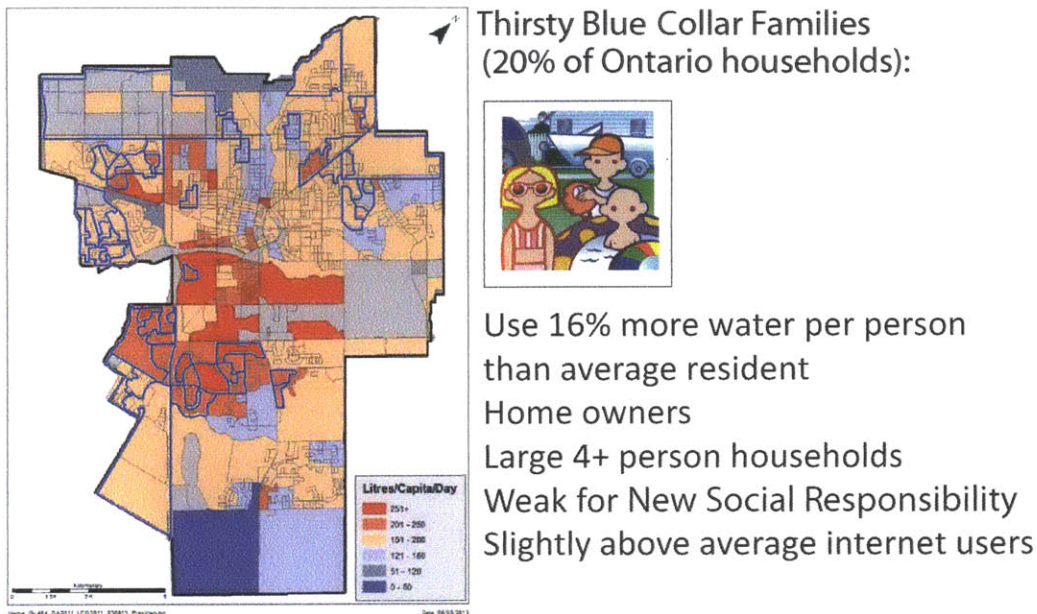


Figure 4.2 “Thirsty Blue Collar Families”

Source: Canadian Urban Institute

### Community-Based Social Marketing Summary

Community-based social marketing includes an understanding of an audience’s values, but focuses on an audience’s behaviors as the more important psychological arena. Since the desired outcome is an action, not a belief, a campaign analyzes the distance between current and proposed behaviors. Community-based social marketing can include a multitude of tactics, recognizing that individuals perform behaviors for many different reasons.<sup>34</sup>

Research and analysis can help answer the second set of questions about the audience: Why do the people who engage in a behavior do it? Why don’t other people? What alternative behaviors do they engage in and why? A study of attitudes of property owners in Minnesota and their adoption of riparian buffers found that “Highly significant differences between adopters and non-adopters were revealed in their beliefs, sense of personal obligation, perceived ability, future conservation behaviors, and past



engagement in civic action.<sup>35</sup> In other settings, the divide between adopters and non-adopters may be as straightforward as access to resources or time.

Discrepancies may also exist between attitudes and self-reported behaviors. A conservation campaign in Arizona found that participants widely believed that they were conserving. Luckily, the campaign asked follow up questions: as it turned out, residents were doing a very poor job of conserving water.<sup>36</sup> It is important not simply to accept an audience's attitudes about a behavior as evidence of it. Observational studies, focus groups, and pilot projects are ways of determining people's behaviors as well as motivations that are particularly rich. According to McKenzie-Mohr and Smith, the goal of such research is to discover "which factors are most important in distinguishing individuals who have adopted a behavior from those who have not."<sup>37</sup> A good campaign will be tailored to the audience and their "point of view...that's why [marketers don't advertise with] the slogan 'use the bus, we need the fares,'" says Don Waye.<sup>38</sup>

While the demographic information does much to define a campaign, it is true also that depending on what action or behavior change a campaign is interested in should influence which demographic to target. From one standpoint, the worst offenders or those least likely to implement the desired behavior ought to be the target group. The expectation with such a strategy is that changing the behavior of this segment will create the largest impact and that this demographic requires the type of outreach that a campaign performs. For instance, Denver Water's Wise Outdoor Watering Pilot Program sends personal consultants to work specifically and directly with customers who use large volumes of water. However, the "problem" population will also be the most costly and probably have significant barriers to adopting the targeted behavior, however.

The opposite strategy focuses on the "low-hanging fruit," the "audiences who will be most receptive to your message."<sup>39</sup> Academic researchers investigating the correlation between social characteristics of households and vegetation propose just this:

To promote the goals of urban foresters and environmental planners, an ecological marketing strategy could be developed systematically by using the tools of

geodemography and cluster-based market segmentation. In this way, they could measure different lifestyle groups' preferences and motivations for various environmental behaviors and then devise communication strategies and management activities that would address those preferences and motivations in a spatially explicit context.<sup>40</sup>

Gardeners and those who support environmental campaigns will predict with a high success rate who might be interested in building a raingarden on their own property. Not incidentally, political campaigns use the same techniques. They use past voter history, support for advocacy groups, and even commercial data to triangulate the likelihood of an individual voter supporting a candidate. They don't waste time on convincing those who are likely going to strongly favor the "other guy." Simply, the patterns of people's past behavior is a good predictor of future behavior. A new behavior or action that fits a person's existing values and activities is more likely to be adopted.

The emphasis on behavior is based on the premise that there is a set of barriers and benefits associated with the targeted behavior (and existing behaviors). The barriers and incentives to adoption may be internal, meaning psychological, or external, meaning technical or resource-based. Through interviews, focus groups, comparisons with similar segments, and pilot projects, a campaign determines the barriers and incentives of audience members. Regulations, which influence norms of behavior, and financial incentives can be an effective part of this re-balancing.<sup>41</sup> "The function of a social marketing program, then, is to change the ratio of benefits and barriers so that the target behavior becomes more attractive."<sup>42</sup> Each audience will have specific barriers and incentives, internal and external, yet there are common strategies for adjusting the balance of these two which will be discussed in the next section.

### **Establishing a Baseline and a Goal**

Once demographic and activity information has been gathered, the next phase of a campaign is to determine a strategy and a goal. Without both having information about baseline prevalence of a behavior or management practice and setting a destination, there is no way to know if a campaign has been successful or not. While goal-setting is important to measure the impact of regulatory and financial mechanisms, the

conventional emphasis of outreach on people engaged rather than environmental criteria makes it particularly significant. The range of goal articulation among study participants was unfortunately wide. For Denver Water, the long-range objective was very clear. After the 2002-3 drought, the progressive five-member board of Denver Water directed staff not to let up on conservation and to reduce consumption 22% by 2016 goal.<sup>43</sup>

On the whole, there was less clarity among informants working on stormwater issues, in part because of the range of local government entities working to improve water quality. Many programs fulfill the education and outreach components of municipal separate storm sewer system (MS4) permitting so they are an end goal in and of themselves. The next level at which most stormwater programs were operating included stormwater goals, but not specific targets. For instance, Angie Hong described the goal of her program in the following way: “[T]o educate and inspire people to use native plants, raingardens, and shoreline plantings to both beautify their yards and reduce run-off pollution. To keep lakes clean and reduce impacts on groundwater resources.”<sup>44</sup> However, measuring the reduction in run-off was outside the parameters of the program. As another informant said, “Even after you reduce the load, it’s going to take ten years because of all the legacy [pollutants] that’s there.”<sup>45</sup> Tim Kurtz, engineer with the Portland Bureau of Environmental Services estimated that there has to be a twenty percent change in land cover to get beyond the noise of monitoring data which can be attributed to natural variation.<sup>46</sup> Without a monitoring system analogous to the distributed metering standard to water utility practices, measuring changes in stormwater quality and volume is difficult.

Yet, in Portland and Washington, D.C., residential stormwater management installations are directly tied to reducing engineering and financial demands. In Portland, the goals of certain programs were described as both precise and tangible.

For both the downspout disconnection as well as private property retrofits, all of the work we’re doing we have databases for how much control we get at each property. Our modeling engineers that are modeling the capacity of our sewers basically take that data straight in to evaluate the input into our sewer system. From the very beginning we realized, that if we can’t count the impacts of what it

is we're doing, it won't make a difference in how we construct or model or design our sewer projects. We invested really a lot really early on to figure out the connection between rainfall and how our system was going to respond and how we needed to change our system in order to be more resilient.

Once you have that condition assessment, you can really start determining where your risk is in your system. We know where the capacity risk is because we've done all this modeling risk is, we know where all the pipes are that aren't big enough.... Once we confirm that yes we need to do work, our modeling engineers usually get a target, an impervious area target that they would like us to hit in order to find that breaking point for cost-effectiveness. That can be anywhere from 3,000 square feet to 74,000 square feet depending on how large the area is.

By contrast, when asked what the goal of the program was, one interviewee laughed, seemed genuinely taken by surprise, and then said "that's a really good question."

### **SECTION 3: Changing the Balance of Barriers and Benefits**

#### **Non-Monetary Costs**

Depending on audience survey responses or interviews, it should be apparent what barriers prevent adoption of a practice. Most likely, these barriers involve some combination of internal and external factors. Time and effort are significant external barriers to adoption of behaviors. Like money, they can take on relative meaning based on the opportunity-costs of other activities. Targeted behaviors which take more time and effort than existing behaviors will have to be offset by significant incentives, otherwise they have little chance of being adopted. The precursor to D.C.'s RiverSmart Homes, for instance, promoted adoption of personal stormwater management techniques by free tree and rain barrel giveaways – but not a lot of residents in Washington own cars so simply transporting the items home was a prohibitive external barrier.



The chart below displays a variety of activities which can be performed to reduce water consumption. Scan them and pay attention to your own reaction to them. While all are effective at reducing water consumption and all are promoted, some should strike you as more severe lifestyle changes or cost outlays.

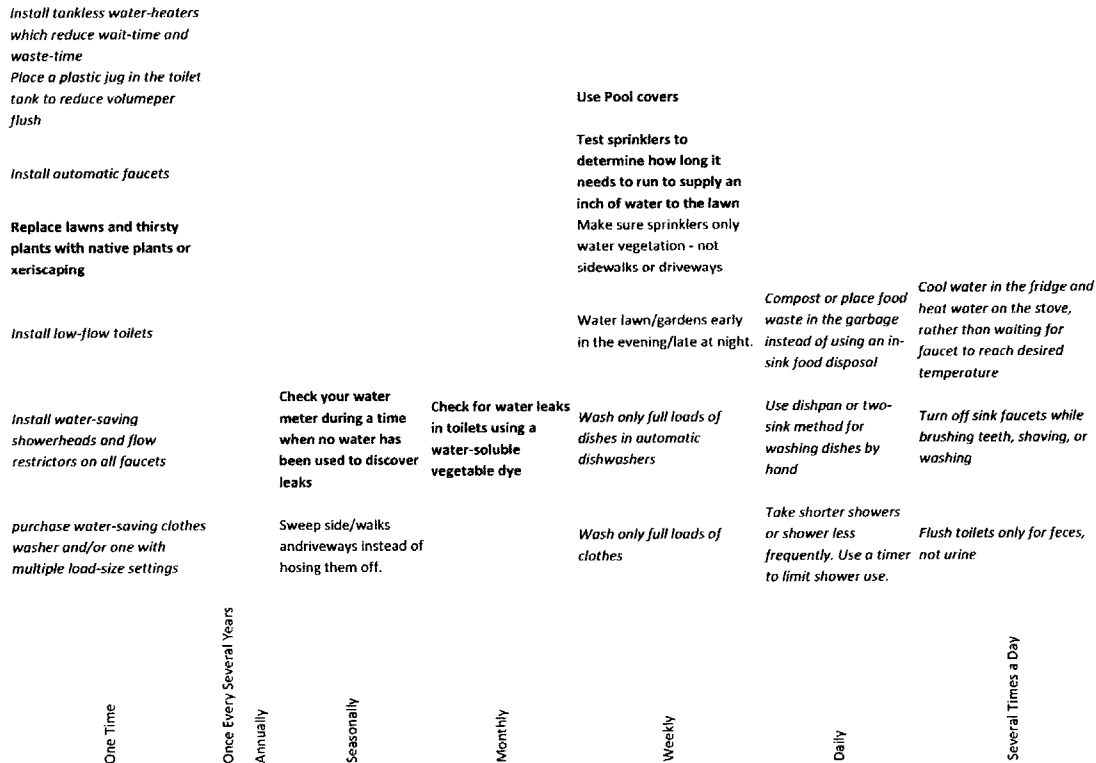


Figure 4.5 Recurrence Gradient of Water Conservation Actions

With many of the above actions, there are trade-offs among time, effort, frequency (a measurement of time and effort), financial costs, and psychic costs. Installing automatic faucets, for instance, is something that only has to be done once, but it may take an hour to pick-up and install and it has an upfront monetary cost. Meanwhile, turning off faucets while teeth-brushing or shaving takes no preparation or financial cost, but it has to be done everyday, multiple times a day. However, turning off faucets or using a faucet with

a motion-sensor is something that everyone already does and know how to do. Put another way, the targeted behavior has a precedent in an existing behavior.

Compare this with the two activities listed (in bold) to check for leaks. One activity is to check the water meter before and after a time during which no water has been used – the house is empty or its tenants are sleeping. Another leak-checking activity involves taking the lid off of the toilet and using a water-soluble dye. In both cases, these behaviors are entirely new. Most people will not know where their water meter is or how to read it. These actions are a sort of transgression of infrastructure, according to sociologist Susan Leigh Star. According to Leigh Star, two of the fundamental properties of infrastructure are its embeddedness, socially and technologically, and its taken-for-grantedness.<sup>47</sup> Campaigns about the sink or the toilet face the barrier of asking people to de-familiarize themselves with routine interactions, manifesting the appliances that had been figuratively invisible. Though seemingly modest almost mechanical behaviors, their adoption may face significant internal barriers.

Replacing hardware like faucets, showerheads, and toilets simply suspends temporarily people's relationship with infrastructure, changing that relationship altogether is a higher bar. Asking people not to flush their toilet will face a high internal psychic barrier. Equally, the effort required to adopt a completely new behavior is much higher than simply adapting. For this reason, many of the actions associated with stormwater management present larger barriers. Part of the strategy for overcoming those barriers is linking them as much as possible with existing - and preferably enjoyed - behaviors. Where the connections are not obvious, audience interviews and creativity can help bridge the gap.

### **Technical Assistance and Self-Efficacy**

A promoted action should be understandable and easily accomplished by the audience. Don Wayne, Nonpoint Source Outreach Coordinator at the EPA, described this as “confidence that your target audience can easily see itself embracing the preferred

behavior.”<sup>48</sup> In this context, education *is* the important factor necessary to overcome a barrier. It is what instills in an audience a feeling of self-efficacy and moves the audience from the preparation stage of adoption to the action stage. “A lot of times what we’ve found is that people, homeowners, are interested in this stuff, but they’re intimidated by it. They don’t know how to go about it if they wanted to.”<sup>49</sup> This is the context in which outreach is welcome. Ginny Gaynor of Maplewood, Minnesota describes the process in her campaign:

We have some homeowners whose primary gardening experience is mowing the lawn. So we do need to teach people. A year ago we increased our support for residents and provided one-on-one garden consults in two neighborhoods. These were gardens planted and maintained by contractors for one year. It was the first year residents were required to maintain their gardens. Consults were typically twenty minutes. Many gardeners just needed encouragement and to be assured they were on the right track. Some people need much more help with weed identification and weeding methods.<sup>50</sup>

Part of the message is not to overwhelm participants or they will get discouraged and turned off. For this reason, the campaign in Maplewood dialed back resident responsibility. Initially, residents were required to help plant the gardens. The amount of effort needed by staff to help residents through the planting and care during the first year left limited resources for staff to provide educational support to residents in maintaining their gardens. In response, the city shifted to having contractors plant and maintain the garden during the first year. They also “changed the planting design over the years to simplify them and make them easier to maintain.”<sup>51</sup> While the campaign took a risk of having the residents feel decreased ownership and therefore responsibility over the gardens, having residents adopt the garden after installation and maintenance allowed residents to familiarize themselves with the garden over time.

The generalizable lesson is to start with an easily accomplished task on which a participant can build. As Figure 4.5 indicates, there are many actions which someone *can* do. Recommending all of them is overwhelming. Professors Philip Kotler and Gerald Zaltman who coined the term social marketing wrote in their seminal article “the poor results of many social campaigns can be attributed in part to their failure to suggest clear

action outlets for those motivated...<sup>52</sup> Suggest easy tasks first and then move on to more difficult ones. The last thing a campaign should do is elevate people's emotions by telling them how important it is for them to perform some action and then bury them in options or, worse, give them no conceivable course of action to respond.

### **An Example: A Rain Barrel**

One mechanism for handling stormwater on-site is the rain barrel or cistern. Among its advantages in comparison to landscape-based techniques is that it is compact. In being (perceived as) a product more than a practice, it is familiar and perhaps more akin to indoor plumbing hardware. Typically rain-barrels are re-purposed 55-gallon drums connected to downspouts.



4.6 Typical Rainbarrel with Downspout and Spigot. Source: author

In concept, the barrel is straightforward: a container to collect rainwater. However, there are a number of installation and operation steps which are required for proper functioning. The downspout must be shortened or disconnected from the drain. Depending on the position of the downspout, a connector piece must be added to direct water to the barrel. The barrel must be raised off the ground in order to provide adequate pressure. It must be positioned so that water existing a downspout doesn't spray widely

and splash from the barrel back against the building. Most importantly, the barrel must be drained between rain events otherwise there will be no space for the water to be collected and it no longer serves its purpose.

A number of small studies found that barrels were not, in fact, used properly. In a 3,000-person town in Ontario called Wingham, residents picked up 900 free rainbarrels over the course of two weekend distribution drives. However, several months later, fewer than half were found to have been installed. “In informal interviews, residents were asked why they had not installed their barrels. Reasons...included that they didn’t know the barrels needed to be installed, they gave their barrels to a relative outside of the community, they found the barrels too hard to install or they would ‘get to it’ later.<sup>53</sup>” The study also found that of those that had been “installed, very few were regularly emptied after rain events.” The study suggested gravity drains to empty the barrels automatically rather than rely on human action.

The conclusions would seem to be that the barrel barriers were too high and the incentives too low, even to take on the recommended action of installation. One would imagine that residents were positive about stormwater collection given their effort to obtain the rainbarrels, yet their actions afterward are confusing unless external barriers are considered. Operation, ongoing draining after rain events, maintenance, and cleaning of debris proved too difficult – or were not even understood. Further suggesting the failure of residents to integrate rainbarrel maintenance into their behaviors, the Wingham study authors write that “no significant reductions were noted” in use of treated water. In other words, there was no displacement of piped water usage for harvested water.

What is queer about rainbarrels, though, is that many stormwater managers report that among stormwater best management practices, residents are particularly excited about them. Jenny Guillaume, Environmental Protection Specialist with RiverSmart Homes in Washington, D.C. said that rainbarrels are probably the most popular and requested item by participants.<sup>54</sup> Indeed, in a 2009 audit of installations on private property, 43% of households that participated in the program had rainbarrels.<sup>55</sup> A voluntary survey of 157

households in the RiverSmart Homes program found that more than a third of respondents emptied their rain barrels after every rain.<sup>56</sup> A random inspection of rainbarrels scored maintenance at about an 85%, indicating that they can be operated effectively.<sup>57</sup> It may be that the relative success of rainbarrel owners participating in RiverSmart Homes is due to the professional installation by the non-profit GreenWorks or it may be that the self-selection of survey respondents biased the results.

Another rainbarrel program carried out by the Nine Mile Run Watershed Association in Pittsburgh found that a majority of barrel owners who responded to a survey were “pleased” with the barrels and would refer them to a friend, however “the use and maintenance data suggest that many owners are negligent in draining and caring for the barrels.”<sup>58</sup> The study focused singularly on the effectiveness of the barrels at managing water, not on resident attitudes about them. One explanation for this discrepancy between effectiveness and attitudes may be that residents consider the rainbarrels as a product, an object whose purchase automatically produces a desired outcome.<sup>59</sup> Whatever the reason, having residents believe that they have performed a targeted behavior when they have not is a particularly poor outcome.

Given that a 55-gallon rain barrel collects only a fraction of the runoff volume produced from the roof of a typical single family home when properly installed, it might seem that they are not terribly useful. Indeed, they are not necessarily popular among stormwater and outreach professionals. Angie Hong described that she doesn’t promote rainbarrels very much, “A rainbarrel is 50 gallons. That get’s filled up in a teeny tiny little rain event versus a raingarden which can collect 1,000 gallons.” Bob Fraley, CleanRiver Rewards in Portland was similarly dismissive, “They’re full when you don’t need the water and they’re dry when you do.”<sup>60</sup> While rainbarrels may not be effective in and of themselves, they are in the sense that they get homeowners thinking about stormwater management.<sup>61</sup> Evidence from many other types of campaigns indicate that rainbarrels might work as “gateway” actions to more effective and intense activities. Doug Mckenzie Mohr and William Smith write that partaking in one environmental action “alter[s] how...individuals perceive...themselves. [They see] themselves as the type of person

who is concerned about...conservation and, as a result, carry through with other actions suggested...<sup>62</sup> On the other hand, if residents are discouraged by the ineffectiveness of their rainbarrels, they may be turned off to further action.

### **Commitment and Consistency**

One possible explanation for residents' satisfaction with the rain barrels is that they may serve a symbolic purpose as a conspicuous demonstration of green values, like reusable canvas shopping bags. The rainbarrels in the Pittsburgh project were designed to "engage watershed residents in visible solutions to local problems."<sup>63</sup> While raingardens or swales can have tall and flowering plants which may not be interpreted by others as an environmental improvement over a lawn, by contrast, rain barrels are easily legible extensions to the existing water management devices of the gutter and the downspout.

McKenzie-Mohr and Smith review quite a few studies which show an increase in participation in expensive or elaborate behaviors once participants have voluntarily agreed to a very small gesture. People feel an impulse to continue a pattern behavior associated with an identity they have created out of a desire to be seen as by others as trustworthy and having integrity.<sup>64</sup> Written commitments act like contracts and public commitments greatly increase the likelihood of honoring a commitment. The more specific a commitment, the greater the success.<sup>65</sup> Ralph Waldo Emerson derides this human characteristic of consistency, but it is quite useful for those in the profession of behavior change. "As soon as [man] has once acted or spoken with eclat, he is a committed person, watched by the sympathy or the hatred of hundreds, whose affections must now enter into his account."<sup>66</sup>

To tap into this type of motivation, the Livable Neighborhood campaign in Arlington, Virginia gives members an action log in which they write down not just actions that they plan to perform but also the day and time they plan to perform them.<sup>67</sup> Members discuss their action plan with other team members before carrying them out and report back on actions at the next meeting.<sup>68</sup> These written and verbal declarations are an internal

mechanism to increase the likelihood of follow through (taking the individual adopter from step 4 to step 5 in the diffusion model).

In the context of public commitments, rainbarrels represent a potentially-conspicuous effort at stormwater management. Often they are bright blue or hand-painted. Working with homeowners to locate rain barrels on the front of their property voluntarily would be a great way to increase effectiveness of barrel use as well as the adoption of additional stormwater behaviors.

### **Modeling and Norms**

Public behavior creates a model which others mirror in an attempt to abide by norms.<sup>69</sup> In one study of water conservation conformity in a locker room shower, the presence of a planted “model” who turned off the shower to lather prompted 46% of other to do the same – even though there was no eye contact during the study. When there were two “models,” the rate rose to 67%. The sociologist Loist Wright Morton writes that “most behaviors that people engage in are learned, either deliberately or inadvertently, through the influence of example.”<sup>70</sup>

The importance of visibility in creating a norm lends itself to landscape-oriented water conservation and stormwater management behaviors. No one knows how their neighbors consume water inside the house (unless a bill shares this information) and few know what their neighbors do in their backyards. For this reason, Denver Water encourages participants in one water conservation program of theirs to put up free yard signs. The goal of normative approach is to make a behavior like wasting water “unacceptable.”<sup>71</sup> The Watershed Stewards Academy in Maryland specifically aims to “create a new norm.”<sup>72</sup>

The impact of modeling and the strength of norms depends on the cohesion of the community in question. A neighborhood in which residents have raised their children



together will have very different levels of cohesion than one with high turn-over of residents.

### **Norms and Landscape**

Adoption of water conservation and stormwater management practices that transform the aesthetic and function of a yard may encounter significant internal barriers in audience members. It is not surprising to think that yards, like other public expressions of identity, are contained within a socio-cultural and relational context. “A household’s land management decisions are influenced by its desire to uphold the prestige of the community and express its membership in a given lifestyle group.”<sup>73</sup> Angie Hong described this phenomenon in relation to the difficulty of getting residents to adopt shoreline plantings for erosion control, “There’s a social norm for a lot of lakes, you’ve got a lawn that goes right down to the edge of the shoreline and that’s the way it looks.”<sup>74</sup> Researchers in Montreal described a strongly statistically significant “repetition of vegetation and of non-vegetated area descriptors...in front yards of close neighbors.” At the same time, the style was not constant across the whole neighborhood. In other words, the norms of landscape aesthetics were very much localized.<sup>75</sup>

In the US, aesthetic idea(l)s about the yard are connected to American Dream notions about the house. In his seminal work, *Crabgrass Frontier*, Kenneth T. Jackson writes that as early as the 1860s, “in the United States carefully tended grass became the mark of suburban respectability...The well-manicured yard became an object of great pride.”<sup>76</sup> He adds that by 1890, “the expectations about residential space shared by most Americans today had become firmly implanted in middle-class culture.”<sup>77</sup> Norms of landscape are codified in homeowner covenants and town ordinances.

Uprooting the American lawn is no easy task, figuratively speaking. Tall grasses convey weediness that symbolizes disorder. Elsewhere, overgrowth indicates the blight of foreclosure in a neighborhood or the plague of vacant lots in de-populating cities. In “Broken Windows,” James Q. Wilson and George L. Kelling famously argue that physical disorder sends a message that anti-social and criminal behaviors will be

accepted. The “sense of mutual regard and the obligations of civility” break down in the “jungle” of weedy properties and abandoned buildings.<sup>78</sup> Whether or not literature supports the theory that physical disarray promotes criminal activity, it nevertheless underscores the degree to which landscape is understood in moral terms. Aesthetic discussions are not a far step from this topic. Raingarden plants like sedges and even the groupings of different flowering species can appear more akin to the untended plot than the well-manicured lawn, greatly effecting their level of acceptance. The authors of a review of Kansas City’s Manual of BMPs write, “landscaping and appearance is critical to public acceptance.”<sup>79</sup> Ginny Gaynor of Maplewood, Minnesota discusses her campaigns efforts managing that issue.

Our original raingarden designs had many native plants. They included tall plants like false sunflower and New England aster in the center. The gardens felt out of balance aesthetically with such tall plants in a relatively small garden right on the boulevard. It was difficult to teach people how to keep these particular species from overwhelming the garden and becoming an eyesore.

In addition to height and aggressiveness, New England aster blooms very late -- in mid September in our area. So there’s a big spot in the garden where you wait all season for something to happen. When it does it’s glorious for three weeks, but it’s a long wait and it can look very weedy much of the summer. We have transitioned to using more cultivars in our gardens.<sup>80</sup>

Joan Iverson Nassauer, a professor of landscape architecture, argues that aesthetic preferences for landscape characteristics are malleable as long as the landscapes “display care.”<sup>81</sup> These “cues to care,” include the well-mowed lawn and trimmed hedges typical of the suburban model, but also suggest opportunities for more varied landscapes. Well-defined edges, fences, freshly painted structures, and signs that convey “neatness and order” give aesthetic breathing room to native plantings or raingardens.<sup>82</sup> Those cues contain the different vegetative areas and allow them to be seen as intentional rather than neglectful. “Cues to care have a protective effect on ecosystem functions because they attach recognizable cultural value and aesthetic experiences to ecosystem functions that would not necessarily elicit these values and experiences independent of noticeable care.”<sup>83</sup>

Anecdotal evidence of the cues being more important than the aesthetic form was shared by Portland's Amber Clayton.

Fifteen years ago... realtors were a big stumbling block for us. They were accusing us of putting deed restrictions on the property. Now we talk to realtors and they say "oh yeah, not a problem. We see that all the time." It's really been a culture shift in accepting [raingardens]. People know what they are, they're used to seeing them and if you do it right, they can look great.<sup>84</sup>

An April 2013 article about horticulture designer Piet Oudolf describes how his high-profile work on the New York City Highline and Chicago's Lurie Gardens at Millennium is part of a widespread landscape attitude that favors "romantic drifts of ornamental grasses and blocks of perennial flowers rather than the trees, shrubs and lawn grass look that dominated American landscapes... Elsewhere in the United States, primarily in the upper Midwest, ecologists had begun to promote native wildflowers as an alternative to the conventional lawn. The idea of the garden was becoming steadily wilder."<sup>85</sup>

In the southwestern U.S., an aesthetic style has emerged from xeriscaping that emphasizes the sculptural qualities of cacti and xeric plants, the textural patterns of gravels, and a ruddy color palette of stone and steel. As seen in the yards below in Phoenix, signs of order like the novel gabion fence (left) and the staked and moated tree (right) adhere to Nassauer's "cues of care" while complying with a completely different aesthetic from the prototypical American lawn.

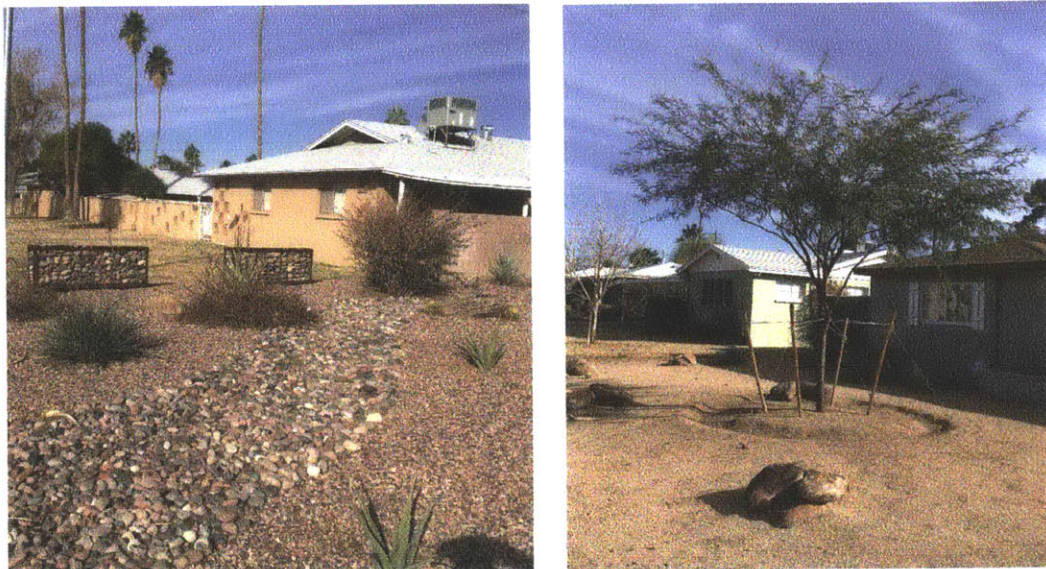


Figure 4.7 Front yards with a southwestern landscape aesthetic. Source: author

This style has been promoted by water departments and landscape architects for decades and it is not always accepted. A member of a homeowners board in Albuquerque that established a policy permitting xeriscaping in 1998 received hate mail, according to an article in USA Today. "People basically hated me because I gave everyone a choice not to have grass," Scott Varner, the former board member said "Some people just don't want to let go of traditional landscaping."<sup>86</sup>

Understanding audience members' and their neighbors' attitudes about their landscape and how they use it can help a campaign determine which practices will be well received and which will represent an insurmountable barrier. In comparison to identifying other types of information like demographic characteristics, learning about what features and vegetation already exist in a neighborhood can be accomplished simply through observation.

### **Geographic Relevance and Place-basedness**

Landscaping can be part of a larger environmental strategy of connecting people to the natural environment and landscape heritage of their area. It can also play off of a sense

identity and heritage associated with a certain place. This connectivity can depend a lot on the existence of charismatic flora like a saguaro cactus or the bald cypress or on habitat types like the prairie. These native plants and landscapes that strongly define the place can be quite important. Identifying and celebrating plants as native has been a strategy to build pride and status into vegetation which might otherwise be seen only as an ugly alternative to a lawn. For some people, especially newcomers, whether or not a species or landscape style has personal relevance may be less important than the notion that it will confer membership to an identity group.

The connectivity extends even more easily, perhaps, to fauna. After conducting a telephone survey, the Chesapeake Bay Program decided to create a campaign to discourage fertilizer use not to improve water quality, but to “Save the Crabs. Then Eat Them.” Another advertisement shows a mansion and large lawn under the question, “Is the grass really greener if all of the blue crabs are gone?”<sup>87</sup> The 7-week campaign reduced self-reported fertilizer use by 10%. Where general environmental concerns were not enough to change behavior, appealing to viewers sense of place, lifestyle, a shared heritage (membership in the “Chesapeake Club”), and a charismatic fauna, the campaign was able to change behavior.

The National Research Council describes this phenomenon on a community level but it applies to individuals as well. “One of the obvious differences is the level of interest and effort exercised by coastal communities or communities in close proximity to a water resource that have immediate access to the beneficial uses of those resources but also have an immediate view of the impacts of polluted runoff.”<sup>88</sup> The connectivity residents feel to the natural environment will be very different in New Orleans, where the major geographical feature, the Mississippi River, is a flowing shipping channel blocked by levee walls, from Denver which has mountains behind its skyline and a riverfront park as its public living room. The issue of proximity and prominence might partly explain why Minnesota, whose geography and identity are defined by thousands of small lakes, has been successful in mobilizing residents to participate in campaigns to manage stormwater.

Randy Hester describes the significance of certain local places where common and yet emblematic actions occur as “sacred.” These places include landscapes, built artifacts, and cityscapes that “exemplify, typify, reinforce, and perhaps even extol the everyday life patterns and special rituals of community life, places that have become so essential to the lives of the residents through use or symbolism that the community collectively identifies with the places.”<sup>89</sup> If these places are connected to water, then connecting a campaign to them would likely be effective. In Minnesota, for instance, the lakes are part of people’s quality of life and beloved activities happen on and in them.

Of course, connectivity to place can occur in negative ways, too. Residents suffering from sewer back-up or street flooding will be excited about employing stormwater best practices.<sup>90</sup> Even short-term disruptions to infrastructure are messaging and mobilizing opportunities. For those for whom the system works and the infrastructure keeps stormwater invisible, though, a project may lack relevance and be seen only as a burden. That was the experience for Tim Kurtz, an engineer with the Sustainable Stormwater Management Program of Portland:

I’ve had two projects where a community really was opposed to having green infrastructure and they weren’t having back ups. For those parts of town, the issue is simply a larger water quality issue. The issue for them was ‘We understand what you’re doing, we understand why you want to do it, but we like our street the way it is, we can’t believe that you have to do *our* street.’

This fundamental axiom of geography is worth keeping in mind: features that are close together have a greater relationship than features which are further away. “If the benefits of stormwater controls are not going to materialize in waters close to or of value to the community instituting the controls, then the costs of the program from the locality’s standpoint are likely to outweigh its benefits.”<sup>91</sup>

If a waterway is so degraded as to be a nuisance or eyesore, residents may be excited in supporting efforts to clean it up. If residents are unaware of their local waterway or it is simply seen as dirty, it will be difficult to mobilize them to perform individual actions

using environmental messaging about a shared resource. A healthy waterway may seem too abstract or unrealistic goal.

Not that it can't be done. Professor Anne Whiston Spirn's work in and along the former Mill Creek area of West Philadelphia models how long-term environmental change can come out of even polluted areas. However, it was not easy and drew upon a variety of resources. She worked for years with residents and school children to demonstrate how a legacy of subsidence and structural damage revealed a buried flood-plain. "To read this landscape is also to anticipate the possible, to envision," she writes.

Without an understanding of the forces that shaped the neighborhood, many believed the poor conditions were the fault of those who lived there, a product of either incompetence or lack of caring. Learning of all the historical reasons sparked a sense of relief...They came to consider the possibility of alternative futures and brimmed with ideas.<sup>92</sup>

Learning about a different, past landscape and the dynamics that created the current landscape served as platform for imagining alternatives. Her work promoted a set of activities involving a place and the natural environment which can best be described as stewardship. But it was a stewardship that was not intuitive to the residents. The conditions of a place may not be easily transformed, but the connections to it are malleable.

### **Personal Contact and Additional Audiences**

Many interviewees expressed the importance of personal contact in their campaigns. Personal contact can be thought of as an incentive because it elevates the status of an audience member and their action. It can also decrease barriers like uncertainty and lack of self-confidence to perform a new behavior. Karen Guz, Conservation Director, San Antonio Water System, said that she places a lot of value on face-to-face interaction:

We do send out a weekly e-newsletter to 11,000 people, but that's a flash. We don't know if people are opening them. It's just a digital message flashing by them... We've put a lot of energy into talking to people. Our goal is to exceed 100,000 face-to-face education interactions in a year.

The value of interpersonal requests was echoed by Melissa Elliot in Denver, “there is no substitute for human contact when asking for behavior change. You must ask for the change directly.” Evidence from the Merle-Ramsey Water District in Minnesota suggests that proper maintenance of raingardens increased significantly after personal visits with homeowners. In June, 2006 District staff found that 52% of raingardens were maintained. After site visits, maintenance improved to 91%. The next June, 82% were found to be maintained, even though no more contact had been made. While a better experiment might have created a control group who received no visits or created an experimental group who received site visits and education and a control who received a site visit without education, the improvement in maintenance correlates with visits.

It also suggests that staff were trusted messengers. The likability and trustworthiness of spokespersons are very important to consider. In one campaign recruiting residents, door-to-door canvassers received so few answers knocking on doors that they sent letters with photographs of the canvassers in advance. As Angie Hong said, “People weren’t opening their doors because... ‘Who are you?’”<sup>93</sup>

Trustworthiness explains the use of doctors to recommend cigarettes for so many years – and the current investment by pharmaceutical industries to get doctors to promote certain drugs. Despite this rather crass historic (and some would say continuing) undermining of professional credibility, medical doctors along with nurses and pharmacists still garner very high or high ratings from 70% or more of respondents in Gallup Poll’s most recent gauge of honesty and ethical standards.<sup>94</sup> However, this doesn’t necessarily mean that the best messenger for a water conservation or stormwater management campaign would be a doctor.

Who is the best individual spokesperson will depend on the community in question. For some, it may be a church leader or football coach. For others, it may be a successful business leader or the founder of a community development corporation. The marketing firm Q Scores which measures consumer appeal describes a spokesperson this way, “The



right choice is one that the target audience perceives as being *believable and appropriate in relationship to the promise of a brand* [emphasis included].”<sup>95</sup> For this reason, master gardeners are often messengers in landscape programs.

In its studies of spokespersons, Q Scores also measures familiarity, a proxy both of influence and trustworthiness. Sometimes, more than one spokesperson is useful for meeting all of those characteristics. The Powderhorn Lake, Minnesota “Neighborhood of Raingardens” campaign found success combining “pairings that included a neighborhood resident or volunteer and a Metro Blooms staff. This allowed for the neighbor to attest to the validity of the project and the staff member to answer questions about the process.”<sup>96</sup>

A different type of familiarity characterizes most people’s communication: small scale and personal. Information moves in a much more networked manner than in a one-to-many model of a spokesperson and audience. Because people are so likely to listen to their friends, companies provide large incentives for users to recommend a service to a friend. A survey of Washington, D.C.’s RiverSmart Homes participants found that 34% of participants learned about the program through word of mouth and the second highest category at 17%, was a neighborhood blog or listserve.<sup>97</sup> For this same reason, community based social marketing campaigns place a lot of emphasis on neighbor-to-neighbor interactions in settings with strong cohesion.

To harness the natural information sharing and values articulation on personal interactions, campaigns Tupperware Party-model of diffusion. The Powderhorn Lake “Neighborhood of Raingardens” campaign utilized raingarden parties to attract residents to participate. However, just as with a celebrity endorsement, “the characteristics of the host seemed to be critical in terms of whether the garden parties were a success or not.”<sup>98</sup> Or more colloquially, “People come because it’s their friend or their neighbor – not because they’re necessarily interested in the lake.” Angie Hong described a similar use of a party,

We had a watershed district board member who lived in the neighborhood, friendly person knew her neighbor. She invited everyone in her cul-de-sac to

come over in the evening. She had margaritas and had chips and salsa. I came over and told everyone about their lake nearby and that there were grants and assistance available through the watershed district and here are some pretty pictures. And that one worked spectacularly. Everybody at the neighborhood wanted one. It started a domino effect.

Underlying this method is a theory that people engage in and decide to engage in actions as part of a group, not singularly. “Groups influence their members by subjecting them to a variety of obligations to act in the corporate interest and by ensuring that these obligations will be fulfilled.”<sup>99</sup> In newer developments without social fabric, “neighbors” may be reticent to interact with each other, let alone be motivated to partake in collective action.<sup>100</sup>

And in strong neighborhoods, the domino effect can work the other way, too. As Ginny Gaynor attests:

We find that neighbors talk amongst themselves, and this is a huge part in selling or not selling the project. On some projects one resident on the block will dislike the raingarden approach and he’ll talk many others out of participating. So the idea to have residents be advocates is a really important one.

For this reason, a campaign may want to engage not just with potential adopters, but with all stakeholders: “those creating change, those affected by change, those with authority to enforce change, those who can block change.”<sup>101</sup> These leaders act as community gatekeepers.<sup>102</sup> Their political influence has the potential to harm or boost a campaign. Courting influential and potentially problematic stakeholders is not quite a reversal of the audience segmentation and targeting strategy, but it is a holistic and political risk assessment and management strategy. Particularly in situations in which there is hostility to government or a particular agency, a campaign can neutralize opposition and smuggle in receptivity this way. Ideally, unexpected partnerships can form and campaigns can establish legitimacy through existing leadership. Second to these options, a campaign can create an advisory board or shop out components to a community non-profit is another.

Interestingly, RiverSmart Homes used the outreach opportunity in the opposite manner of a normal campaign. They specifically kept the outreach and technical assistance “in house” as a method to help improve the perception of the utility.

As effective as personal interaction is, it is expensive. Returning to the internal diffusion model of adoption, personal contact may be better employed further along an adoption process like in step 3, deliberation, rather than at step 1, exposure. In Powderhorn, “An initial broad outreach... ‘prime[d] the pump’ by generating a baseline level of familiarity.” When homeowners were visited later, the “canvassing was more effective as it already had more legitimacy.”

### **Water Stewards**

Two programs in suburban Washington, D.C. are extraordinary models of behavior change that combine several of the strategies described above including a personal contact approach, commitment, and self-efficacy. For Suzanne Etgen, Anne Arundel County Watershed Stewards Academy Coordinator, the whole idea of “training and supporting citizen volunteers is about creating community, creating relationships and sustaining those relationships.”<sup>103</sup> This is also predicated on a diffusion model of behavior adoption.

Based in Arlington, Virginia, the Livable Neighborhood Water Stewardship Program explicitly is working to create 1,425 teams of 5-8 people so as to reach the 15% tipping point of the local population described by Everett Rogers as the natural tipping point at which innovations self-perpetuate.<sup>104</sup>

Located around Annapolis, Maryland, the Watershed Stewards Academy trains residents to become leaders of stormwater projects and activities in their communities. The program developed from years of growing public interest and existing partnerships. For some time, the Department of Public Works, the Anne Arundel County Public School System, and a local environmental outdoor education center called Arlington Echo

partnered on large restoration projects to moderate the impact of outfall discharges.

According to Suzanne Etgen,

The surrounding community would be involved and parents would come, people would say “We understand what stormwater is now, how can we do something in our neighborhood to help.” Volunteers started to work with different neighborhoods and realize that there was a pull there, you just can’t be in every neighborhood. And so that’s how this idea was born, out of need to create an army of people out there in communities who can help their communities coordinate environmental restoration.<sup>105</sup>

At the same time, the Director of Public Works was pro-active about engaging residents to meet the forthcoming Total Maximum Daily Limits, according to Etgen. Since 2009, the Academy has graduated 5 different classes totaling 100 Watershed Stewards. The initial training consists of 64 hours of classroom and field training that spans 13 sessions over 5 months. Over the remaining seven months of the year, trainees are required to create a capstone project. The project must include a community assessment, however the final project can be either behavior-change-oriented or residential LID installations. Additionally, certified stewards must annually perform 40 hours of watershed action in their community, attend 8 hours of continuing education, and participate in three networking meetings to keep their active status. The training program was modeled after existing master gardeners program except with fewer liability restrictions.

The power of the Academy technique is not just in the numbers of graduates, but in the relationships of graduates to their individual communities.

Stewards live in the communities where they work, where they are stewards. They’re there for the long haul. We know that change doesn’t happen overnight so we feel like investing in stewards who live in communities are investments for the long haul. They also know their communities so much better either than environmental or government organizations that would be coming in from the outside. They’re starting with a relationship with the people who live there, a knowledge of what the community’s both environmental and social climates are. They have the potential to start at a much higher level and go much longer than any outreach that would be coming in from the outside. That’s key.<sup>106</sup>

Empowering stewards also means a certain lack of control over outcomes. “Not everyone is going to do what you want them to do....[but] there are all different kinds of ways in

which people are watershed stewards. The more we [at the Watershed Stewards Academy] embrace that, the better outcome we'll have.”

And the outcomes have been impressive. One year, Watershed Stewards brought in \$47,000 of contributions from their community to do projects and about \$10,000 raised through grants. In 2012, Watershed Stewards created 9,000 square feet of “rainscaping,” planted over 4,500 trees and native plants, and met with 5,200 citizens over the course of 167 separate events.<sup>107</sup>

Across the Western Shore of Maryland, The Livable Neighborhood Water Stewardship program uses a similar model of motivating participants and expanding the circle of actors. It was developed with the help of the Empowerment Institute in collaboration with the non-profit Arlingtonians for a Clean Environment and the following local government agencies: Arlington County Department of Environmental Services, Alexandria City Government, Fairfax County Department of Public Works and Environmental Services, and Falls Church City Government. The program partly fulfills their MS4 permit requirements. The program started by training five team leaders who in turn led teams of 5-8 people. Team stewards participate in five meetings over three months, which recur bi-weekly. The initial meetings are focused on interpersonal exchange and trust-building, setting the foundation for a sort of environmental support group. The latter three meetings are focused on three categories of actions: improving water quality, conserving water, and community participation. Team members are given an action workbook with 10-12 types of activities per weekly category. The workbook describes the benefits of the actions as well as how to perform them and the materials, cost, and time needed. When appropriate, the action descriptions include a resources section with phone numbers of program partners or other allied organizations like the Virginia Cooperative Extension. Selecting among different activities allows stewards to choose actions that are the most relevant or exciting and with which they are comfortable performing.

In addition to the support group technique, the Stewardship program has a number of advantages over traditional outreach campaigns. The new actions in which Stewards

engage are tracked as part of the process. So there is a record that for 2004-5, 35 households replaced cleaning and lawn care products with environmentally-friendly substitutes (Toxic Sleuth action) and eighteen households installed raingardens (Catch it While You Can action). While these actions are only proxies for expected improvements in water quality improvements or water use savings, they do represent changes over a baseline.

Secondly, the program is highly personal. The program suggests that Watershed Stewards discuss their weekly actions with members of their households to “get their ideas and participation.”<sup>108</sup> The final module of the program entails choosing among a selection of activities that are outreach-oriented. Some are more political, like advocating for stormwater considerations in planning and zoning decisions. But others are focused on building the capacity of stewards to take leadership roles in the next generation of stewards in a pyramid-like model of reproduction. At the end of their training, each team starts at least one new team.<sup>109</sup> Becoming a team leader or coach also serves as a reinforcement “to keep yourself motivated to maintain the water-friendly lifestyle.”<sup>110</sup> It’s easy to see how quickly this technique could become powerful.

Northeastern Virginia is an interesting test case for this model and perhaps not the best. It is diverse, highly educated, has a high concentration of federal employees and is very wealthy. Fairfax and Arlington counties and Alexandria and Falls Church City are consistently within the top ten wealthiest counties in the country.<sup>111</sup> It remains to be seen whether the unique demographic conditions under which both of the above stewardship programs were created have determined its success or whether they work off of audience dynamics which are extant elsewhere.

These stewardship models which rely heavily on personal diffusion run the risk of disenfranchising subsets of the community who cannot mobilize resources or time, a problem endemic to other decentralized policy approaches like public-private partnerships for operations and maintenance of public parks. Etgen acknowledges this limitation in Anne Arundel County, “In order to go after those audiences, you really have

to go after them. I think we have to recreate our programs specifically to reach those people, which absolutely needs to happen, but we haven't gotten there yet." Etgen's goal is to have at least two stewards in every neighborhood in the county. One tactic they are considering is slightly rebranding the program such that one-year graduates would be Master Stewards and Stewards would be certified after a reduced number of hours of coursework and training.

### **Prompts and Reinforcement**

As the irrigation reminder campaign in Las Vegas demonstrated, people's attention is greatly sought after. Sometimes external prompts are the only incentives needed for adoption of a behavior. People forget to perform actions the importance of which are very well understood – recognizing an anniversary with a spouse or remembering to take a medication. No surprise that everyone forgets to perform much less critical actions. In Washington, D.C., the District Department of the Environment is working with electronics firm Geosyntech to install small sensors in the rain barrels. The combination of hardware and software can text or tweet a homeowner to drain a barrel in advance of a rain event. That is a significant start. A thank you message from the rainbarrel would be a great way to reinforce the positive behavior.

### **Multi-platform Message Delivery**

Denver Water ran a well-branded innovative campaign called "Use Only What You Need" that was hard to miss or to forget. It involved billboards with the metal beam painted like a garden hose, benches cut in half and cars stripped of the body and seats. It was memorable. But the penetration of a message happens when it is delivered by many different people and in many settings. When different entities collaborate on a campaign - a manufacturer, a retailer, a utility and a non-profit - the message also takes on a normative value. EPA's Community-Based Social Marketing WaterSense workbook titles a whole chapter "Who Else Can Help: Identifying and Enlisting Partners." Encountering the same message in different places not only gives it legitimacy, but also acts as a particularly strong reminder. It is much more likely to be internalized as opposed to remembered only in a specific context.

## **Monitoring and Evaluation**

Keeping track of and evaluating the work was a discussion that brought about divergent views among informants which correlated significantly with the goals of their programs. J.C. Davis at the Southern Nevada Water Association was able to say immediately that Las Vegas' turf replacement program had converted 160 million square feet of lawn across 50,000 individual projects. Similarly, Amber Clayton proudly stated that they had disconnected 54,000 downspouts over the 18 years of the Bureau of Environmental Services program. Follow up surveys show that property owners are maintaining their disconnected downspouts. A survey of the RiverSmart Homes found that 35% of respondents completed additional stormwater management projects, while majorities or near majorities reduced the amount of fertilizer and pesticide. Thirty-five thousand registrants have participated in Portland's CleanRiver Rewards Program.

In smaller municipalities particularly on the stormwater side, the focus of informants was more on market penetration, resident participation and behavior-change than it was on quantifiable water quality improvements. Since water conservation efforts are inherently about diverting or delaying system expansion, monitoring is essential to ensure that the cost per acre foot of water conserved is cheaper than the cost of new supply. All informants valued impact and evaluation and many described that measuring the impact was a profound question. Angie Hong describes how the growing success of her program has caused her and other program partners to adjust their spending to be more targeted toward water quality improvements:

We're now in the midst of talking among all our watershed partners and cost-share partners: in the beginning we just wanted people to do these projects and now we are getting so many people doing them that we have to prioritize more.

We really need to prioritize where we're helping people and giving out cost-share grants that are coming from public funds. So if someone calls and they're in a land-locked basin, that's when we need to start saying "okay, well that's really great." Come out to the site-visit and "here are some resources and good luck."



We're also getting much more targeted because we have [Total Maximum Daily Load limits] on a lot of the lakes. We're doing studies and saying "okay we need to do x amount of load reduction in phosphorus and we could do 120 curb cut raingardens in this catchment area." So we're being very intentional about where they are going and how many we need to get it.

Most importantly, monitoring and evaluation is necessary to see whether a program is working the way it was intended to, and if not investigate why.<sup>112</sup> Karen Guz with the San Antonio Water System described how the behavior of residents had run counter to program expectations:

When I first came here, we evaluated the landscape rebate program that had been around for a long time. It was really distressing: on the net we weren't saving. We were doing a lot of rebates and working with a lot of customers but there was no water savings. What we found was after customers changed to what should have been a low water landscape, a third used less water, a third used more water and a third didn't change at all. Those who used more washed out all the savers.

So it boils down to a bunch of things which were all behavioral. They just kept watering it the same way they did before even though they got this water saving landscape. It's this bizarre thing. People think that because they have this water-saving xeric landscape, the savings are automatic. For whatever odd reason, unless you make it explicit, people do not understand that they must also start applying less water.

The other interesting factor is that if you just spent a lot of time and energy going from that grass that you really weren't very enthusiastic about it to now these cool interesting plants, you're very fond of them and we show our affection to the plants by watering them. It was fascinating that we figured out a lot of what was going on was not the wrong plant material, it was the wrong maintenance practice.

### **Rebound Effect**

Unfortunately for environmental campaigns of all stripes, these types of behavior-based losses resulting after efficiency measures are common. This phenomenon is called by several names with slightly different meanings, but the rebound effect or moral licensing hazard are two common versions. Classically, the rebound effect is related to price such that increasingly efficient use of resources makes additional capital available which is then spent on more resource use. More broadly, and behaviorally, the rebound effect or moral licensing describe a leniency related to one action as a reward for

positive behavior elsewhere. Doug Bennett was familiar with this phenomenon: “People may feel like ‘I really did my chore, I did that project, I worked my butt off, I deserve a 15 minute shower instead of a 5 minute shower.’ That’s how humans work.”<sup>113</sup> There are, unfortunately, nearly endless examples of this beyond taking longer showers: driving more after purchasing a more efficient car, or feeling at liberty to eat a large desert after working out. The rebound effect can nearly erase all gains. Doug Bennett warns just that “People don’t fully capitalize on the potential of some of these things, and in fact they may rationalize their way to negative outcomes.”

#### **SECTION 4: Conclusions**

There are a lot of different techniques and considerations when employing community-based social marketing. It requires significant time to understand the audience and their barriers and benefits with regard to a certain action and to create mechanisms that change the balance of those barriers and benefits. While some tools like commitments and prompts are effective on an individual level, most of the strategies of community-based social marketing rely on personal interactions. “Social science research indicates that we are most likely to change some behaviors in response to direct appeals or social support from others.”<sup>114</sup> Indirect forms of social pressure also can change behavior significantly. Personal contact self-reinforces or multiplies out certain attitudes and behaviors until they grow to be community norms. The impact of community-based social marketing is not always immediate, but it is internalized and so long-term.

## Chapter 5, Conclusions

### The Context of the Research Question

The discussion of this paper has not been about the responsibility and opportunities for action by private citizens. That condition has simply been the context. Any number of historical forces from Jane Jacobs's publications to privatization of government services to tactical urbanism has resulted in, depending on one's viewpoint, decentralization, stewardship, community power, or inequity of service allocation, localizing the context for evaluating what is the public good. There is no longer a single powerful decision-maker which is the representative actor for the collective. Instead, there is a more individualistic model in which the levels of opportunity, responsibility and power, which vary among groups and individuals, is permitted to play out in the public sphere. Just as the advocates of technocracy in the nineteenth and 20<sup>th</sup> century were undemocratic, the decentralization which has been the mode more recently carries with it risks of inequity.

The ways in which private citizens in urban settings interact with and effect public water resources in their daily lives is also well known. People use water treated by a water utility and piped to their residences for hygiene, drinking and food preparation, and landscaping. The waste-water is conveyed through sanitary sewer pipes to treatment work. Rain that falls on private property picks up intended and unintended physical artifacts of people's activities and carries them through storm sewers into lakes and rivers, sometimes being treated first. In 772 U.S. municipalities, storm sewers and sanitary sewers are combined.

Water utilities and stormwater permittees are having difficulty dealing with user needs and environmental limitations under current but long-standing regulatory, political, and financial circumstances. This difficulty is expected to grow collinearly with population and in unexpected ways with climate change. So they are seeking to change the ways users interact with and effect water resources. At the same time, residents and environmental advocates, unsatisfied with the environmental conditions of water bodies and adjacent habitats, have been taking their own initiative. The basic research question,

then, is how can water utilities and local departments that manage stormwater get their users/constituents to help them achieve their respective goals of ensuring adequate water supply and improving stormwater runoff?

One of the first steps in answering that question is to differentiate among the various stakeholders. The reality is that water utilities and environmental departments employ multiple campaigns at once and target all users. For the sake of focus, this study analyzed one segment of the private sector: single-family households. The separation of single-family households from other users is not only academic. Inherently the circumstances of and strategies described for single-family households are different from those related to commercial establishments, which can have extensive organizational structures aimed at maximizing profit, or to rental properties, where programs must address the tensions between landlord and tenant priorities. The acreage and percent of household types which single-family households represent makes them potentially powerful partners. Yet any propositions about household involvement in reducing stress on the water supply and improving local hydrology must also contend with deeply-held notions about home and the yard or they will be doomed.

The more refined version of the research question is how effective are the current methods utilities and local stormwater entities use to get single-family households to adopt prescribed best practices. These methods are regulatory, financial, and community-based social marketing. The table below summarizes the findings of the study with regard to the effectiveness of each method. To further operationalize the term effectiveness, a broad cost-benefit determination of each method is included.

	<b>Regulations</b>	<b>Financial Levers: Pricing</b>	<b>Financial Levers: Incentives</b>	<b>Social-Marketing</b>
Water Conservation	Moderate short-term effectiveness, uncertain long-term effectiveness. High Cost-Benefit	Highly Effective. Low Cost Benefit	Moderately to Highly Effective. Moderate Cost Benefit.	Highly Effective. Moderate Cost Benefit.
Stormwater	Negatively effective. Cost-Benefit Not Applicable. Effective for new development.	Ineffective at current levels. Strong future potential. Effective for commercial. Cost-Benefit unclear.	Moderately to Highly Effective. Moderate Cost Benefit.	Highly Effective. Moderate Cost Benefit.

Figure 5.1 Review of Best Practice Adoption Mechanisms

In practice, the methods are rarely employed separately. While that condition increases the difficulty of isolating the causes of certain outcomes, it also means that each lever is stronger than what might be described. Karen Guz, Director of Conservation at the San Antonio Water System (SAWS) says that “the combination of education, and then the incentives, and regulations can come together and drive the customer to decide to make a permanent change.”<sup>1</sup> The President and CEO of SAWS attributes this “three-legged stool” method as responsible for lowering the per-capita water use 42% despite a 67% increase in population.<sup>2</sup> In other words, the variety of messages and incentives reinforce each other. For analytical purposes, however, the effectiveness of each lever was separated and is in the descriptions below. The descriptions also include ways of enhancing or expanding the uses of the levers beyond their current form.

## **Recommendations**

### **Regulations, Water Conservation**

Regulations about water use are helpful in the way that any rule-making creates an expected baseline or boundary of acceptable activity. However, the enforcement component of water regulations seems burdensome and may backfire by creating resistance. Asking residents to surveil their neighbors can expand the enforcement capacity, but is problematic, too. Furthermore the use of restrictions as a mechanism to respond to drought may create a motivation to be wasteful when restrictions are lifted, leading to a rebound effect. Regulations seem to be most effective when applied to

plumbing and irrigation fixtures and new development – large one-time changes that don't require water users to reconsider their behavior every time they turn on a faucet. In other areas, existing landscape ordinances or homeowner covenants hinder the adoption of xeriscaping.

### **Regulations, Stormwater**

Plumbing and building codes in many municipalities, not to mention water laws in western states, make environmentally beneficial stormwater management at best exotic and at worst illegal. Changing existing municipal codes to make them amenable to stormwater best practices is a requisite first step. Regulations can go further to allow for different types of water re-use like greywater and blackwater that are generated through water use. These overlaps between potable water, wastewater, and stormwater provide an opportunity to address a household's impact on the water cycle holistically.

Ideally, municipal process of reviewing and updating codes should be more flexible to respond quickly to technological and scientific advancements. As with conservation, water-sensitive zoning and regulations on new development are important measures. Regulating behaviors that impact stormwater quality like cleaning up pet waste and use of fertilizers and pesticides suffer from the same issues as enforcing water restrictions.

### **Pricing, Water Conservation**

Changing water rate structures to encourage conservation is a very effective lever for reducing water use and one that can be pushed harder when it is politically feasible. Linking the costs of water use as closely as possible to the time and location of that use strengthens the impact of rates in the psyche of customers. Technologically, that means advanced metering connected to software like the Fathom platform which can compete for customer attention among a plethora of blinking and buzzing devices. While water utilities are not in the business of developing plumbing hardware, they should anticipate the proliferation of electronic plumbing and the potential value of its incorporation into use-monitoring platforms.

### **Pricing, Stormwater**

Stormwater utilities can learn a great deal from water utilities. Creating a stormwater utility that charges property owners proportionally for the costs of managing stormwater is an excellent way to link stormwater problems with personal property. It creates accountability. In practice, stormwater rates are not high enough to motivate single family households to reduce their runoff, with the exception of a handful of municipalities. Part of this problem is discounting: people would rather and may only have the resources to pay a minor fee for stormwater infinitely into the future instead of paying a large one-time cost for a raingarden in order to save that small amount going forward.

### **Incentives, Water Conservation and Stormwater**

Price-signaling to encourage water conservation can be magnified by incentivizing physical alterations which reduce the need for water use. Incentives for stormwater best management practices work in the same way as incentives for water conservation with two significant exceptions. The lack of robust stormwater pricing means that reduced fees will move only a tiny portion of the market. Incentives will have to be higher. Second, the relative novelty of stormwater practices means that their impacts (from a household's point of view) are riskier and so households will have to be given more favorable-sized incentives. The influence of familiarity with a practice on a price point of that practice is one of several ways in which price is a malleable concept. Efforts to use price would be advised to consider that.

At the same time, water conservation and stormwater management efforts can avail themselves to a greater array of financial mechanisms. Credit trading systems, bids to contractors that bundle residential property landscape renovations, and multi-partner funding pots like LIDs are all creative ways of responding to financial constraints. One obvious tack is a fund jointly contributed to by water utilities and entities responsible for managing stormwater that could finance landscape practices that displace potable water use with harvested rain.

### **Community-Based Social Marketing, Water Conservation and Stormwater**

Though more intensive than other mechanisms, community-based social marketing can also integrate well with them. The legally private but visually public realm of the lawn makes water consumption and stormwater runoff particularly well suited to influence from community and neighbors. Like regulations, it attempts to create and rely on norms of behavior. It builds off of education and awareness campaigns. Yet generating action around stormwater requires overcoming a cognitive hurdle far greater than water conservation. The Las Vegas Valley Water District has a campaign called “It’s a Dessert Out There: Be WaterSmart.” There are few equivalently and easily understood comprehensive message that can tie urban residents’ existing attachment to a place to stormwater quality. Perhaps the increasing reuse of urban waterfronts will result in greater advocacy and place-based resonance of stormwater messages.

Community-based social marketing is an important and effective tool to that end. Using research about audience attitudes, motivations, and behavior, community-based social marketing can determine how to develop programs that are relevant to different demographic groups. Campaigns have been remarkably successful by altering the balance of barriers and benefits which accompany targeted behaviors among different demographic groups. Community-based social marketing is by far the most comprehensive and long-term method of achieving adoption of best water practices, though it requires patience and considerable staff time. As an approach based on a set of tools rather than a set series of steps, its strength is that it is highly customizable.

Water conservation and stormwater management efforts in neighborhoods often rely on the sense of community that is expressed as civic pride. That sense of membership might be mobilized for competition, as well. Competition is motivating by itself, but it can be even more powerful in the context of a team. It could well be applied to reducing water use or picking up litter. While social marketing is not social media, incorporating eco-behaviors into public digital personas can help the mix.



If there is one over-arching characteristic of an audience which determines what types of tools can be used, it is the degree to which an audience is socially cohesive: to what degree does membership in a larger community influence personal behavior and the appearance of member properties? Evidence from neighborhoods in Montreal indicates that proximity is correlated with landscape norms. One question for future work is whether new development with water-sensitive landscaping can create a “spillover effect” whereby neighbors not subject to regulations are influenced to modify their lawns to meet a new norm. Whether demonstration projects and modifications of public landscapes can change behavior is another question.



**APPENDIX A:**

**Organizational Affiliation and Title Of Informants**

**Stage 1**

**American Public Works Association**

Nikki Guillot, Professional Development Program Manager

**Center for Watershed Protection**

David Hirschman, Program Director

Bryan Seipp, Watershed Manager

**EPA, Office of Wastewater Management**

Veronica Blette, Chief, WaterSense Program

Chris Kloss, Green Infrastructure Program

Amber Lefstead, Outdoor Coordinator, WaterSense Program

Stephanie Thornton, Marketing and Partnerships

**EPA, Office of Wetlands, Oceans, and Watersheds**

Robert Goo, Environmental Protection Specialist

Don Wayne, Nonpoint Source Outreach Coordinator

**Low Impact Development Center**

Neil Weinstein, Executive Director

**National Association of Clean Water Agencies**

Nathan Gardner-Andrews, General Counsel

**Natural Resources Defense Council**

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