LANDSCAPE
TOOL SERIES

CASE STUDY REVIEW

Community-Based Social Marketing: Vol. 1

SEPTEMBER 2018

CALIFORNIA
WATER EFFICIENCY
PARTNERSHIP
A Chapter of the Alliance *for* Water Efficiency

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Community-Based Social Marketing: Vol. 1

SEPTEMBER 2018

Prepared by California Water Efficiency Partnership and
the Cadmus Team (Cadmus, C+C, and Action Research)

ACKNOWLEDGEMENTS

Prepared and written by

Lisa Cuellar, Program Manager
California Water Efficiency Partnership

Wesley Schultz, Ph.D, Professor of Psychology
Action Research

Julie Colehour, Partner
C+C / Public Relations & Social Marketing

Jan Kleszynski, Director & President of Project Management
C+C / Public Relations & Social Marketing

Crystal Myers, Senior Associate
The Cadmus Group, Inc.

Ashley Chymiy, Associate
The Cadmus Group, Inc.

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- Paul Herzog, *Ocean Friendly Gardens Program Coordinator*

California Water Efficiency Partnership
- Sarah Foley, *Deputy Director*
- Michael Walker, *Administrator*

Cover Photo Source: Peter Veilleux, East Bay Wilds | Design: Sonja Turner-Montaño, Design & Effect

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EXECUTIVE SUMMARY

The most recent California drought made clear the urgent need for water conservation professionals to develop effective, long-term water supply management strategies. As shrinking water reserves triggered mandated conservation targets, water agencies were challenged to expand conservation efforts beyond the standard best management practice approach. They met this challenge by implementing demand-management strategies to motivate a larger sector of water customers to cut back on their usage. Savings were impressive! Reductions in water consumption reached 20% or more due in part to individual user cutbacks. With the passage of the State's Conservation Framework[1] in 2018, the need to sustain these water use reductions will continue well into the foreseeable future.

The California Department of Water Resources—in partnership with the California Water Efficiency Partnership (CalWEP), formerly the California Urban Water Conservation Council (CUWCC), and East Bay Municipal Utility District (EBMUD)—commissioned the following report to inform demand-management solutions with a focus on outdoor efficiency and conservation at the household level. While many water agencies across the state have experienced measured success with roll-out of residential rebate, incentive, and service programs, conservation potential studies have revealed that there remains a significant margin for water savings outdoors. To shrink this margin, agencies are now looking to engage and garner interest from customer segments who have not been motivated by existing marketing and incentive campaigns to do their part and save.

The following report was written for water agency professionals seeking additional methods for driving customers to action, including those harder-to-reach residential demographics. It offers a detailed look into a select number of early conservation programs and campaigns that applied principles of Community-Based Social Marketing (CBSM) to shift social norms and motivate behavior change. By offering a detailed review of 6 case-studies, this report is intended to help professionals grasp the basic concepts of CBSM and assess how the approach might be implemented to support decentralized demand-management strategies at their own agencies. These same professionals might be surprised to learn after reading the case study summaries that many of the conservation programs and messaging campaigns they oversee already embody elements of the CBSM approach, and with a bit more refinement could result in increased uptake.

The objective was to glean from each of these studies a set of the most effective CBSM tools for influencing conservation behavior at the household level; an understanding of environmental, social and institutional barriers that typically inhibit conservation; key findings and lessons learned regarding CBSM program design and interventions; as well as means for assessing receptibility of target audiences to CBSM. The case study summary also directly supports CUWCC's Sustainable Landscaping Market Transformation Plan (Plan). Published in 2015, the Plan outlines priority strategies for overcoming common barriers to wider market adoption of sustainable landscaping principles and installations.

A number of screening criteria were utilized to carefully select candidate studies; of utmost importance was that each case study provided measurable results that could be evaluated for replicability and scalability within California[2]. A thorough literature review yielded an initial collection of 62 case studies. These were eventually narrowed down to a subset of six:

1. Target 140 Campaign (Queensland, Australia)
2. Skip a Week Yard Watering Campaign (Southwest Florida)
3. Water Check Audit (Logan City, Utah)

1 In 2018, the California legislature and governor passed Senate Bill 606 (Hertzberg) and Assembly Bill 1668 (Friedman) into law which codify measures aimed at making water conservation a way of life in California. The bills provide a framework for setting water use targets by 2022, as well as implementing and enforcing the new water use requirements. (see: https://water.ca.gov/Programs/Water-Use-And-Efficiency/Making-Conservation-a-California-Way-of-Life)

2 Note that Case Study #6 (Toronto, Canada) did not produce measurable results, and instead was selected due to its specific investigation into the applicability of promoting rain barrel and rain garden adoption in an urban setting using CBSM strategies and tools.

4. Home Water Update (New South Wales, Australia)
5. Water Budget Communication (College Station, Texas)
6. Rain Barrel and Rain Garden Uptake (Toronto, Canada)

Individual findings and lessons learned from each case study are too nuanced to summarize in great detail here. Readers are encouraged to review the Key Learnings section of this report to obtain specifics. Collectively, findings from the case studies revealed what is already widely understood by most water conservation professional: education alone is often not effective at driving water-saving behavior. Rather, education coupled with CBSM strategies that apply tools such as rebates and incentives, feedback, and services to name a few, can be effective at achieving behavior change. These tools should be carefully selected to help mitigate primary barriers that often account for inaction by the targeted community. Simply put, CBSM works by reducing barriers to a desired action, while simultaneously enhancing benefits that appeal to targeted communities.

At its core, CBSM applies social normalizing tactics rooted in social and behavioral sciences. By exploiting the power of social norming on human behavior CBSM can reinforce that the desired action is not only perceived as the "right thing to do" by the larger community, but taking the action could also improve one's social status. And as the case studies demonstrate, these can be powerful motivators when the target audience has strong ties with their neighbors and are supported by social capital within their communities.

This report is the first of a three-volume CBSM resource package, which has been organized as follows:

CBSM Volume 1: Case Study Report & Pilot Framework

CBSM Volume 2: Landscape and Outdoor Water Survey & Best Practices Guide

CBSM Volume 3: Survey Implementation & Findings

The last section of this report contains a framework for a CBSM pilot, applicable in California, and targeting lawn conversion and replacement with climate appropriate plants. Turf rebate and incentives remain a cornerstone to many agency conservation programs, and these same agencies continue to grapple with ways to reach more diverse customer segments. By laying out a programmatic framework for the pilot phase of CBSM implementation, professionals can better gauge resource needs. Further, while the CBSM survey and its associated best practices guide are issued under separate cover, and can be reviewed as stand-alone resources, they were intended to be published as part of this bundle of CBSM resources. In fact, administration of the survey fulfills one of the initials steps proposed in the CBSM pilot framework.

The following additional references dive deeper into the theory and application of CBSM, and serve as resources for agencies and other interested parties looking to apply CBSM to their conservation programs:

- McKenzie-Mohr, D. (2011). *3rd Edition: Fostering Sustainable Behavior, An introduction to Community Based Social Marketing*. New Society Publishers
- EPA WaterSense (May 2012) Community-Based Social Marketing Workbook: A Guide to Using Social Marketing to Help Plan and Implement a WaterSense We're for Water Campaign.

DISCLAIMER:

Sections 1 to 3 of this report provide a summary of academic studies and published works. These publications are clearly cited at the start of each Section. The studies were neither sponsored nor endorsed by CalWEP. At times throughout the report CalWEP offers notes that consider how information from the case studies relate to conservation program design and services administered by California water agencies. These comments have not been vetted by the authors of the case studies.

INTRODUCTION

BACKGROUND

CalWEP promotes a Watershed Approach to Sustainable Landscaping as a framework for minimizing outdoor water use, while simultaneously reaping a number of additional benefits. A sample of these benefits include but are not limited to: green waste and greenhouse gas reductions, capture and filtration of rainwater, and habitat creation. This approach has been formally endorsed and implemented as part of several sustainable landscaping initiatives, including turf rebate programs sponsored by water agencies across the state.

In 2014, CalWEP, at the time known as the California Urban Water Conservation Council (CUWCC), convened hundreds of its members and stakeholders to begin working collaboratively towards establishing the watershed approach as a viable option for water conservation. The discussion yielded a formal Sustainable Landscaping Market Transformation Framework (Framework) in April of 2015. The Framework identified the top barriers to achieving a market transformation and detailed associated interventions. One of these Framework interventions called specifically for "devising effective, unified, and collaborative marketing, branding, and outreach." The contributors emphasized that "knowing which customer segments are pivotal to a market transformation and learning how to effectively communicate with, and market to, these segments can expedite what would be a longer transition to sustainable landscaping." As such, this intervention was understood as a charge to investigate the application of Community-Based Social Marketing (CBSM), a popular framework for designing successful behavior change campaigns, to accelerate wider community acceptance and buy-in of the watershed approach to sustainable landscaping.

The Framework was subsequently developed into a detailed Sustainable Landscaping Market Transformation Plan (Plan) that contained a list of the top six prioritized strategies deemed essential to shifting the market. Of these, the second strategy focused on messaging and branding campaigns. Following publication of the Plan in late 2015, the CUWCC selected the marketing team at The Cadmus Group, Inc. (Cadmus)—through a competitive bid process with grant funding provided by the DWR—to conduct sustainable landscaping market segmentation and branding research. Cadmus produced a report that focused on potential uniform branding approaches as well as an overview of select CBSM case studies that addressed outdoor water use efficiency and integrated a few sustainable landscaping principles (e.g., organic lawn care). The marketing team summarized key takeaways regarding target audience receptiveness and lessons learned per each CBSM case study.

MARKETING RESEARCH

This report is considered an extension of the initial Cadmus marketing research completed in 2015. However, it does not focus on any branding components, but rather builds from the initial CBSM case study assessments. The marketing team was tasked with conducting a comprehensive literature search to gather and review six (6) CBSM case studies relevant to the sustainable landscaping strategies specified within the Plan. These case studies were intended to be similar in size, scope, and subject matter to the Plan's initiatives, so as to glean key learnings that will be applied when planning and implementing similar efforts.

All candidate case studies were screened to ensure that they combined CBSM principles and strategies to promote desired behavior changes. Preference was given to case-studies that addressed elements of the watershed approach to landscapes, or encouraged adoption of products and training similar to the WaterSense [3] brand for improving outdoor water use efficiency.

Additionally, this case study review helped to inform a CBSM pilot design frameworks for implementation in California. The pilot framework was designed to test various CBSM strategies to influence adoption of sustainable landscapes within residential neighborhoods and is included at the end of this report.

3 WaterSense is a voluntary partnership program sponsored by the U.S. EPA and includes a label for water-efficient products and is a resource for helping people save water. (https://www.epa.gov/watersense)

WHAT IS COMMUNITY-BASED SOCIAL MARKETING?

When explaining CBSM, it is best to begin by defining *social marketing*, which is the practice of creating positive social change by directly influencing individual behaviors. Social marketing can be framed as *community-based* when it "focuses on a group of individuals who share a common connection" (Schultz, 2014). This common connection can vary in size and geography and may be framed as an apartment complex, a neighborhood, a city of residence, a utility service district, or local watershed. It can even be a social or workplace network. In every case, CBSM targets a specific group of people by designing a program tailored to their specific priorities and circumstances. It involves meeting people where they are and crafting messages and campaigns that change behavior. The purpose of CBSM is to remove the barriers to desired actions by reaching the target audience with the right message, at the right time, in the right place. Typically, social and economic co-benefits are emphasized to increase behavior adoption.

HOW CBSM WORKS

At a practical level, CBSM combines psychological knowledge with applied research methods to provide a usable framework for practitioners to promote behavior change across diverse settings. Ultimately, CBSM strategies seek to identify and remove barriers to a desired behavior change, while simultaneously promoting associated benefits of the behavior. Practitioners follow a five-step approach that includes piloting specific CBSM tools prior to rolling out a broad-scale program (McKenzie-Mohr, 2011). These steps include:

1. Selecting Behavior(s),
2. Identifying Barriers and Benefits,
3. Developing Strategies,
4. Piloting, and
5. Broad-scale Implementation and Evaluation.

When applied to environmental initiatives, CBSM can prompt behaviors that help curb resource consumption and/or improve the health of the local environment. In recent years, CBSM has emerged as a promising framework for promoting energy efficiency and other sustainability-related behaviors such as reducing water use outdoors.

Once barriers to adoption of the desired behavior change are identified, the CBSM approach involves strategically selecting tools to overcome these barriers. These tools can be grouped into two categories based on the type of barrier:

GROUP 1 (High Barriers): *Incentives/Rewards*, *Commitments*, *Contests*, and *Convenience*

Incentives/Rewards – Providing incentives that help overcome the identified barriers (e.g., rebates, tools, expert advice, etc.).

Commitments – Soliciting a public commitment to taking a desired action. CBSM research shows that people are more likely to follow through if they publicly commit. In-person and written commitments have the strongest correlation to behavior change, while verbal and online commitment also work, but to a lesser degree.

Contests – Creating a sense of competitiveness among the target audience, incentivizing them to adopt the desired behavior in order to earn recognition.

Convenience – Making it easy for the target audience to do the desired behavior.

GROUP 2 (Low Barriers): *Social Norms/Modeling, Social Diffusion, Communication, Feedback, Prompts, and Cognitive Dissonance*

Social Norms/Modeling – Using peer pressure and influencers to change the way the behavior is viewed by society, and increase the perception that everyone is doing it.

Social Diffusion – The adoption of new behaviors as a result of friends, family members or others in a social network introducing the behaviors to each other.

Communication – Present information that is personalized and compelling to help overcome knowledge gaps and establish an intention to take action.

Feedback – Providing positive feedback by reporting individual or community impacts. People are more likely to stick with a behavior over time if they receive positive feedback about doing the behavior and the impact it is making.

Prompts – Reminding people to take the desired action. Prompts work best if they occur close to the place the behavior occurs.

Cognitive Dissonance – Pointing out to an audience that its behavior is not aligned with its values.

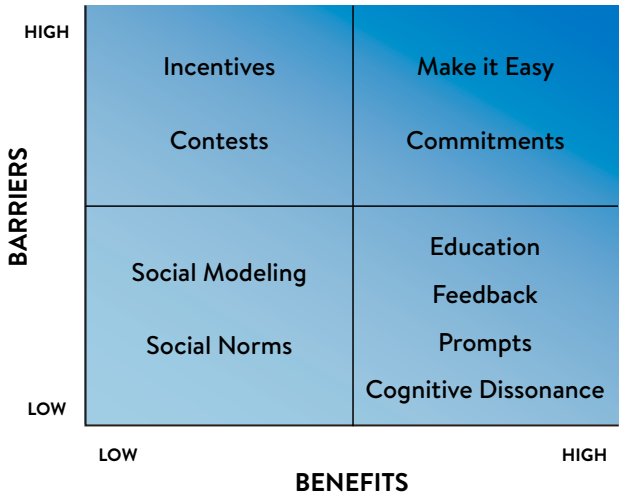


Figure 1: Identifying when various behavior change tools work best (Schultz, 2014)

Figure 1 above provides general guidance for identifying effective CBSM tools. Tools should be selected based on the desired behavior change's degree of benefits (low or high) in conjunction with the degree of barriers (low or high) that must be overcome. Typically, more than one tool is selected in order to effectively influence behavior change. Contextual information can also prompt selection of tools from different quadrants despite rankings of barriers and benefits. In accordance with the five steps of CBSM, tools are designed into a CBSM pilot program for testing and assessing on a representative sample of the target populations. A small-scale CBSM pilot can be refined as needed until there is documented evidence to show that the program works, before it is broadly implemented (McKenzie-Mohr, 2011; McKenzie-Mohr, Lee, Schultz & Kotler, 2012). In the context of sustainability, the effectiveness of a CBSM campaign is often measured by comparing pre- and post-intervention metrics. In the case of outdoor water use efficiency, monthly metered water consumption may be the preferred metric for comparisons.

APPROACH

The Cadmus team conducted a comprehensive literature review to identify published academic studies and CBSM case studies, with the goal of gathering the full "universe" of generally relevant case studies. The search yielded 62 case studies available through related websites, such as CBSM.com and ToolsofChange.com; peer-reviewed academic sources; various CBSM-based organizations, such as International Social Marketing Association and Pacific Northwest Social Marketing Association; and relevant industry conferences, such as the Behavior, Energy and Climate Conference (BECC) and SPARKS Social Marketing Conference.

Of these 62 case studies, the Cadmus team with assistance by CalWEP staff identified six case studies that were optimal candidates in accordance with criteria listed here. These six case studies are detailed in this report.

REQUIREMENTS – The initiative or program *must* have all of the following characteristics:

1. Program focuses on water conservation and/or efficiency through behavior change,
2. Program design employs CBSM principles,
3. Measurable program outcomes are available, and
4. Initiative is scalable and replicable in California.

PREFERENCES – Preference is given to initiatives with the following characteristics:

1. Program promotes water-use efficiency and conservation via adoption of WaterSense products and/or training and certification programs or similar applications,
2. Program uses a watershed approach to promote behavioral changes related to outdoor irrigation and landscaping,
3. Study areas are located within California or places with similar climate and water supply challenges as California, and
4. Program focuses on outdoor consumer behaviors, rather than indoor.

ORGANIZATION OF REPORT

This report summarizes the six CBSM case studies selected using the criteria outlined above. The case studies are organized into three sections depending on the context under which they occurred and/or the specific CBSM tool they utilized:

- Section 1: Drought Response Studies,
- Section 2: Information Campaign Studies, and
- Section 3: Sustainable Landscaping Study

For each case study, the following CBSM elements are identified:

- Goals and objectives,
- Target audience,
- Desired behavior change,
- Identified barriers,
- CBSM strategies,
- Messaging,
- Motivators and benefits,
- Results, and
- Evaluation and lessons learned

Section 5, Key Learnings, summarizes all major takeaways from the collective assessments of the case study findings, while Section 6 offers a CBSM pilot framework focused on turf removal.

SECTION 1: DROUGHT RESPONSE

In situations like drought response, water agencies looking to deploy CBSM campaigns must do so in a relatively short amount of time and produce immediate results. Case Studies #1 and #2 focus on targeting a single behavior projected to result in significant water savings: limiting showering time to 4-minutes and skipping a week of lawn irrigation. Case Study #3 used a personalized water audit to engage the audience directly to influence a number of behavior changes related to outdoor irrigation and landscape maintenance. While Case Study #1 had the most impressive results, the other case studies experienced variable degrees of success as well.

Supplement the case study reviews in Section 1 with the following resource:

Turner, A., White, S., Chong, J., Dickinson, M.A., Cooley, H. and Donnelly, K. (2016). "Managing drought: Learning from Australia," prepared by the Alliance for Water Efficiency, the Institute for Sustainable Futures, University of Technology Sydney, and the Pacific Institute for the Metropolitan Water District of Southern California, the San Francisco Public Utilities Commission, and the Water Research Foundation.

Case Study #1: Target 140 Campaign (Queensland, Australia)[4]

OVERVIEW

In 2007, Australia faced the worst drought in a century. In the Brisbane and Southeast Queensland (SEQ) area rainfall totaled less than 10% of the regional average, and reservoirs dwindled below 20% of their capacity. These conditions coupled with increased population growth estimated at 1,000 new residents per week moving into the same area, prompted the Queensland Water Commission (QWC) to implement a CBSM approach to increase water conservation. The approach was integrated into the Target 140 campaign. Implemented to help meet Level 6 drought measures (the most stringent), the Target 140 campaign was a crisis-response program that sought to achieve immediate gains in water conservation, while long-term capital strategies were being developed and slated for completion in late 2008.

During implementation of the Target 140 campaign existing drought restrictions required individuals to reduce their water consumption to 140 liters of water per day (or 37 gpcd), hence the campaign name. For perspective, in 2015, during drought conditions and active water restrictions, the average Californian used anywhere between 72 to 162 gpcd[5] (depending on where one lived within the state). To achieve this stretch goal of additional cut-backs in household water consumption, the Target 140 campaign focused on promoting a 4-minute shower. Overall the QWC sought to "personalize the problem; individualize the solution".

Campaign materials were first disseminated in May 2007. The campaign was characterized in the case study report as "the most publicly visible activity undertaken by the QWC during the stated period". Prior to the launch of the Target 140 campaign, the QWC had initiated indoor-fixture rebates as early as 2005, as well as watering restrictions which began at a Level 1 in 2005 and were incrementally adjusted to Level 5 by April 2007. To measure the effectiveness of the Target 140 campaign, a study was implemented over a three-year period spanning from 2006 to 2009.

4 **Case Study #1:** Walton, A. and Hume, M. (2011). "Creating Positive Habits in Water Conservation: The Case of the Queensland Water Commission and the Target 140 Campaign," International Journal of Nonprofit and Voluntary Sector Marketing. 16: 215–224.

5 "Fact Sheet: September 2016 Statewide Conservation Data," California Water Boards. http://www.waterboards.ca.gov/water_issues/programs/conservation_portal/docs/2016nov/fs110116_%20sept_conservation.pdf

Case Study #1 is also supplemented with information provided in the Alliance for Water Efficiency's (AWE's) report *Managing Drought—Learning from Australia*, published in 2016. The AWE report includes additional details on the Target 140 campaign program costs, as well as dollars allocated per program element.

GOALS AND OBJECTIVES

The QWC in Southeast Queensland developed and rolled out an eight month campaign from May to December 2007, rooted in CBSM methodology, with the objective of influencing customer behavior such that their water consumption would be reduced from an average of 179 liters per person per day (lpcd) to 140 lpcd, or equivalent to a reduction of 46 to 37 gpcd. An assessment of customers' water usage revealed that 70% of water consumption was attributed to the residential sector, when compared with all other users including industry. In addition, by the end of August 2007 QWC set a goal of 50% recall of key campaign messages.

TARGET AUDIENCE

The QWC Target 140 campaign was designed for residents living within the entire regional service area which included Brisbane and neighboring SEQ. The total population was approximately 2.3 million people.

It is important to note that other water conservation programs had already been launched in the region prior to the Target 140 campaign. Therefore, citizens were likely to have already participated in water-saving activities. Some of these programs included home audits and rebates for low-flow shower heads, low-flow water meters, and rainwater capture tanks for landscape irrigation. In total, over 500,000 rebates for fixtures, low-flow toilets, and rainwater tanks were distributed. Additionally, many individuals had installed gray water systems on their properties and were redirecting these waters to their landscapes, signifying that there was already a deep awareness of the importance of water conservation throughout communities. Local code modifications were enacted to enable installation of these types of systems.

DESIRED BEHAVIOR CHANGE

The Target 140 campaign was designed to achieve a stretch-goal of an additional 20% reduction in personal water consumption. The centerpiece of the campaign became promotion of the 4-minute shower. By focusing on a simple, daily action, participants were able to "individualize and customize a solution for achieving the necessary reductions." The authors of the case study also pointed to Roger's 2003 assessment of the Diffusion of Innovation theory, which supports that an innovation that can be customized to the consumer will help to increase the chances of a sustained long-term change (Rogers, 2003).

IDENTIFIED BARRIERS

The QWC drew upon earlier market studies to establish residents' attitudinal barriers that could prevent adoption of an individual 140 lpcd target. The first was described as a form of drought fatigue, because, after two years of complying with mandatory drought restrictions and voluntary measures, citizens felt as if they had already done their part to maximize their water conservation. The second was a common misconception among residents that industry, rather than individual homeowners accounted for the largest use of water (though the opposite was true). Lastly, the authors explained that a "green drought" was also at play with many visible landscapes, including parks and streetscapes, remaining green during elevated drought-level restrictions. This ultimately sent a mixed message to residents that the water supplies were not critically low, despite drought messaging reporting otherwise. Based on these attitudes, QWC determined that the following knowledge gaps and beliefs would need to be addressed through CBSM messaging:

1. A lack of understanding of the critical nature of the problem.
2. A misunderstanding of who was using the water.
3. Lack of belief that an individual could make a difference.

CBSM STRATEGIES

The QWC sought to influence desired behavior changes by altering customer attitudes through educational messaging that sought to challenge misbeliefs held by the target audience. Because the QWC had a substantial budget to implement the Target 140 campaign ($3 million USD in total), they were able to roll out a robust marketing program. The program design included the following CBSM strategies and tools for mitigating barriers:

1. Promote Benefits: present a benefits-cost comparison between the benefits of the desired behavior and the costs of the undesired behavior.
2. Feedback: messaging to let customers know how they were performing against the 140 lpcd target (see *Messaging*)
3. Social Diffusion: generate social influences from well-known public figures (e.g., community leaders and celebrities).
4. Education/Convenience: offer information on the skills and abilities needed to change behavior, while addressing any constraints that might prohibit the behavior.

MESSAGING

The Target 140 campaign can be described as a multi-media program that aimed to "personalize the problem; individualize the solution." The QWC did this by honing in on indoor water use and one key consumer behavior: not exceeding a 4-minute shower. To reinforce messaging and reiterate the importance of individual action, 4-minute shower timers were mailed to 1.1 million households with an accompanying information booklet.

Numerous media vehicles were used, from direct mailers to featured content in local newspapers, to radio spots featuring water-saving tips, to online advertising and outdoor billboards. Messages were designed to challenge knowledge gaps and misbeliefs. Television media content was also produced to address barriers as described in Table 1.1.

Household feedback included weekly progress reports of usage against the 140 lpcd target, coupled with a measure of the combined dam storage; congratulatory messages for those that met or conserved water beyond the target; and encouragement to try harder when residents did not meet the target. Additional messaging was delivered via water bills which included comparisons of quarterly water usage to the previous year's quarterly usage, and daily newspaper updates on dam water levels.

Table 1.1: Television Media Content for the Target 140 Campaign

BARRIER	MESSAGE	TELEVISED CONTENT
A lack of understanding of the critical nature of the problem	**Water supply levels are critical**	Images of dry catchment areas (i.e., dams) and reports on combined dam water levels during daily weather reports on the local news.
A misunderstanding of who was using the water	**70 percent of overall water use is residential**	Faucets pouring water that switches appearance from an industrial outlet to a residential kitchen outlet.
Lack of belief that an individual could make a difference	**Small individual behavioral changes can make a difference**	Water-saving strategies identified within the home, including the 4-minute shower that could be tracked with a timer.

MOTIVATORS AND BENEFITS

A number of CBSM tools were deployed to motivate behavior change for South East Queensland residents. Through their program approach, QWS ultimately sought to alter the habitual patterns of residents, or more specifically, reduce showering times to 4-minutes. Because old habits are hard to break, the QWS had to first invite residents to try the new behavior and then regularly prompt residents to practice again. Distribution of shower timers and informational materials might be considered the first invitation. Routine feedback encouraged residents to try harder when they were not meeting the target 140 lpcd. The case study authors suggest that "goal-setting and feedback, prompts, incentives and rewards are possible reinforcement strategies that facilitate new habit formation."

Additional strategies for motivation included social norming through drought shaming of individuals who consumed water above the conservation restriction levels, as well as social diffusion tactics via public endorsement of the Target 140 campaign by celebrities and community leaders.

The study analysis suggested that the success of the Target 140 campaign could also have resulted from fear, as explained by the Protection Motivation Theory (PMT) model (Rogers, R. 1975, 1981). Simply put, PMT is a behavioral model used to predict responses to fear. Based on the model, the perceived severity and vulnerability of a threat can motivate individuals to alter their behavior to combat the threat. In the context of the millennium drought, the depletion of the region's water supply was the threat that generated fear. Further, the PMT suggests that an individual's protective motivation to combat a threat is based on a *coping appraisal*. This appraisal includes an assessment of the counter behavior efficacy, the cost to act, and the perceived effectiveness of the behavior. Residents were more likely to arrive at a positive appraisal for the 4-minute shower because it was easy to implement, required no significant monetary investment, reduced e utility expenses, and conserved water supplies for the utility. Therefore, the Target 140 campaign was perhaps successful not only because it effectively educated the community about vulnerability to drought and water shortages, but also because it provided a solution that was easy to perform.

RESULTS

During the eight-month Target 140 campaign, SEQ water customers who were already conserving to meet earlier drought restriction further reduced their average daily water use by 22%, exceeding the 140 lpcd goal. For eleven consecutive months following commencement of the campaign, water consumption dropped to an average of 129 lpcd and saved an estimated 20 billion liters (or approximately 5.3 billion gallons) of water. These results were achieved significantly earlier than anticipated. Also noteworthy is that in August 2009, more than a year after the millennium drought ended, water consumption remained below 140 lpcd, despite a less restrictive target of 200 lpcd being enforced.

In total the Target 140 campaign cost $3 million (USD) and reached an estimated 2.3 million people. The largest fraction of the total budget, or approximately $1.2 million, went towards the direct mail-out of shower timers and information booklets. The remainder of the budget was distributed between market research to identify barriers in customer attitudes, development of messaging and marketing collateral, establishment of a website and other contracted professional services.

EVALUATION AND LESSONS LEARNED

Promoting a simple behavior change like reducing showering times, allowed individuals to easily participate in drought response. This was especially critical for engaging communities that were already proactively conserving and experiencing "drought fatigue", like many in Brisbane and SEQ during the millennium drought era. The lesson then, for those looking to implement a CBSM campaign to improve water conservation at the household level, is to carefully consider the current regional and regulatory contexts for water usage before selecting a target behavior to promote. The Target 140 campaign was successful because it allowed for households to "individualize and customize" the solution with relative efficacy and perhaps lessoned the perception of sacrifice.

A substantial budget allowed for the development and deployment of a robust CBSM campaign. Messaging that led to attitudinal changes and elimination of misconceptions regarding residential water usage as well

implementation of several CBSM tools (i.e. feedback, convenience, social norming and diffusion, etc.) all contributed to the success of Target 140. However, the authors claim that: "It is impossible to determine from this study which strategy is more or less effective in achieving behavioral change other than to observe that in combination, the strategies appeared very effective in facilitating change". Credit might also be extended to other conservation programs that were initiated in parallel with the Target 140 campaign, such as the outdoor watering restriction program, and rebate programs for installing water-efficient fixtures indoors.

While the Target 140 campaign can be replicated at various scales in California, the extreme environmental and social contexts surrounding Australia's millennium drought likely helped drive people to further conserve within already thin margins. Fear too, as explained by the PMT model, could have been a primary motivator for many households to take action. Therefore, agencies looking to emulate the Target 140 campaign will be better off conducting a small-scale pilot (step 4 of the CBSM method) to assess receptivity and feasibility before committing substantial resources to a larger campaign.

Case Study #2: "Skip a Week" Yard Watering Campaign (Southwest Florida)[6]

OVERVIEW

At the onset of 2010, Southwest Florida was experiencing its fourth year of drought. As part of its annual water conservation campaign, The Southwest Florida Water Management District (District) implemented a demand-management CBSM program focused on improving outdoor water-use efficiency across its service area. Approximately 50 percent of domestic water use within the District was attributed to outdoor irrigation. To address this outdoor waste the District launched a seasonal yard watering campaign called "Skip a Week." As the name implies, Skip a Week encouraged customers to reduce their outdoor irrigation frequency to every other week during the winter months of December through February[7].

The campaign was designed to incorporate findings from existing research, a two-year pilot program that investigated irrigation behaviors amongst customers, and previous surveys administered by the District. The campaign content was publicized through mass media vehicles, including radio, television, billboards, bill mailers, standard mailers, and advertising on buses. The campaign ran for a total of three months from December 2009 to February 2010.

GOALS AND OBJECTIVES

The District engaged its service area of west-central Florida in a mass-media informational Skip a Week yard watering campaign, infused with CBSM-type messaging, to reduce outdoor irrigation during the winter months spanning from December to February. The District predicted that substantial water savings could be realized if customers were better informed about best practices for irrigation and prompted to take action. The campaign, which promoted a bi-weekly schedule for lawn watering was supported by research findings from University of Florida which demonstrated that during cooler months, grass needed supplemental watering every 10 to 14 days.

TARGET AUDIENCE

The District intended to reach its entire regional service area which distributes water to 16 counties in west-central Florida.

DESIRED BEHAVIOR CHANGE

The Skip a Week campaign focused on one specific behavior change: reducing the frequency of outdoor irrigation to once every other week during a winter period from December through February.

6 **Case Study #3:** Glenn, D., Endter-Wada, J., Kjelgren, R., and Neale, C. (July 2015) "Tools for Evaluating and Monitoring Effectiveness of Urban Landscape Water Conservation Intervention Programs," *Landscape and Urban Planning*, 139: 82–93.

7 Southwest Florida Water Management District Skip a Week homepage: http://www.swfwmd.state.fl.us/conservation/skipaweek/

IDENTIFIED BARRIERS

The District referenced survey feedback from an earlier pilot program focused on household water conservation to determine potential barriers that could limit the success of the Skip a Week campaign. In regard to lawn care, residents tended to believe that limiting outdoor irrigation would cause lawns to suffer and die, and were thus overwatering their landscapes. Challenging this belief by stressing the negative effects of overwatering became a major point of focus for the Skip a Week campaign.

CBSM STRATEGIES

Prior to launching the Skip a Week campaign, the District conducted a pilot irrigation program from 2007 to 2009 to assess which social marketing strategies held the most promise for improving water-use efficiency. This sequencing is in alignment with recommended CBSM procedures which call for smaller scale pilot assessment prior to broad-scale implementation. The pilot engaged 100 households living within the District's highest water-using neighborhoods. During the pilot design, organized focus groups were interviewed to solicit feedback from residents living within these neighborhoods[8]. In parallel, the District also administered surveys to 802 individuals, approximately half of which were targeted for the pilot. The survey respondents were selected because they all watered their home lawn or landscapes and maintained an automatic irrigation system.

Findings from these focus groups and surveys were used by the Skip a Week campaign to develop content for commercials. A second focus group was most receptive to a commercial that featured two neighbors, Tom and Stan (see Figure 2.1). They became staples of the campaign and thus served as a mechanism for **social diffusion** at the community level to help shift behavior change. Commercials ran on more than 20 government access stations.

In addition, extension agents, master gardeners, and the District, which were identified by the pilot survey respondents as trusted sources, became representatives for the Skip a Week campaign. Messages that were delivered by these sources helped to further advance the **social diffusion** of desired behaviors. **Social norms** were also modeled by members of Home Owners' Associations (HOAs) who agreed to the bi-weekly irrigation schedules.

Figure 2.1 Example Marketing Material for the Skip a Week Campaign

8 Southwest Florida Water Management District. (2009). Media Research Focus Group Report: Qualitative Research Presenting of "Skip a Week" Water Conservation Campaign Ads. Prepared by Salter Mitchell.

The Skip a Week campaign name itself promoted a sense of **convenience**. Rather than promote action, the program encouraged curbing behavior. The benefits of which were demonstrated by Tom and Stan enjoying leisurely hangouts. Finally, direct appeals through **educational** messaging including **prompts** to conserve sought to motivate outdoor water-use efficiency.

MESSAGING

The Skip a Week campaign was a mass-media intervention, infused with social normalizing messages. Campaign materials were distributed for a relatively short period, commencing in December 2009 and terminating by February of the next year. In order to help increase the public's recall of messages District "staff created a cohesive look by using the same actors, logos and messages on each advertising piece." Standard media outlets such as television, radio, newspaper, bus wraps, and billboards, as well as social media platforms like Facebook and Twitter were utilized to disseminate messaging. The District also e-mailed information in a monthly newsletter to more than 8,000 residents. Additionally, the campaign provided information to 1,330 HOAs throughout the west-central Florida service area and obtained local utility support to distribute 435,000 inserts in utility bills. Specific messaging content was developed to address the belief held by previously surveyed residents that limiting irrigation could cause the lawn to suffer and die. To overcome this barrier, "the campaign's messages emphasized the deleterious effects of overwatering and confirmed that yards do not need to be watered weekly during the winter months".

MOTIVATORS AND BENEFITS

Previous survey feedback indicated that residents "preferred receiving lawn maintenance information from their neighbors" and that the majority of these same respondents did "not want their neighbors to think they watered too much". Recognizing the ability of community influence to drive behavior change, the Skip a Week campaign enlisted Tom and Stan and other trusted representatives as community spokespeople for disseminating social normalizing messages. The influence of these program ambassadors coupled with the proliferations of high-visibility marketing collateral, was anticipated to drive residents to adopt the behavior change.

The benefit of time-savings attributed to reducing lawn watering were reinforced by Tom and Stan, who at times were featured kicking back in lawn chairs and engaging in leisurely conversation. Additionally, community benefits were touted via statistics of the projected water savings that totaled in the millions of gallons. Thus impressing upon customers the potential magnitude of their collective efforts.

RESULTS

The District conducted pre- and post- campaign intervention surveys in November 2009 and March 2010. In total, 1,152 residents provided a response. Total water savings were calculated by accounting for the 19% increase of households who indicated in their post-intervention survey response that they had indeed reduced yard watering to every other week. In total, over the course of the Skip a Week campaign, an estimated 1.2 billion gallons of water were conserved. Based on

Table 2.1: Changes in Awareness, Attitude and Behavior (Pre- and Post-Campaign)

SKIP A WEEK RESPONSE	AWARENESS, ATTITUDE, OR BEHAVIOR	% INCREASE (PRE- TO POST-CAMPAIGN)
Awareness of Skip a Week campaign	Awareness	450%
Recall of Skip a Week campaign	Awareness	18% (4% pre, 22% post)
Belief that yards need watering every week	Attitude	-19%
Belief that brown grass doesn't always need water	Attitude	23%
Manual adjustments to irrigation system to meet every other week target	Behavior	16%
Adherence to the Skip a Week irrigation schedule	Behavior	19%

these water savings, program costs were reported as $0.60 per thousand gallons of water saved.

A comparison of the before and after survey results yielded observations listed in Table 2.1 below. These results suggest that the Skip a Week campaign was successful in increasing awareness and shifting attitudes related to outdoor irrigation efficiency; subsequently nearly 20% of respondents reported to have adopted bi-weekly watering in accordance with the desired behavior change. This is also reflected in the survey measure that found that prior to the campaign interventions, residents believed that they should water their lawns 3.1 times per month versus 1.8 times per month after the campaign.

EVALUATION AND LESSONS LEARNED

Based on the survey feedback presented in the previous section, the Skip a Week yard watering campaign was successful in influencing behavior change among water users within the District's service area. However, a case could be made that relying on self-reporting to verify impacts is not as accurate as making measured observations. In the case of outdoor water usage, collecting pre- and post- campaign outdoor water meter readings for all participating households would reflect the actual water savings associated with the interventions. Measured water savings in turn could be used to generate a true dollar estimate for return on investment. Further, meter readings can also provide additional insights, such as behavior response times in relation to the campaign launch.

Pilot programs and messaging focus groups allowed the District to test and adjust messaging and marketing collateral to generate the greatest appeal to the target audience, and perhaps maximize the overall return for dollars invested in the Skip a Week campaign. The District noted that "focus groups and surveys helped us to identify our target markets real and perceived barriers to the desired behavior". Additionally, repetitive messaging that promoted a single behavior along with the catchy tag line of "Skip a Week" likely enabled a strong recall of the campaign's message (more than 40 %) by post-intervention survey respondents.

Certain elements of this campaign suggest replicability in California. For example, one of the key barriers in this study was residents' fear of their lawns dying, which is a concern for many Californians as well. The prevalence of this fear suggests that prioritizing behaviors that will lead to durable, long-term water-use changes could include removing lawns entirely, installing rain gardens, and/or planting drought-tolerant vegetation.

Case Study #3: Water Check Audit (Logan City, Utah)[9]

OVERVIEW

Faced with the sixth year of drought in 2004, the City of Logan, Utah implemented a demand management pilot program infused with CBSM tools that sought to increase outdoor water use efficiency. The program was free to residents who received city-provided water and was widely publicized. The program, deemed "Water Check", was an in-person landscape irrigation audit service. The City partnered with a local university, and graduate-level students were trained to conduct the in-field audits which included a detailed evaluation of a household's landscape and irrigation systems. Based on findings from this evaluation, a personalized and seasonally-adjusted irrigation schedule was provided to each homeowner for the period of typical peak outdoor water use: April to October. Water-saving tips were also included within the report to help improve outdoor water use efficiency. The Water Check audit program ran for two consecutive years in 2004 and 2005.

The City of Logan is in a mountainous, semiarid environment. The climate during the irrigation season from April to October fluctuates between warm-to-hot days and cool nights. At the time of this study, the City was viewed as a water scarce region "experiencing growth of low-density urban developments, increasing prevalence of domestic gardens, and recurrent drought".

As an internal evaluation metric,, the Water Check program utilized the Landscape Irrigation Ratio (LIR) for assessing post-intervention water saving impacts. Where the LIR was a measure of deviation from an estimated irrigation water budget. A water budget is defined as the minimum amount of water required to maintain a select area of vegetated landscape after taking

9 **Case Study #3:** Glenn, D., Endter-Wada, J., Kjelgren, R., and Neale, C. (July 2015) "Tools for Evaluating and Monitoring Effectiveness of Urban Landscape Water Conservation Intervention Programs," *Landscape and Urban Planning*, 139: 82–93.

into consideration local rainfall and evapotranspiration. Aerial multispectral images from the spring (before tree canopies formed) and the summer of 2002, as well as observations made during a 2004 summer reconnaissance fly-over were used to distinguish area of vegetated landscape per residence. Three vegetative classifications were assigned to representative areas of the landscape: turf, trees and/or shrubs, and turf under trees, which were in turn used to estimate water budgets. (See Case Study #5 for another example of a water budget-based approach to conservation).

Post Water Check interviews were conducted at the end of the irrigation season to assess how well residents integrated irrigation schedules and water conservation recommendations. A second interview was conducted two years following the last audit to assess how effective the Water Check program was on long-term, sustained outdoor water use efficiency.

GOALS AND OBJECTIVES

The primary objective of the City of Logan Water Check audit program was to reduce peak water usage during warmer months when demand on water supply was the greatest. The program utilized expert in-person communication as a mechanism to influence homeowners' behaviors, such that they adjusted outdoor watering habits to meet actual landscape water requirements and in turn improve their overall water use efficiency.

Post-intervention data was utilized by the university partners to evaluate the overall effectiveness of water audit services in residential settings. An evaluation of pre- and post- intervention LIR measures were also utilized to help gain perspective on demographics with the greatest potential for water savings.

TARGET AUDIENCE

The Water Check program target audience included single-family residential households in Logan, Utah who received city supplied water. Because Water Check was administered twice—once in 2004 and once in 2005—two distinct intervention groups were targeted. The 2004 group included 148 volunteers. Because they were self-selected, this group likely contained residents who had a positive bias toward water conservation. The 2005 group was comprised of 105 participants obtained via letters and phone calls. They had been identified as above average water consumers based on billing records. Comparing the two intervention groups, mean baseline water use was 39% lower for the 2004 volunteers in comparison to the 2005 recruits.

DESIRED BEHAVIOR CHANGE

The City's primary objective in piloting the Water Check audit program was to generate the following two behavior changes:

1. Convince participants to adopt the suggested irrigation schedule to meet a personalized water budget, and
2. Convince participants to adopt specific conservation recommendations provided in the reports.

IDENTIFIED BARRIERS

The following list of primary barriers were targeted by the Water Check audit to help improve adoption of the target behavior:

- Inability to adjust maintenance and operations of irrigation systems to address biologically dynamic zones within the landscape,
- Need for improved understanding of seasonal climate changes and ability to interpret ecological cues as they relate to the landscape,
- Need for improved problem-solving skills to address irrigation challenges, and
- Lack of water conservation performance evaluations.

CBSM STRATEGIES

The Water Check audit pilot program relied on a combination of CBSM tools to influence outdoor water use efficiency on a residential scale including **feedback**, **incentives**, **convenience**, and **prompts**. Members of the university auditing team provided direct feedback regarding the benefits of specific landscaping best practices while conducing in-person landscape and irrigation system inspections. Auditors thus solicited expert advice to incentivize behavior change. The tailored irrigation schedules were a source of convenience as they spared residents the trouble of

developing the schedules themselves. As a blueprint for action, the irrigation schedules and conservation recommendations provided in the audit reports, were intended to help improve the perceived efficacy of the recommended behavior. They also served as prompts for encouraging homeowners to make tangible landscape and irrigation system changes in accordance with their water budgets.

MESSAGING

One-time Water Check audits were offered during the irrigation season in 2004 and 2005. The audits were identical in both years. A detailed report was generated on-site during the audit and administered to each household. Auditors also provided homeowners with a check list of specific problems identified during site inspections and instruction on how to mitigate these issues. They also answered questions that the homeowners had regarding any content of the report that was unclear. Table 2.2 includes report details per Water Check topic.

MOTIVATORS & BENEFITS

The Water Check audits were intended to motivate behavior change through person-to-person engagement. The information exchange was strategic in that it sought to help improve the perceived efficacy of adopting recommended actions by empowering residents with the information and tools needed to make the change. The greater the perceived efficacy of the behavior, the greater the intention to take actions becomes. Additionally, although a formal commitment by the homeowner to implement irrigation schedules or adopt the recommended tips provided in the Water Check report was not required, residents might have been motivated to act knowing that the auditing team would return to assess any improved water efficiency.

RESULTS

Data was collected and assessed for three periods over the course of the study, they include: 1) a baseline period two years prior to the launch of the Water Check program; 2) intervention periods - following distribution of reports in 2004 and 2005; and 3) response period - two years after the conclusion of the program. Additionally, households had to meet the following criteria in order have their outdoor water use efficiency assessed: they did not experience any leaks; they received a correct irrigation schedule; and the residents remained in their homes over the course of the study. Of specific relevance was the approximately 13% increase in population growth within the City of Logan over the course of the study period. A housing boom resulted in some participants who had originally received Water Check reports relocating to

Table 3.1: Audit report details per Water Check topic

WATER CHECK AUDIT TOPIC	AUDIT REPORT DETAILS
Sprinkler system and landscape	• Distribution uniformity of the irrigation system, system design improvements, and maintenance practices that contribute to inefficient water use. • Ecological characteristics of the landscape including soil and plant types. • Physical characteristic of the lot including sun exposure on landscaped areas.
Site-specific irrigation schedules	• Irrigation schedules based on seasonal landscape water budgets.
Outdoor water conservation recommendations	• Tips on adjustments to irrigation system design, operation and maintenance to improve water use efficiency. Examples include cleaning clogged sprinkler heads, adjusting spray patterns, installing pressure regulators, and improving spacing. • Tips for assessing soil and plant health.

another residence. These dynamic events, coupled with other disqualifying criteria listed above limited the total number of homes that could be evaluated for program effectiveness to 144 (101 cases for 2004 volunteers and 43 cases for 2005 recruits).

In summary, the following challenges were encountered during the Water Check program that impacted overall program effectiveness: four (4) homes experienced leaks; thirty-four (34) irrigation schedules contained erroneous information; and sixty-six (66) residents relocated during the course of the Water Check program.

Overall Water Use Efficiency

Landscape water use efficiency was evaluated using the LIR metric, which is equal to measured outdoor water use (based on billing data) divided by the prescribed water budget for the landscape[10]. Based on performance, households were categorized into one of four groups, where each group is defined as follows:

- **GROUP A:** started and remained in the efficient category,
- **GROUP B:** reduced its LIR,
- **GROUP C:** increased its LIR, and
- **GROUP D:** started and remained in the excessive water use category.

Members of Groups A and B were considered to have "justifiable" water use, whereas members of Groups C and D were considered to have "unjustifiable" water use. Outdoor water use efficiency performance results for the baseline and intervention periods are summarized in Table 3.2 below for 144 participating households. Group A participants continued to conserve water below their designated water budgets post intervention, and Group B participants reduced their overall water usage though some tended to irrigate above their recommended water budget. Unlike Groups A and B, Groups C and D increased their water usage post-intervention. Other noteworthy observations include:

- Households that implemented recommended soil management practices used 25% less water on average and had lower LIR values than the remainder of the intervention group (1.15 versus 1.52).
- The only statistically significant relationship between adoption of water conservation recommendations and improved water use efficiency was attributed to participants who implemented soil management practices including application of mulch and aeration of compacted areas, 73% of whom successfully reduced their outdoor water use.
- 58% of participants who listed "time constraints" as a barrier to adopting audit recommendations did not reduce their water usage and on average used 23% more water during the response period than the remainder of the participants.
- Participants with time constraints also maintained a higher LIR values than those who did not face similar constraints (1.74 versus 1.44).

During the response period, in the summer of 2007, a follow-up survey was forwarded to Water Check participants who had indicated during the first post-intervention survey that they "had implemented or tried

Table 3.2: Baseline and Intervention Water Check Outdoor Water Usage (millimeters per day)

GROUP	WATER USE	BASELINE LIR	GROUP TOTAL (OUT OF 144)	BASELINE WATER USE (MM/DAY)	INTERVENTION WATER USE (MM/DAY)
A	Efficient	LIR≤1	41	1.8	1.8
B	Acceptable	1 < LIR ≤ 2	44	5.7	4.0
C	Inefficient	2 < LIR ≤ 3	55	4.3	5.3
D	Excessive	LIR > 3	4	11.2	13.3

10 An LIR of 1 represents 100% efficient use of irrigation water. This means that the volume of water applied to the landscape is equal to the exact water budget for that landscape. Whereas an LIR of 2 is equivalent to two times the water budget requirement.

to implement the irrigation schedule." The City received 96 responses from the 2004 self-selected volunteers and 29 responses from the 2005 recruits. Survey responses revealed the following about adoption of the audit water conservation recommendations:

- Irrigation schedule adjustments were the most popular, followed by adjustments and repairs to the irrigation system.
- Alterations to existing irrigation system were the least popular.
- Soil and soil management changes were only slightly more popular than irrigation alterations.

Segmented Water Use Efficiency (2004 vs 2005)

During the intervention period, both the 2004 and 2005 participants improved their water use efficiency. However, water savings achieved during the intervention period diminished during the response period (2 years after the intervention period). The data is presented in Tables 3.3and 3.4 below. Data collected during the response period also revealed that the 2004 volunteers' mean water use was 41% lower than that of the 2005 recruits.

EVALUATION AND LESSONS LEARNED

The immediate response to the Water Check audits resulted in improved water use efficiency. The biggest savings were attributed to the 2005 sample group. However, rebound in water usage two years following the audits overwhelmed any savings achieved during the intervention period. Over time, fewer homes continued to meet their annual water budgets and as a result, LIR values became less "justifiable". These results seem to suggest that the effectiveness of the Water Check audits diminished as time progressed past the initial on-site engagements with property owners. Thus, if the goal is to sustain long-term outdoor water use efficiency, additional interventions deployed at some routine frequency and over a longer period of time might be necessary. Further, the CBSM program approach could be refined to address the needs of different segments of the sample groups. For example, field observations found that unlike their 2004 counterparts, who generally consisted of Do-It-Yourself enthusiasts with an existing propensity to conserve water, the 2005 recruits "were just beginning to address water conservation issues." Whereas the 2004 volunteers requested to learn new tips beyond what was provided in the audit, the 2005 recruits likely required basic how-to information to help increase their confidence level in taking on the recommended Water Check actions. As stated in the case study: "Success appears to be site-specific and relies

Table 3.3: Percent Distribution of 2004 Volunteers in Justifiable and Unjustifiable Water Usage Categories during Baseline, Intervention and Response Periods (N = 101)

WATER USE	BASELINE LIR	BASELINE	INTERVENTION	RESPONSE
Justifiable	LIR≤1 and 1 < LIR ≤ 2	93%	96%	91%
Unjustifiable	2 < LIR ≤ 3 and LIR > 3	7%	4%	9%

Table 3.4: Percent Distribution of 2005 Recruits in Justifiable and Unjustifiable Water Usage Categories during Baseline, Intervention and Response Periods (N=43)

WATER USE	BASELINE LIR	BASELINE	INTERVENTION	RESPONSE
Justifiable	LIR≤1 and 1 < LIR ≤ 2	63%	75%	56%
Unjustifiable	2 < LIR ≤ 3 and LIR > 3	37%	25%	44%

on adoption of a combination of recommendations addressing residential landscape conditions, as well as households' conservation competency."

The 2005 recruits also has a greater margin to conserve than the 2004 self-selected volunteers who used 41 % less water on average. Further, households targeted by the Water Check program in 2004 were already conserving water at an efficient level with over 90% residing within "justifiable" use. These results make the case for eliminating self-subscription as a method of program participation.

Because multiple elements dictate landscape water requirements (i.e. vegetation type, irrigation infrastructure, and management) the results from the study suggest that modifying irrigation schedules alone might not be enough to obtain larger gains in efficiency. A landscape design can actually prevent water savings if it does not embody elements that promote efficiency. Along these lines, other environmental contextual factors can serve as barriers to efficient use. For example, plant water needs that fluctuate between seasons and establishment periods are "essentially a moving target that less experienced participants may have found difficult to perceive." Direct feedback from Water Check participants on ways for improving the audit included offering more robust information on topics like plant choice, irrigation and landscape design, maintenance resources, and relevant classes. Others suggested including additional hand-holding by offering follow-up communication either via telephone or a second site visit.

The inability of homeowners to verify or track the effectiveness of their new behavior (e.g., irrigation schedule adjustments) might have resulted in diminished motivation for following through with Water Check recommendations. Performance feedback can be a powerful form of positive reinforcement by showing that actions can result in immediate results, and therefore help to continuously motivate the target audience to keep practicing the recommended behavior. In simpler terms, feedback can show that what one does makes a difference.

The Water Check program results also make a strong case for extending the evaluation period beyond a year following interventions. Initial water savings observed during the intervention period, if projected to account for savings in future years, would have resulted in inaccurate estimates since there was significant rebound in water usage two years following the audits.

SECTION 2: INFORMATION CAMPAIGNS

When it comes to residential water use, many lack a true understanding of their household's water consumption. In California, residents often incorrectly cite indoor activities rather than landscape irrigation practices as using the most water. Information campaigns that reveal disaggregated water use between indoor and outdoor consumption can help bridge this knowledge gap for residents. However, the ability of informative statistics to influence water efficient behaviors tends to increase when coupled with messaging that utilizes CBSM tools. The following case studies present residential water users with customized home water use reports infused with CBSM messaging to drive outdoor water use efficiency.

Supplement the case study reviews in Section 2 with the following resources:

Liu, A., et al., (2017). "Online water-use feedback: household user interest, savings and implications," *Urban Water Journa*l. Vol 14, Issue 9, pages 900-907

Nola Hastings & Galib Rustamov (March 2015). *Potential Best Management Practice: Customer Water Use Messaging*, Prepared for CUWCC.

Nemati, M., Buck, S., and Soldati, H. (2017). "The Effect of Social and Consumption Analytics on Residential Water Demand", 2017 ASSA Annual Meeting-Chicago; AERE section on Behavioral Interventions and Water Conservation, Working Paper

Mitchell, D. L. and Chesnutt, T. W. (2013). "Evaluation of East Bay Municipal Utility District's Pilot of WaterSmart Home Water Reports", Prepared for California Water Foundation & East Bay Municipal Utility District.

Case Study #4: Home Water Update (New South Wales, Australia)[11]

OVERVIEW

In this study, MidCoast Water (MCW) of New South Wales Australia collected, analyzed and reported smart water meter data as part of a trial information campaign to inspire reductions in residential household water usage. Beginning in May of 2013, MCW launched the Home Water Update (HWU) program which reported water usage metrics in combination with CBSM-type messaging to a subset of homes located in the suburbs. The data was collected from an existing network of smart meters twice a year during the winter and summer months for a duration ranging from two to five weeks. These meters were installed several years prior as part of a pressure study. Under the HWU program, meter readings were collected in one-minute intervals and then subsequently disaggregated among assigned end-uses (i.e., toilets, washing machines, outdoor use, etc.) with computer software. In turn, these findings were summarized into reports for the winter and summer reporting periods and then mailed to residents for review. Meter readings were taken pre- and post- HWU program interventions in order to measure overall effectiveness as a demand management tool.

GOALS AND OBJECTIVES

Through the launch of its HWU campaign, MCW sought to inspire individual residents to change their behavior and reduce their overall household water consumption. Rather than set target water reduction levels, households were mailed customized water end-use feedback to demonstrate margins for water

11 **Case Study #4:** Liu, A., Gieuro, D., and Pierre, M. (2015). "Urban Water Conservation through Customized Water and End-Use Information," *Journal of Cleaner Production*. 1–12.

reduction and encourage behaviors to help achieve those reductions. Participants' degree of responsiveness to the campaign was evaluated based on measured pre- and post-intervention water consumption. Finally, attitudes about the HWU program and overall awareness in household water usage were assessed by feedback received during a post-intervention household evaluation survey.

TARGET AUDIENCE

Households with previously installed smart meters (141 in total) were contacted to solicit their participation in the HWU study. Information packets, a consent form, and a baseline survey were mailed to the target audience. Participants were established following receipt of authorized consent, a completed survey, and after meeting a set of screening criteria (i.e. home must be occupied, etc.). To increase participation rates, a second round of solicitation bookended with follow-up calls occurred within two months of the first mailers to homes who did not initially respond. Finally, a $50 AUD (equivalent to approximately $50 USD) discount on participants' water bills was offered as an incentive for completing the survey. In total, 68 households were selected and were divided into an intervention and control group using stratified randomization methods. Both groups consisted of 34 participants and shared a similar distribution of household water consumption and number of occupants.

Responses from the baseline surveys revealed participants had a median pre-tax household income within the range of $30,000 to $59,999 AUD (In 2011, this was equivalent to a similar range in USD); nearly 70% of households were occupied by two residents and a near equal divide between men and women for survey respondents (44% female, 47% male, 9% non-reported); the median and mode age was above 65 years; and 64% were retired. Additionally, survey results indicated that most participants had water-saving appliances in their homes at the time of the HWU campaign: 79% had all dual-flush toilets and 58% were fitted with efficient shower heads.

DESIRED BEHAVIOR CHANGE

MCW anticipated residents who participated in the HWU information campaign and received reports describing their water end-use would alter their behavior to decrease consumption below the previous summer and winter season's baseline levels. These goals were not communicated directly to the participating households. Despite no promotion of an explicit water conservation goal, the HWU reports did contain a benchmark comparison of the households' water use to the average water use of a double-occupied residence within the same community. Therefore, the intervention group could have seen the benchmark as a target to meet or outperform.

IDENTIFIED BARRIERS

The pre-intervention survey administered to residents during the recruitment phase of the HWU program helped to gauge residents' understanding of household water usage. Although limited in the feedback it generated, the survey results revealed that most respondents from both the control and interventions groups did not feel informed about their household's water use nor understood how much water was used by their appliances. Despite these low figures, more than 80% of respondents for both groups believed they knew where most of the water was used in their homes but were less sure of their household's overall usage. To summarize, knowledge gaps were identified as a barrier to improved water use efficiency.

CBSM STRATEGIES

Individual household data was obtained from the smart water meters and personalized into an HWU. The HWU was distributed as a double-sided, standard 8.5x11-inch mailer. The mailer content integrated several CBSM tools including **communication**, **feedback**, **prompts** and **social normalizing** messages. The following section provides details on how the HWUs integrated each of these elements

MESSAGING

Homeowners in the intervention group were informed of their disaggregated water use via a single sheet, double-sided mailer, in a format that conveyed the water-usage data in a visually appealing way. Two mailers were prepared and distributed over the course of the study, the first was sent out in May 2013 and the second in September 2013. The mailers were strategically distributed separate from quarterly water bills to avoid them being confused for a "generic bill insert" and discarded. No personal interactions via telephone or house visits were made by MCW. See Tables 4.1, 4.2 and Figure 4.1 for a description of the mailers and embedded CBSM tools.

MOTIVATORS AND BENEFITS

The data assessment provided in the HWU reports was intended to influence behavior change via prompts, feedback and social normalizing messaging. The HWU reports were the sole collateral of MCW's targeted information campaign. The reports were designed to make the information easily digestible by residents and focused on the three largest end-uses per household. In addition, since water metrics are not commonly understood, daily water use was reported in both the standard measure, liters, as well as number of buckets. Bucket volumes were thought to be easier for the average homeowner to visualize. A simple layout with color-coded metrics per end-use improved the readability of the report. The content was then intentionally organized to highlight the highest water consuming end-uses while offering water conserving prompts as a means to motivate individuals to cut back on usage.

Perhaps one of the most effective forms of messaging contained within the HWU report was the comparison of the target home's daily water usage to an average user. In this case, the designer presented daily water consumption by sizing rain droplets for the homeowner and an average double-occupancy residence in accordance with their average usage (see Figure 4.1). As a result, the homeowner might have been motivated to consume less water if his or her household's water droplet was pictured to be larger than that of the average

Table 4.1: Home Water Update front-side mailer content

HWU MAILER FRONT SIDE CONTENT DESCRIPTION	CBSM TOOL
General program information including the key features of the HWU report, as well as program sponsor contact information for directing questions or comments.	NA
Pie chart consisting of the following end-use water consumption categories: shower, toilet, washing machine, taps, outdoor and leaks.	Communication/Education
Comparison between the subject household's water use and that of a "neighbor" in liters. [The study reported that "two-person households represented the majority of study households and were selected as the benchmark for simplified presentation.]	Feedback/Social Norm
Average daily water consumption reported in buckets, where each bucket is equivalent to 10 liters.	Communication

Table 4.2 Home Water Update reverse-side mailer content

HWU MAILER REVERSE SIDE CONTENT DESCRIPTION	CBSM TOOL
Average daily water use in liters for all smart meter end-use categories: shower, toilet, washing machine, taps, outdoor and leaks.	Communication
Personalized water-saving tips typically focused on one of the three highest water end-use categories. For each tip, the potential water savings were reported in buckets or liters. Tips were never repeated per household.	Feedback/Prompts

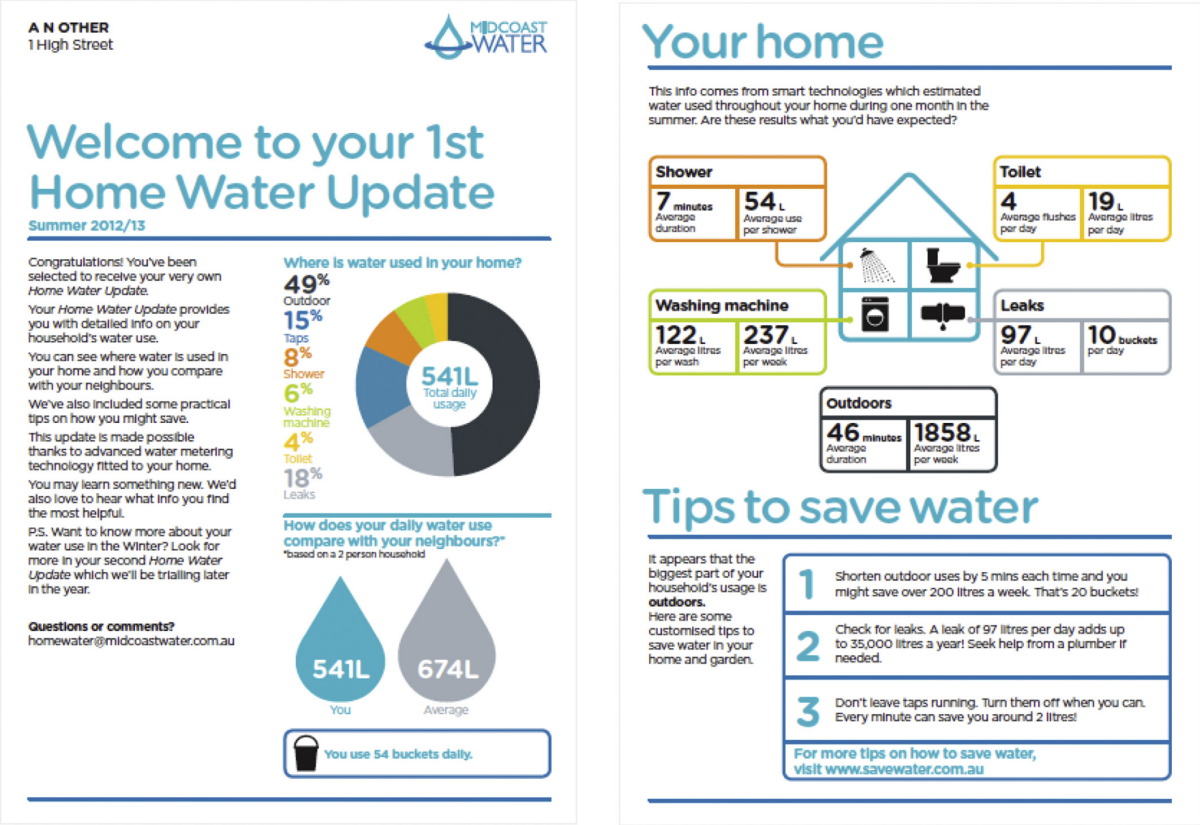


Figure 4.1: Example Home Water Update Mailer (front and back view).
Reprinted from Liu, A., Giurco, D., Mukheibir, P., Motivating metrics for household water-use feedback. 2015 Resources, Conservation and Recycling, 103, 29–46, Copyright (2015), with permission from Elsevier.

user (the standard assumed to be socially acceptable). On the contrary, if the homeowner's droplet was presented to be smaller than the average user, the homeowner might have been dis-incentivized to further curb his or her water usage.

RESULTS

Baseline water consumption from summer/winter 2012 was compared with summer/winter 2013 post-intervention water consumption to assess whether homeowners had indeed altered their behavior after receiving their personalized HWUs.

Note that the data represents a snapshot of water usage since measurements were only collected for a period between two to five weeks. In the summer analysis, 26 intervention households and 29 control group households were examined. In the winter analysis, 28 intervention households and 29 control group households were examined. Several factors contributed to the decline in original group size of 34, including residents moving out of their homes, residents going away on vacation during meter reads, meter failure, or faulty meter readings.

The summer pre- and post-intervention comparisons found that total water use increased by a net 9% in comparison to the control group, whereas the opposite was observed with winter pre- and post-intervention consumption. In winter, the intervention group used a net 8% less water than the control group post-intervention. Despite these findings, a statistical analysis found that "the measured effect of the HWU intervention was not significantly different between the intervention and control groups".

When the meter readings were disaggregated between end-uses the results also differed between summer and winter. During the summer, outdoor applications comprised the most water usage of any other end-use; in the winter, indoor taps comprised the largest fraction of water usage. While water use increased for nearly every end-use during summer for both the intervention and control group post HWU distribution, most notable

was the 11% increase in outdoor water usage by the intervention group in comparison to an 8% decrease by the control group for the same end-use. The authors note that these results may have been linked to a larger number of water features on the intervention group properties, such as swimming pools, in comparison to the control group. The pre- and post-intervention winter results revealed that "consumption was lower in the intervention group than the control group for every end-use." The largest margin of savings was achieved for outdoor and washing machines, which saw a 25% and 24% decline relative to the control group respectively.

Despite the disappointing results in the summer, post-intervention surveys seemed to indicate that the HWU information campaign improved residents' overall understanding of water usage attributed to specific end-uses. Post-intervention surveys were administered three months after the last HWU was mailed to participating households. In total, 22 responses were received (representing 65% of intervention participants), after offering an AUD 20 rebate for participation. The intent was to generate feedback on the following topics:

1. Homeowner's receptiveness to the reports (reach and appeal),
2. Behavioral changes related to household water usage, and
3. Improved awareness of overall household and disaggregated end-use water consumption.

All respondents reported that they took at least a few minutes to read over the HWU reports, with 50% spending between 5 to 10 minutes reviewing the content and the same percentage reviewing the report more than once. Additionally, 75% of respondents kept their summer report to compare it with their winter report, and 66% of respondents discussed the results with others. Among 14 survey comments received, some residents reported to have found the results either "interesting" or "very interesting," others described feelings of "shock" or "surprise" in response to their results, while two questioned the accuracy of the smart meter data. In total, eight of the survey respondents reported that they were motivated to change their behavior in order to conserve water.

Additional survey results showed an increase in respondents' awareness about their household water consumption. For example, pre-intervention, 82% of respondents said they knew "where most water is used in my home." This increased to 100% after the dissemination of HWU reports. Similarly, pre-intervention, 32% of respondents said they knew their "household appliance water use"; this increased to 82% post-intervention. Another marked growth in awareness was signified by an increase from 36% to 91% in pre- and post-interventions surveys, respectively, when respondents were asked if they felt informed about their household's water use.

EVALUATION AND LESSONS LEARNED

The HWU program was designed to capture two seasonal snapshots of water usage only. Despite this limited engagement, all but one of the survey respondents reported that they would like to continue receiving HWU reports. Smart meters with web-based data portals or in-home displays that can be accessed by residents at their convenience are an alternative to paper report generation. In addition to providing residents with real-time water usage data, these technologies also reduce the cost burden levied upon water utilities to generate personalized HWU-type reports. Access to real-time data also empowers residents to respond to water waste immediately and eliminates the lag time between significant water events and report generation. This is an important consideration when it comes to leaks, which should be addressed with haste. Lastly, these technologies enable immediate notification of meter malfunctions. See the "supplemental reading" references cited at the beginning of Section 2 of this report for more information on other agencies currently generating home water reports using smart meter technology.

This study demonstrates the need for better program evaluation protocols. For example, the study results might have revealed more about household behavior change if post-intervention smart meter reads were extended beyond the two 2-to-5 week measurement periods. With only a snapshot of water usage, the effectiveness of the campaign is not fully understood. Longer measurement periods could have also enabled a statistically significant evaluation of the data, not to mention, offer additional insights into water usage patterns. Further, increasing the number of participating households would allow for marginal reductions of the sample group due to unexpected circumstances, such as

homeowner relocation, without impacting the ability to conduct meaningful statistical analysis. In addition, a limited measurement periods prevents a return on investment analysis, an assessment typically warranted prior to scaling up a pilot program. With regard to the study design, the authors shared their feedback on sample size and statistical analysis:

> *"The statistical power of the analysis could have been improved via additional recruitment efforts to increase the sample size for the quantitative analyses. Alternatively, since the manual production of HWUs for additional households would have been costly, longer measurement periods might have offered a better approach by reducing the variation in average daily consumption, thereby increasing the statistical power of the trial."*

Interestingly, this study revealed an increase in post-intervention water usage during the summer months. This could suggest that any attempts to curb water usage via personalized home water usage reports could be offset by other environmental factors occurring in the summer months (contextual and environmental factors are addressed in Case Study #5). Thus, seasonal consideration should be assessed while developing a CBSM-type information campaign. Another explanation of the increased summer water use against baseline measures could be the "Boomerang Effect." Homeowners that were using water below the average household upon learning this information might increase their usage, or to put it another way, their behavior "boomerangs" in an undesired direction.

In the summer, the largest percentage of overall water use occurred outdoors. As noted in the results section, the intervention group possessed more water features in their landscapes relative to the control group, which might have contributed to an increase in post HWU intervention water usage in the summer. Disaggregating outdoor water use further (i.e. landscape irrigation by equipment type, water features such as pools and fountains, etc.) might reveal specific behaviors to target that contribute to overuse. Thus, a more granular analysis of outdoor water use could have revealed specific behaviors to target within the HWU prompts.

Case Study #5: Water Budget Communication (College Station, Texas)[12]

OVERVIEW

In 2012 the Texas Water Development Board determined if per-capita water consumption remained constant with estimated rates of population growth, water demand in College Station, Texas would exceed available supplies as early as 2030. College Station relies solely on local groundwater for both its domestic and commercial needs. This supply is most at risk of serious depletion during the hotter summer months when rain is limited (below three inches in July and August) and peak water usage is the highest. In order to address peak usage and projected future water shortages, residents were encouraged to curb outdoor water use during the "irrigation period" from April to October via a targeted information campaign. Like many of the hotter regions of California, outdoor irrigation in College Station comprises the largest percentage of household use in warmer months as residents seek to keep their turf grass alive.

The City of College Station Utility Water Service (UWS) targeted their most prolific residential water users and launched an information campaign infused with CBSM-type messaging beginning in the spring of 2012 just before the irrigation period. The objective was to inform high water using households of their monthly water budgets while simultaneously encouraging the same residents to maintain consumption levels at or below their water budget threshold. A water budget is defined as the maximum volume of irrigation water required to sustain landscaped area after accounting for local rainfall and evapotranspiration. In order to establish water budgets per residence, the following information was obtained: irrigable area derived from County tax assessment records and City owned shapefiles of parcel details (where irrigable area is equal to the total parcel area in square feet less the area of buildings and the driveway), and regional weather station rain data, including monthly rain totals and evapotranspiration rates. Differences in pre- and post-intervention outdoor water consumption were used to evaluate the impact of the information

12 **Case Study #5:** Landon, A., Kyle, G., and Kaiser, R. (2016). "Predicting Compliance with an Information-based Residential Outdoor Water Conservation Program," *Journal of Hydrology.* 536: 26–36.

campaign on water-use efficiency. To generate further insights, environmental contextual factors were assessed to determine their effects on homeowners' intentions to conserve.

GOALS AND OBJECTIVES

This case study conducted an analysis of the potential for CBSM-type campaigns that offer personalized feedback, like the City of College Station's water budget communication program, to effectively drive behavior change. The researchers investigated the following hypotheses after two seasons of water budget reporting:

1. Households with a higher intention to meet their water budgets will utilize outdoor water more efficiently.
2. If the household believes they possess the skills to comply with the water budget, then they will utilize outdoor water more efficiently.
3. Various environmental contextual factors can both positively and negatively impact compliance with the water budget.

As stated within the study, "The efficacy of persuasive instruments in achieving a change in behavior varies as a function of constituent attitudes toward the behavior that they promote, and the social and environmental contexts in which they occur." Thus, the analysis sought to develop explanations as to why an intention to conserve water does not always translate into changed behavior. This included an evaluation of the extent by which the following environmental contextual factor influence water-conserving behavior:

- Market value of home (income),
- Landscape irrigable area,
- Possession of a pool, garden, and/or pond,
- Age of home, and
- Number of irrigated landscaping features other than the lawn.

The evaluation was conducted using responses to a survey that was administered to a subset of homes that had received the water budget communication. The surveys were mailed to select households two-weeks following the water budget distributions.

TARGET AUDIENCE

When the water budget information campaign was launched, College Station had a population of roughly 100,000 citizens. While assessing water usage patterns, UWS discovered that just 15% of service accounts (or 5,565 households) accounted for nearly 40% of the city's overall water usage, where outdoor water use comprised the largest fraction of household usage. The information campaign was designed to target this specific group of homeowners, which resided in 12 distinct neighborhoods of variable size, location and HOA landscaping rules within College Station.

On average, study participants were characterized as 62% male, 58 years old, had lived in their homes for 11 years, and more than half had completed a master's degree. The average home value for this same group was just above $220,000 with an average irrigable landscape area of 9,300 ft^2.

DESIRED BEHAVIOR CHANGE

The UWS anticipated that participating households would alter their behavior intentionally to decrease monthly outdoor water use to levels at or below their individual water budgets. When water consumption exceeded the target water budget, homeowners were provided tips on specific actions to improve efficiency, in hopes that those individuals motivated to conserve would implement these tips.

IDENTIFIED BARRIERS

The information campaign was intended to generate positive attitudes around water conservations and result in behavior change. However, external factors can serve as barriers and counter one's intention to conserve. Examples include costs associated with the time to learn and implement the desired behavior change and purchasing and installing new water-conserving technologies. Additionally, relatively low water rates can make for a weak financial incentive to conserve water. Table 5.1 below lists a number of potential environmental and social contextual barriers to water use efficiency.

Table 5.1: Environmental and Social Contextual Barriers that have the Potential to Influence Behavior Change in Residential Outdoor Water Use

BARRIER	BARRIER TYPE (ENVIRONMENTAL OR SOCIAL)
Neighborhood of Residence	
Formal institutions such as HOAs that mandate certain landscape aesthetics and installation policies be met (in some cases to maintain property value), and fines levied if they are not met.[1]	Environmental and Social
Informal institutions like neighborhoods or cultural influences that shape landscape choices and maintenance.	Social
([1] Note that in California Assembly Bill 2100 prohibits HOAs from imposing a penalty on homeowners for reducing or eliminating watering of vegetation or lawns during a drought, and AB 2104 eliminated loopholes HOAs used to prevent homeowners from utilizing low water-using plants when replacing turf grass.)	
Income and Household Infrastructure	
Affluent residents tend to have larger irrigated landscapes and high-water usage features, including pools and fountains, for recreation and would opt to maintain these elements rather than meet a water budget.	Environmental
Displays of large landscaped areas and water features conveys one's social status.	Social
Lawn Area	
Landscaped areas that are covered with lawns make it challenging to meet water budgets (the most relevant environmental contextual factor influencing compliance with the water budget).	Environmental
Water usage per unit area of smaller lawns tends to be higher than larger lawns. Or in other words customers with smaller lawns will use water less efficiently than customers with larger lawns.	Environmental
Age of Home	
The older the home the more potential for leaks.	Environmental

CBSM STRATEGIES

UWS deployed an information campaign intended to motivate behavior changes among the most prolific water-using segment of residential customers. Imbedded in the water budget communications were several CBSM-type messaging strategies including water use target and **feedback**, conservation **prompts**, and **social normalizing** messages addressing household water use. These are the same set of strategies utilized in the New South Wales, Australia Home Water Update campaign (Case Study #4). As such, the water budget communications were designed to be a "persuasive effort intended to foster positive attitudes toward water conservation, positive beliefs concerning water conservation behaviors in the broader community, and the skills and knowledge needed for one to comply, and ultimately the intention to do so."

MESSAGING

In the spring of 2012, the first water budget communication mailers were sent to high water households prior to the irrigation period (April to October). The mailers included a water-use summary from the previous season's irrigation period. The first distribution included a cover letter explaining the intent of the study signed by the city water manager, as well as a directory of web-based city water conservation resources.

The mailers contained a personalized assessment of homeowner's monthly outdoor water use and compared it to two baseline metrics: a monthly outdoor water budget and the total summer average outdoor water use of the neighborhood. The water budget was presented in gallons per month, whereas average neighborhood usage was presented in gallon per square foot of outdoor landscape.

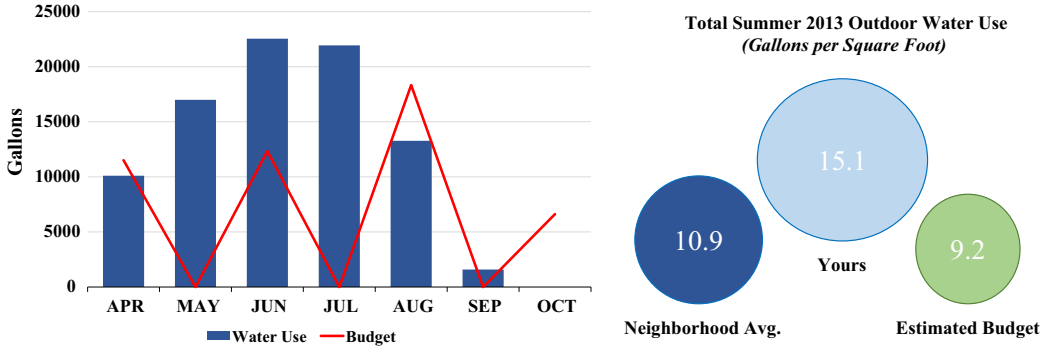
Lastly, the water budget communication included normative behavior statements by referring to users as either "below average" when they were under their water budget or "above average" when they were over their water budget. For above-average users, a prompt was included in the communication suggesting tips on how to conserve further.

MOTIVATORS AND BENEFITS

Based on the principles of behavior science, it was presumed that a targeted and personalized information campaign which helped households to visualize their water consumption against a threshold would "create positive attitudes towards compliance" and, in turn, motivate the highest water-consuming households to do their part to conserve. In order to communicate effectively, water consumption data was organized to make it easily digestible for the homeowner. Text was limited, and data was presented in bar charts and figures (See Figure 5.1): circles representing total average summer water consumption were proportionately sized, based on measured usage for the participating household, an average neighbor and the estimated water budget. Via this social normalizing tactic homeowners might be motivated to consume less water after presented with information displaying higher water usage than the average. On the contrary, if the homeowner's circle was presented to be smaller than the average user and/or water budget, the homeowner might be dis-incentivized to further curb his or her water usage.

RESULTS

Monthly meter readings of outdoor water usage were collected and totaled for the irrigation period spanning from April to October, then assessed against the water budget for the same period to determine the range of deviation for each household. A deviation of 0% indicated that the household used exactly their water budget for outdoor irrigation, while a positive deviation meant they had exceeded the water budget, and a negative deviation indicated they had not only met the water budget but had conserved below this target (Note that the weighted breakdown of households per categories was not reported). The authors reported that the span of deviation was quite large, ranging from a "low of - 100 percent to a high of 343 percent."



- **Under-Budget or Below-Average Water Use: If your charts show you are under-budget or below average for your neighborhood – keep up the good work!**
- **Over-Budget or Above-Average Water Use: You may be able to realize substantial savings on your water bill by using conservation practices such as covering a swimming pool, fixing irrigation leaks or adjusting your irrigation controller**

Fig. 3. Example water budget communication.

Figure 5.1: Example City of College Station Utility Water Service Water Budget Communication Mailer. Reprinted from Landon, A., Kyle, G., Kaiser, R., Predicting Compliance with an Information-based Residential Outdoor Water Conservation Program. Journal of Hydrology, 536, 26–36, Copyright (2016), with permission from Elsevier.

The post-campaign evaluation sought to assess the ability of the water communication mailers to influence attitudes about water conservation. Surveys were mailed to a sub-set of the participating homes (2,500 residents), and a total of 654 viable responses (or 26% of the survey population) were received. These responses were key to the campaign evaluation. Attitudes were evaluated based on how respondents rated the following statements: "Staying within my water budget is a positive thing" and "It is important to stay with my water budget." On a scale of 1 to 5, where 1 represents "strongly disagree" and 5 represents "strongly agree," the mean response was a 4.14, indicating an overall positive attitude towards compliance. A similar result of 4.10 was reported for an intention to comply with the water budget. Perceived behavior control, a measure of self-efficacy in adopting the behavior was relatively high with a mean of 3.91, followed by 3.74 for subjective norms, an indication of the importance of social acceptance on meeting the water budget. However, the researchers note: "Although we did not utilize an experimental design, and therefore cannot attribute causation, the water budget program appears to have been successful in shaping positive attitudes towards compliance".

Attitudinal factors in combination with environmental factors were utilized in various regression analyses to test the three hypotheses presented under *Goals and Objectives*. In support of the first hypothesis, the study found that those who intended to stay within their water budgets used water more efficiently. Noting that while intention was a significant predictor of behavior change, the relationship overall was relatively weak. The second hypothesis however, was not supported by the analysis, which found that perceived behavior control was not directly correlated with behavior change. Lastly, the environmental contextual factors of irrigable area and home market value (also an indicator of income) were the strongest predictors of percent deviation from the water budget. Strangely enough, homes with larger irrigable areas used water more efficiently than homes with smaller areas. And as expected, affluent homeowners were more likely to use water above their designated budgets. Lastly, the study also performed a regression analysis investigating the impact of neighborhoods. Findings indicated that "formal and informal institutions represented by the neighborhood of residence have an impact on outdoor water use".

EVALUATION AND LESSONS LEARNED

Personalized and direct communication regarding residential water conservation has the potential to shift attitudes and boost customer confidence to change behavior. Nevertheless, as the case study demonstrated, anticipated water savings could be limited by other environmental factors that exist within neighborhoods. These include physical characteristics like the possession of water features, the number and kinds of irrigated areas on site, and variable sizes of irrigated landscapes. Formal institutions such as HOA's and the culture they reinforce via standards and social norms can also hinder improved water use efficiency. Thus, the impacts of CBSM campaigns are optimized when they conduct a comprehensive assessment of barriers that impact behavior change and are not solely focused on shifting attitudes and beliefs held by the target audience.

Because pre-intervention surveys were never conducted during the first round of water budget communication deployment, a baseline of customer attitudes, perceived barriers and benefits, and knowledge was never captured. This in turn prevented an assessment of program outcomes rooted in data and observation. Therefore, CBSM practitioners should allocate funds for developing and implementing evaluation protocols during the program planning phase. And although significant water savings were achieved by some accounts (up to a negative 100% deviation from the water budget), the case study did not include a detailed assessment of water savings for different segments of target residents. This form of accounting is necessary to gauge relative effectiveness of marketing campaigns for different demographics and for making adjustments to the approach before launching scaled-up campaigns. Despite this lack of reporting, the authors do suggest that performance metrics be measured as observed behavior, rather than via self-reporting by study participants to eliminate any bias.

As in Case Study #4, water usage data was presented retroactively thereby denying homeowners the opportunity to adjust behavior in real-time to improve efficiency. The dynamic nature of monthly water budgets, which can swing up and down depending on fluctuations in local weather, makes the case for more frequent reporting to homeowners. Viable solutions, as previously mentioned, include web-based data portals

and/or in-home displays linked to smart meters that allow for real-time water consumption to be reported and accessed immediately. This approach also reduces agency resources needed to continuously generate persuasive instruments in the form of personalized messaging.

SECTION 3: SUSTAINABLE LANDSCAPING

The watershed approach to sustainable landscaping challenges traditional outdoor water conservation programs to account for more than just potable water savings. One of the core tenants of the watershed approach is to improve landscape design and maintenance so as to enhance ecological functions in the landscape. It is a wholistic approach that promotes healthy soils, water quality, emission reductions, minimizing green waste, and habitat for native fauna in addition to irrigation efficiency. Many California water agencies have adopted design principles of the watershed approach, even requiring robust criteria for turf conversion incentive programs that achieve these benefits. The following case study investigates residential interest in rain barrel and rain garden installation, two elements of sustainable landscapes that can help to both offset irrigation water and improve water quality. Specifically, Case Study #6 investigates the potential for CBSM to influence uptake of both rain barrels and rain gardens.

Case Study #6: Rain Barrel and Rain Garden Uptake (Toronto, Canada)[13]

OVERVIEW

In 2009, the City of Toronto investigated regional susceptibility to flooding and performed a Basement Flooding Environmental Assessment. Recommendations following the Assessment called for capital improvements to mitigate flooding in the event of a 100-year storm. The cost of upgrading stormwater infrastructure was estimated at $18 million. Decentralized solutions included downspout disconnections at the parcel level. However, despite being a more economical option, the feasibility of implementation was ranked low. In 2010, after capital system upgrades were completed, the City had a renewed interest in promoting stormwater management at the parcel level to help reduce peak stormwater flows and in turn, extend the life of the newly upgraded system.

This case study is a summary of an academic thesis for fulfillment of a master's degree in city planning at MIT published in June of 2011. The study sought to answer: "how and to what extend might CBMS strategies drive uptake of specific actions", in this case rain barrel and rain gardens installations, within three sample neighborhoods residing in the greater Toronto area. Like disconnecting downspouts, installation of rain barrels and rain gardens are considered decentralized methods for reducing peak stormwater flows. In addition, the study evaluated local conditions that impact CBSM's ability to affect long-term sustainability at the neighborhood scale. Although the thesis included additional information on the theory and findings of numerous social- and behavioral-science studies, we summarize here only those insights from the study that directly relate to implementation of CBSM for rain barrel and rain garden adoption at the neighborhood scale.

GOALS AND OBJECTIVES

The goal of the study was to "investigate the factors that shape residents' support for rain barrels and rain gardens in the different neighborhoods" by conducting in-person interviews with volunteers. These factors included homeowners' attitudes towards and awareness of rain barrels and rain gardens and their usefulness; homeowners' identities; and social elements within neighborhoods. With respect to the latter, the study examined the effectiveness of social norming strategies within communities that have varying degrees of social capital (societal networks and trusted entities and organizations that help facilitate cooperation for mutual benefit). In addition, the study assessed the potential opportunities and limitations for CBSM applications within these same neighborhoods, and evaluated CBSM's role in fostering long-term sustainability. *What the study did not do is design and implement an actual CBSM pilot campaign that generated measurable results.*

13 **Case Study #6**: Lightman, Deborah (June 2011). *Community-Based Social Marketing at the Neighborhood Scale: Sustainable Behavior or Neighborhood Sustainability* (master's thesis). Obtained from the Massachusetts Institute of Technology archives.

TARGET AUDIENCE

Three target neighborhoods were selected in the greater Toronto area. They include the Fontainbleu and Moray neighborhoods within the greater Oak Ridge area, and the Jane and Finch neighborhoods which were lumped into one cohort due to their similarities. Neighborhoods were selected to represent diverse socio-economic and physical demographics. Home price was the first filter for selecting candidate neighborhoods. In addition, only those residents who owned single-detached and semi-detached homes were approached about participating in the study. Renters and residents of social housing establishments were excluded. Table 6.1 below summarizes the demographic differences between the three neighborhoods selected for this study.

Thirty in-person door-to-door interviews were administered, where 7 to 8 interviews were conducted per neighborhood in an area spanning only 1 to 2 blocks. Based on feedback during the interviews, where the topics of yards, rain gardens, rain barrels, and other environmental actions were discussed, each resident was assigned an environmental identity groups. Descriptions of these identities are provided below and are taken verbatim from the publication.

Table 6.1: Study Neighborhoods Demographics

NEIGHBORHOOD	HOME PRICE RANGE	MEDIAN HOUSEHOLD INCOME	ENVIRONMENTAL INITIATIVES (WATER-FOCUSED)	NOTES
Oak Ridge, including sub-neighborhoods: • Fontainbleu, • Moray (45 minutes north of Toronto)	$420,000 - $935,000	$97,000	Lake Wilcox Remediation Strategy resulted in removal of all septic systems and establishment of stormwater guidelines. The town offers free landscape audits, and developed Summer Outdoor Water Use Guidelines and by-laws to promote efficiency. Water for Tomorrow Program offered rebates for efficient appliances, rain barrel, and workshops	• Single-family dwellings occupy 86% of the land area. • Rapid growth over last few decades, where 75% of housing was mostly built within the previous decade. • Homeownership is 92%. • Population density per square KM is 1,581 • Extreme variation in groundwater level among neighborhoods (ranging from 5 to 16 meters below ground surface).
Jane/Finch (Toronto proper)	$290,000 - $425,000	$40,000	Black Creek Conservation Project (founded in 1982) is community-based and focused on restoration.	• Concentration of social housing • 60% high-density, high-rise apartment buildings, but occupies only 21% of the land area. • Remainder are single-family homes, most built in the 1960s. • Homeownership is 35% • Population density per square KM is 6,571 • The majority of residents are immigrants.

- **New Environmental Paradigm (NEP) Environmentalist:**

The primary motivation for change originates from environmental, rather than social or economic concerns.

"These residents are concerned about the health of the Earth's ecosystems and the wellbeing of future generations. They are interested in practices that contribute to local and global environmental sustainability."

- **Cost-efficient Environmentalist:**

The primary motivation for change originates from economically affordable/feasible solutions to address environmental concerns.

"These residents are concerned about environmental issues and are interested in adopting environmental actions that are cost-effective. Conservation programs that reduce resource use and save money on water and energy bills are thus appealing."

- **Good Gardener:**

The primary motivation is driven by impacts to a resident's garden directly.

"Many of these residents are lifelong gardeners who enjoy spending multiple hours a day in their yards and are interested in tools or practices that assist with gardening."

- **Good Homeowner:**

The primary motivation is driven by a need to maintain outward appearances of one's home.

"These residents emphasize the importance of keeping homes and yards clean and attractive. They are willing to adopt practices that they see as contributing to the quality and value of their home and neighborhood."

Table 6.2 provides a breakdown of identify assignments per neighborhood, where each resident was allocated three points which could be split between two identities for a total of 90 points.

DESIRED BEHAVIOR CHANGE

This study examined the potential for installation of rain barrels and rain gardens within residential landscapes, and how the implementation of CBSM strategies might affect this potential. Because the study was an exercise in gauging CBSM effectiveness to motivate behavior change no measurable results on behavior outcomes were obtained.

1. The study also suggests that the target behavior has a higher potential for adoption if the three conditions listed below are met. Actions that can be publicly displayed will be more "amenable to marketing strategies using social norms,"
2. Behavior changes that involve a single action, rather than the alteration of habitual actions, have a better adoption rate (replacing a light bulb once versus adjusting one's habit of switching off the lights), and
3. Actions that can be tested and assessed for performance, before making a permanent commitment to that action are easier to promote.

Both rain barrels and rain gardens can be publicly displayed when they are installed in front yards and are visible from pedestrian sidewalks or vehicles along the street. Both require a single installation, but periodically require inspection and maintenance to preserve their functions. For example, rain gardens

Table 6.2: Points per Environmental Identity Groups by Neighborhood

IDENTITY	FONTAINBLEU	MORAY	JANE-FINCH
NEP Environmentalist	11	10	12
Cost-Effective Environmentalist	2	7	20
Good Homeowner	6	2	1
Good Gardener	2	5	14
Total Points	**21**	**24**	**45**

may require removal of sediments carried by rain water over time or replanting of dead vegetation. Similarly, rainwater collected inside rain barrels, if not discharged through an electric pump, require manual operation. Although the study claims that both rain barrels and rain gardens are not testable, one could argue the opposite for rain barrels. Rain barrels can be tested and assessed before permanently installing them. A single barrel can also be used to gauge the appropriateness of installing larger containment systems, such as cisterns. Rain gardens, unlike rain barrels, are not testable. Once installed rain gardens remain a permanent feature; the upfront monetary and time investments could make their removal impractical for some.

IDENTIFIED BARRIERS

The barriers listed in Table 6.3 are a summary of general sentiments expressed by interviewed homeowners. In comparison to rain barrels, rain gardens were considered more difficult to persuade residents to install because they had more challenging barriers to overcome. For example, while most residents were aware of rain barrels and their intended purpose (a few had even installed them), there was an "extremely low awareness" of rain gardens.

Because of their high visibility, rain barrels and rain gardens installed in front yards can establish new social norms around landscape design. CBSM suggests that individuals can become motivated to change their behavior if they receive cues via social norms that something is "the right thing to do". However, as noted within the study, the "strength of normative influences within a neighborhood will depend on the extent to which residents categorize themselves as similar to their neighbors and develop collective norms." Further, "If collective norms do not already exist, residents are unlikely to suddenly begin taking cues from others." Therefore, limited or a lack of social capital within one's community can inhibit the uptake of rain barrel and rain gardens.

Table 6.3: Barriers Cited by Interviewees

BARRIER	DESCRIPTION	RAIN BARREL	RAIN GARDEN
Knowledge Gaps	The majority were unfamiliar with rain gardens, and were unaware of their utility and related environmental benefits.		X
Cost	The retail price for installation was viewed as too steep. (Strongly linked with the Cost-efficient Environmentalist identity group)	X	X
Appearance	The appearance of rain barrels was not viewed as aesthetically pleasing. (Strongly linked with the Good Homeowner identify group)	X	
Use or Maintenance	The time and effort associated with use and maintenance was viewed as too excessive. Some homes with automatic irrigations systems did not see a need for rain barrels.	X	X
Space & Current Use of Yards	Residents cited that their yards were too small to incorporate a rain garden. Others wanted to keep their lawns for recreation, while some felt that landscape installation should be a one-time exercise.		X
Physical Conditions	Soil types (i.e., heavy clay soils), location of downspouts, and hydrology were all cited as potential deterrents to installation.	X	X

CBSM STRATEGIES

CBSM strategies were recommended based on feedback received from the in-person interviews. The strategies varied depending on either rain barrel or ran garden installation, and were proposed at a neighborhood scale. Note that these strategies were not tested on any of the neighborhoods. For a compressive list of all suggested strategies readers are encouraged to reference the thesis directly.

Rain Barrels

Across the subject neighborhoods, residents had either installed rain barrels and/or had a general awareness of their intended function. While some homeowners considered their rain barrels a good choice for the environment, not all who had installed rain barrels did so to reap environmental benefits but rather were focused on their utility in the garden or on water cost-saving. Therefore, a CBSM campaign might be better at increasing rain barrel uptake if it creates targeted messaging emphasizing identity-related benefits. Further still, CBSM strategies that generate normative pressures within individual identify groups or that recruit locally trusted institutions or persons to promote rain barrels could also increase uptake.

Rain Gardens

Overall, awareness about rain gardens and the local environmental issues, such as flooding, that they are indented to help mitigate was very low across all three neighborhoods. Further, only those residents that identified at NEP Environmentalists seemed to demonstrate interest in adopting rain gardens. Under these circumstances, CBSM strategies must first to seek to educate residents of the problem(s) and offer direct solutions. To reach a more varied audience, CBSM messaging used to generate problem awareness should be "specific, concrete, and personalized" and link benefits directly to improving local environmental health Incentivizing uptake of rain barrels with monetary rebates might also be a necessary strategy where interest is low.

MESSAGING

A messaging campaign was not developed for this study. Instead, personal communication in the form of door-to-door interviews was conducted by the researcher to gauge perceived barriers and potential benefits for rain barrel and rain garden installation by neighborhood. This information was evaluated to develop recommendations for practitioners looking to implement CBSM programs.

A total of 30 residents were recruited for interviews. Invitation letters were delivered to homes prior to door-to-door solicitations. Also, a $25 incentive was offered to minimize selection bias. Study participants were engaged in a single interview which lasted between 25 to 75 minutes. A range of topics were discussed from social interactions to neighborhood sustainability. For the purposes of this summary, the focus remains on the parts of the exchange that addressed landscaping practices and rain barrels and rain gardens. Below is a description of how rain barrel and rain garden information was administered, as quoted from the study.

> *"Rain barrel and rain garden information sheet: After inquiring about their familiarity with rain barrels and rain gardens, I asked all residents to look at a one-page information sheet with a description of rain barrels and rain gardens. This sheet included pictures of both measures, and briefly outlined in general terms the "what and why" of rain barrels and rain gardens .... It is worth noting that many residents did not read all (or much) of the text on this sheet, and I often used the information from the sheet to respond to questions."*

> *"Program rating sheet: In order to gauge interest in different program designs, I asked residents to read and rate hypothetical rain garden promotion programs on a scale from 1 to 7. I explained that while they all concerned rain gardens, they could be applied to other types of actions, and that I was primarily hoping to gauge their interest in participating in these types of program designs."*

MOTIVATORS AND BENEFITS

The study served as an initial exploration into the factors that inhibit or motivate installation of rain barrels and rain gardens amongst homeowners residing in Toronto neighborhoods with different physical, socio-economic, and social capital characteristics. Standard CBSM social norming tactics were considered based on their theoretical ability to motivate action. Direct feedback from interviewed homeowners also informed the CBSM strategy recommendations.

The study suggested that homeowners who modeled rain barrel installation may be successful in increasing neighborhood uptake in accordance with social diffusion theories, because of the existing general awareness of rain barrels and their utility. Further, engaging existing community groups to promote or demonstrate the behavior, can enhance visibility and trigger conversation between peers, while signaling that installation of rain barrels is the "right thing to do". CBSM campaigns that are designed to emphasize various individual-level benefits and are specific to relevant identities could help motivate installation of rain barrels. As explained: "Understanding the different identities that are relevant to a particular action is central to understanding how social marketing might be used to promote this action". In addition, changing the "product, price or process to overcome barriers/ and or generate new benefits", could further bridge the gap between intention and action.

Unlike rain barrels, the lack of knowledge about rain gardens, appeared to be the first hurdle to overcome before social norming CBSM tactics would be effective at motivating rain garden installation (see CBSM Strategies above for more information). Further, nearly a third of residents interviewed described "irretractable" barriers when it came to installing rain gardens. Some examples include need to preserve recreation space in yards or unfavorable soil conditions. Thus, overall uptake could be hindered. To address these barriers the study recommended: "For areas with low numbers of NEP environmentalists, design programs that incorporate other community-level benefits (i.e. creating summer jobs for high schoolers, etc.)", and/or "Offer rewards and/ or incentives for neighborhood-scale benefits reaped from individual actions".

RESULTS

Because of the limited number or participants, only general observations could be made regarding homeowners' perceived benefits and barriers towards rain barrel and rain garden adoption. Feedback collected during interviews with residents were classified according to each resident's environmental identity type (as summarized under the Target Audience section). In summary, rain barrels were perceived to offer benefits in all neighborhoods for three out of the four identity types: NEP Environmentalists, Cost-effective Environmentalists, and Good Gardeners. Current rain barrel owners were found amid these same identity groups. Rain gardens on the other hand were most appealing to NEP Environmentalist only. However, some Good Gardeners did acknowledge potential benefits of integrating rain gardens into their existing landscapes.

Rain garden and rain barrel support was also assessed per neighborhood. By numbers, the following observations were made:

Response to rain barrels

- 4 of 15 households from the Jane-Finch neighborhood had rain barrels installed and used them regularly. This represents the highest number of rain barrel adoption of any neighborhood sample.
- 2 of 8 households from the Moray neighborhood had rain barrels installed and used them regularly, another household was preparing to install a rain barrel.
- 1 out of 7 households from the Fontainbleu neighborhood had a rain barrel installed and used it regularly.
- 4 of 11 households without rain barrels in the Jane-Finch neighborhood reported that they were interested in purchasing one or would take one if it were offered free of charge, the numbers were 2 of 5 and 1 of 7 for the Moray and Fontainbleu neighborhoods respectively.
- 5 of 9 rain barrel owners representing all the neighborhoods revealed that non-environmental benefits were the primary motivation for installing one within their landscape.
- 4 of all 30 sample households held no interest and saw no benefit to installing a rain barrel and were from the Moray and Fontainbleu neighborhoods only.

Response to rain gardens

- Not a single participant had a rain garden installed within their landscape.
- 3 of all 30 sample households expressed interest in installing a rain garden within their landscape.
- 10 of all 30 sample households held no interest and saw no benefit to installing a rain garden.

The study also conducted a literature review to generate a list of factors, that when integrated into the CBSM approach, could enable behavior change as well as support long-term sustainability within neighborhoods like those assessed in the greater Toronto areas. The majority of these factors represent elements of social capital; they are as follows:

- An understanding of the connection between social, economic and environmental issues,
- A shared neighborhood identity,
- Supportive and active neighborhood institutions, and
- Connection to support networks outside neighborhood boundaries.

EVALUATION AND LESSONS LEARNED

In-person interviews with homeowners created an opportunity to educate residents about the benefits of rain barrels and rain gardens, while also helping to gauge their receptivity toward installation. Although this intensive qualitative approach was helpful in better understanding nuisances between neighborhoods and perceived barriers and benefits amongst segmented groups, scaling this approach upward for the large and diverse populations that comprise many California towns and cities could prove challenging, Further, the project focuses narrowly on classifying target audiences by "Identity Type," meaning that the outreach and marketing materials developed will work better for some demographic groups than others. Segmenting on identity or demographics reduces the scalability of the campaign by limiting it to smaller target audiences. A more scalable segmentation strategy could be developed using dynamic classifications based on actions taken by the household, rather than immutable household qualities.

This study did not involve engagement with targeted neighborhoods beyond in-person interviews with thirty representatives. The intent was never to test a CBSM pilot, but rather to consider factors that could either support or hinder uptake of a target behavior as part of a college master's thesis. As explained in the study, it was difficult to draw definitive conclusions about observations collected from the interviews because a statistical analysis could not be performed for such a small sample. Nevertheless, the exercise brought to light several issues to consider in the design and implementation of a CBSM campaign focused on rain barrel and rain garden installation. Some takeaways include:

- Perception of rain garden and rain barrel benefits hinges on aspects of self-identity, and similarly, social norming is more effective when the target audience receives cues from those that are included within their same identity groups or family and social networks.
- It is easier to generate buy-in on rain barrel installation rather than rain garden installation. Barriers associated with the later, such as loss of functional landscaping space, might require strategies that offer monetary rewards or incentives to drive behavior change.
- Devising messaging that links the benefits of rain garden to local issues might help to expand rain garden receptivity beyond residents who identify as environmentalists.

The study sought to ground-truth the hypothesis that those who self-identify as "environmentalists" are the most willing to integrate rain barrels and rain gardens into their landscapes. For this sample of residents, interviews revealed "surprisingly high levels of rain barrel interest and ownership among people who do not self-identify as 'environmentalists', further noting that "Of the 9 rain barrel owners in all areas, 5 described non-environmental primary motivations". Thus, while a behavior might improve local environmental conditions, promoting other positive aspects of the behavior might be more effective at driving change.

SECTION 4: KEY LEARNINGS

In identifying CBSM case studies that addressed water conservation, the watershed approach to sustainable landscaping, or both, the team began with more than 60 identified research papers and project summaries (see Approach, page 9 for details on selection criteria). From these, six case studies were selected for a deeper focus:

- Target 140 Campaign (Queensland, Australia)
- Skip a Week Yard Watering Campaign (Southwest Florida)
- Water Check Audit (Logan City, Utah)
- Home Water Update (New South Wales, Australia)
- Water Budget Communication (College Station, Texas)
- Rain Barrel/Garden Uptake (Toronto)

From the detailed review of each of these case studies, the team identified several key learnings that can inform the development of a CBSM pilot for California. They are as follows:

1. **Residential consumption can change.** Across five of the six case studies, reported water savings varied from 9% (Case Study #5 - Water Budget) to 20% (Case Study #1 - Target 140). These savings resulted from CBSM-framed efforts targeting behavior change, and similar savings can likely be achieved in a CA CBSM pilot.
2. **Focus on high-impact behaviors**, rather than generic appeals to "use less water" or promote favorable attitudes toward water conservation or sustainable landscaping. Regional efforts to achieve a specific target can work, as shown in the Target 140 campaign, but these are best reserved for time-specific efforts to make it through a drought period. Providing tailored audits and feedback to residents can also work, but these are best for one-on-one outreach, and have limited scalability (e.g., Case Study # 3 - Water Check, Case Study #6 - Rain Barrel/Garden). For longer-term conservation, it's best to focus on specific behaviors that use a large amount of water and to target changes that will have a lasting change.
3. **Focus on durability of change.** Across the case studies, there was a tendency to focus on immediate water savings, rather than longer-term savings. A long-term focus means prioritizing one-time actions, such as replacing water-intensive landscapes with climate-appropriate landscapes, installing a pool cover, or installing rain barrels. This is contrasted with case studies that focused on "just skip a week" of landscape watering, or taking shorter showers (Case Study #1 - Target 140). These types of behavior changes will require continual reinforcement, highlight "sacrifice" rather than a desirable outcome and are unlikely to change the social norm around the target behavior (once the drought is over, it's okay to go back to my old behaviors).
4. **Evaluation is critical,** but has not been consistently applied. Whereas some of the case study campaigns focused on self-reported survey data (Skip a Week) or interest in engaging in a behavior (Rain Barrels/Gardens), evaluation is best when it focuses on water consumption. Importantly, comparing changes in consumption between a program area and a control area tends to provide the strongest data. Several of the case studies indicated that funding issues led them to not fully evaluate program impacts. Allocating resources to do appropriate evaluation should be at the top of the priority list so that impact can be measured and learning applied to future efforts. Along the same lines, data should be collected that enables calculation of program return on investment (ROI). By measuring the cost of the program, the number of households reached, and the amount of water savings, the ROI can be determined. Calculating the ROI will help identify the cost effectiveness of each pilot's CBSM intervention, thereby helping communities plan resources needed for wider adoption of pilot strategies.
5. **Effective strategies range from highly personalized to mass media.** Some communication strategies require personalized communications, while others use mass media and less personalized communications. While CBSM tends to prioritize personalized

communications, the reviewed case studies provide evidence for both. On the one hand, personalized communications are likely to be more expensive, but the other hand passive mass media is generally not as effective. Based on the reviewed case studies, it seems that a combination using an "umbrella" strategy can combine these two approaches. The umbrella would include a branded set of communications, followed by targeted and more personalized outreach.

6. **Cost is not the only barrier.** In some instances, where the target behavior has a high cost, providing a financial incentive may help to increase participation rates, but the case studies reviewed suggest that changes can be achieved without a direct incentive.

SECTION 5: CBSM PILOT FRAMEWORK

RESIDENTIAL TURF REPLACEMENT

The first step of the CBSM approach is to thoughtfully select a behavior to target. To promote adoption of the behavior, a campaign is designed that reduces the barriers and enhances the benefits by leveraging tools from behavioral science. The campaign is then pilot tested on a small scale to verify its effectiveness before large-scale implementation. The following sections detail an example framework for a CBSM pilot design (Pilot), developed by the same team of consultants who assisted with the CBSM case study summary and in consultation with representatives from the former CUWCC's Landscape Committee. The objective of this Pilot framework is twofold: (1) to provide an initial blueprint for water agencies looking to test CBSM strategies on a select audience within their service areas, and (2) to accelerate CBSM campaign implementation by reducing upfront investment costs in time and resources typically associated with pilot development.

Like the CBSM case study summary, the focus of the Pilot is geared toward improvements in outdoor water use efficiency at the residential scale. While this Pilot framework was designed for use by any water agency, it will require further refinements that reflect the individual agency's campaign goals and specific target audience barriers. As a framework, the Pilot does not include recommendations on specific messaging, which is often finalized after a series of message tests are conducted typically with a subset of target audience members (see Potential Research Approaches below). This Pilot, together with the CBSM case study summary, Landscape and Outdoor Water survey and associated best practices guide, is as an off-the-shelf resource package aimed at assisting agencies with taking the first steps to launch a CBSM demand-management conservation program.

TARGET BEHAVIOR

While choosing a target action for this Pilot, it was important that the action have both a high *probability* of adoption by the intended audience, in this case residential water users, and a relatively high potential *impact* on outdoor water savings. In reviewing the available literature, the team identified a number of potential target actions that help to reduce outdoor water use at the residential scale and thereby improve efficiency. They include:

- Install rain barrels to capture water,
- Fix irrigation leaks,
- Replace front lawns,
- Replace back lawns,
- Plant drought tolerant plants,
- Water lawns in the morning or evening to reduce evaporation,
- Use an irrigation timer,
- Install a smart irrigation system,
- Avoid washing vehicles,
- Use pool covers to reduce evaporation, and
- Use a broom to clean outdoor surfaces rather than hosing them.

Because the intent was to design a pilot that could be replicated and administered by agencies throughout the state, it was important to select an action with the potential for adoption by most residential water customers. From this angle, not all actions were considered equal. For instance, while some actions are applicable to everyone, such as using a broom to clean outdoor surfaces, others such as using rain barrels or pool covers are more applicable to households in certain regions. The project team's internal assessment of each of the target actions for probability, impact and replicability yielded replacement of front lawns (with climate appropriate landscaping) as the optimal action to target via the Pilot. Overall the target action can be characterized as having a moderate probability of adoption, a high degree of impact, with moderate benefits and barriers, as summarized below:

- **Probability.** Moderate. For households that have a front lawn, the team estimated the probability of successfully getting them to switch within a one-year timeframe is approximately 15% (30% interest from target audience and of this fraction 50% will replace turf).

- **Impact:** High. Reduced water consumption. Other positive landscape impacts include reduced stormwater runoff; reduced runoff from sprinkler overspray; reduced fertilizer and pesticides in runoff; and reduced air emissions from lawn mowers and blowers[14].
- **Benefits.** Moderate. Participants can gain social approval as well as an improved status amongst peers. Participants might be viewed as environmentally responsible.
- **Barriers.** Moderate. Uncertainty about landscape design and plant selection. Difficult to find a landscaping company. Cost for removal and new plants. Concern about property value.

PROBABILITY

Residents have already demonstrated their willingness and ability to remove turf. During California's most recent drought (officially ending for much of the state in 2017) many water agencies reported being inundated with turf rebate program applications. There was large uptake in program participation during the drought as monetary incentives were increased and assessed in dollars per square foot of turf removed. The City of Los Angeles spent upwards of $42 million on turf removal rebates alone between 2009 and 2015 (UCLA Luskin, 2016). A notable increase occurred between March of 2015 and July the following year, when participating households jumped from just under 5,000 to well above 23,000 respectively. This trend extended to northern California which also saw significant turf removal for customers of the East Bay Municipal Utility District (EBMUD). From January of 2014 to May of 2016, EBMUD reported that three-million square feet of turf had been removed under their rebate program.

Further, when lawns are converted in the front of homes there is evidence that suggests a "peer effect" occurs (Torpey, 2017; Irvine Ranch Water District, 2015) , in turn improving the probability of participation in turf rebate programs. Visible changes in neighborhood landscapes shift social norms. Residents living in the vicinity of a turf replacement project can be prompted by these social norming cues to adopt changes in their own landscapes Hastings & Rustamov, 2015).

Empirical observations from the consulting team have shown that residents are less willing to remove and replace turf in back yards because it serves a recreational purpose, therefore the probability that homeowners will convert their backyards is relatively smaller when compared to that of front yard replacement. In addition, changes made to front landscapes are highly visible in comparison to back yards and therefore can help establish social norms within a neighborhood or the larger community, which in turn contributes to the "peer effect".

IMPACT

In the 2015 CUWCC report Turf Removal & Replacement: Lessons Learned Seapy reported that "Studies across California measure, model, and/or predict average turf replacement water savings of anywhere from 18% to 83%", noting that these savings were related to rebate program structure as well as avaialbe agency resources (Seapy, 2015). In gallons per square foot, water savings ranged from 14 to 46 gallons where regions with warmer climates experienced the greatest savings. For Southern California agencies, these savings translated to approximatley 45 gallons per square foot of turf removed per year. A recent study funded by the National Science Foundation discovered that the City of Los Angels in 2010 was losing approximately 70 billion gallons of water a year through evapotranspiration of turf grass (Litvak, et al., 2017). The same study also found that turf grass was transpiring at its maximum ability, signaling that it was being overwatered. These measurements were taken before Los Angeles issued mandatroy water restrictions, but nevertheless reveals a significant margin for water conservation through the remvoal of turf in residential landscapes.

REPLICABILITY

Turf grass is ubiquitous across the state. It can even be found in some of the most arid regions such as the Central Valley and Inland Empire. As such, many water agencies have already instituted turf rebate programs, some even preceding the latest drought. Therefore, testing this particular CBSM pilot will allow agencies to leverage existing staffing, resources and institutional knowledge that they have previously relied on to manage turf rebate and or other sustainable landscaping incentive programs.

14 See the California Urban Water Conservation Council's Fact Sheet on the Watershed Approach: www.calwep.org

TARGET AUDIENCE

Despite the increased volume of applications for turf replacement rebates across the state, water agencies have struggled to attract high water users with large landscapes. This demographic remains an untapped opportunity to solicit additional savings. A 2011 study of single family water use efficiency in California evaluated over 700 residents across ten water agencies and discovered that the top water users (> 100 kgal/yr) accounted for 33% of the sample population but used 62% of the total outdoor water usage (Aquacraft, Stratus Consulting, Pacific Institute, 2011). DWR reported within their 2005 Water Plan that residents with large landscapes used nearly 19% of total annual outdoor water use. Generally, large lots use a greater volume of water even when compared to smaller lots that over-irrigate. In Seapy's evaluation for the CUWCC, she found that only around 10% of overall turf rebate program participants owned large lots, making this demographic a key target for this Pilot.

The Pilot target audience was selected after taking into considerations finding from the cited literature as summarized above, as well as discussions with the former CUWCC's Landscape Committee representatives. These representatives noted that many high-water users in their service areas had not been motivated to convert their landscapes to more sustainable models. Based on internal accounting, these high-water users collectively consumed a significant volume of potable water on an annual basis.

The target audience for the Pilot are single-family households who meet the following criteria:

- Maintain front yards with traditional landscapes (i.e., majority of landscaped area covered with turf and standard overhead spray irrigation),
- Have above-average water consumption, and
- Have not previously removed and replaced turf using local- or state-funded rebate dollars.

Other target audiences that were cited but were not chosen for this initial CBSM pilot framework include:

- Residents who had initially applied for turf removal rebates then pulled out of the process because they felt it was too onerous.
- Home Owner Associations who continue to maintain conventional turf landscapes.
- New residential turf rebate applicants that must integrate rainwater harvesting features in their landscape in order to qualify for the rebate (criteria now mandated by both LADWP and SDCWA).

OVERALL PILOT CAMPAIGN STRATEGY

Programs encouraging residents to remove lawns have a long history in California, with mixed results. In her 2015 review of these programs for CUWCC, Seapy concluded that turf rebate programs "have an uncertain future" and that California cannot afford to replace the estimated 2.5 million acres of turf grass in the State (Seapy, 2015). Because residential high-water users with large landscapes have not been motivated by standard returns from turf removal rebates, they might be motivated by social norms or status implications instead. This Pilot was designed to test alternative incentives that might generate interest to participate.

The pilot program outlined here are designed to develop and test targeted messaging and enhanced incentives using CBSM strategies that encourage residents with high-water usage to replace their front lawns. The first pilot focuses solely on CBSM messaging interventions. Messages will highlight the benefits of using climate-appropriate plants, share positive feedback and utilize social norming tactics. The second pilot program will offer enhanced incentives (beyond standard turf removal rebates), in addition to the same CBSM messaging interventions used in the first pilot.

A Return-on-Investment (ROI) analysis will be conducted for both pilot scenarios to help predict the costs of replicating the strategies elsewhere in California. A control group will also be evaluated to isolate impacts of the pilot interventions.

PILOT GOAL

The two primary goals of implementing the two CBSM pilot programs are as follows:

1. Determine if a CBSM approach that implements strategic messaging only, or an approach that utilizes a combination of messaging and enhanced incentives are effective at generating interest among 30% of the

target audience of residential high-water users, with a 50% conversion rate, resulting in 15% of the target audience switching from traditional front lawns to more sustainable models.

2. Determine if landscapes that undergo transformations results in significant water savings based on total annual outdoor water use reductions.

PILOT OBJECTIVES

The three primary objectives of implementing the two CBSM pilot programs are as follows:

1. Measure water savings associated with each pilot strategy to support proof of concept.
2. Calculate ROI of each pilot strategy to evaluate the economic feasibility of scaling the pilot program up.
3. Create a CBSM framework that can be duplicated in other California communities that face similar efficiency challenges with high water users.

RECOMMENDED PILOTS

The proposed pilot framework is recommended for water agencies whose rebate and incentive programs in the region have been unsuccessful at motivating a critical mass of high water users to improve their outdoor water use efficiency through landscape conversions.

The pilot design assumes that existing rebate and incentive programs for turf removal are available to all residents within the designated pilot neighborhoods. This consists of a baseline monetary incentive offered at a unit rate in dollars for square footage of turf removed (typically around $\$1/ft^2$).

In order to establish demonstration landscapes for visual reinforcement of social norms, the following CBSM pilot program elements will be offered to residents within the designated pilot neighborhoods for a limited time:

- Free front yard designs, each at a different price point (low, medium, high).
- A fixed price for each of the three designs, that has been previously negotiated with one or more landscape companies.
- Outreach to identify residents in the pilot area who are willing to receive the "updated" landscape designs for free, and then serve as early adopter models.
- Publicity of these landscapes via photos and social media.

To assess effectiveness of CBSM pilot interventions the following CBSM pilot approaches will be implemented within two neighborhoods that meet the target audience criteria.

Pilot 1: Messaging

- Campaign focused on "updating" front lawns with climate-appropriate landscaping.
- Employ personalized outreach strategies through direct mail, door hangers, and Homeowner Associations (HOAs).
- Positive messages and social recognition. Where messaging is tailored to address specific attitudes and beliefs that are barriers to partaking in the local turf replacement program.

Pilot 2: Messaging + Enhanced Incentives

- Same messaging and outreach deployed in Pilot 1
- Offer enhanced incentives to overcome specific barriers. Examples include: discounts on water bill to improve ROI, discounts on plant material for groups of residents who do it together, etc.

PILOT MESSAGE POINTS

The list of points below should be used to frame pilot messaging. Note that after message testing with a sub-set of the target audience these points are subject to change.

- Focus on front yard, which is largely ornamental.
- Emphasize positives of sustainable, climate-appropriate landscaping (not lawn removal, but instead, "upgrading" or "updating" your front yard. Important to focus on improvements, and not loss of grass).
- Show positive images of front yards. For example, images with "creekbed" designs are generally viewed positively. Avoid a barren appearance including "gravelscapes" with sparse plantings

POTENTIAL RESEARCH APPROACHES

Messages should be developed and tested prior to implementation of the pilots. To test messages, we recommend conducting short 1:1 interviews with 15-20 members of the target audience. This is a qualitative approach designed to make sure that the messages communicate the desired behavior change, overcome barriers and are motivational.

Additionally, administering surveys to the target audience will help to identify any barriers related to beliefs or attitudes that could potentially be mitigated via targeted messaging (see CalWEP's CBSM Vol. 2: Survey & Best Practices Guide).

CBSM INTERVENTIONS

The following list of interventions will integrate the power of social influence into the pilot design:

- Focus on benefits, neighborhood pride, and environmental responsibility (establish status through "doing the right thing").
- Target specific communities in an effort to get neighbors on board/engaging with each other.
- Use social norming techniques that recognize neighbors that make a switch

PARTNERS

Before launching the CBSM pilot program, it is important to establish local partnerships upfront to ensure success. For this particular pilot design, support by the following groups and organizations is integral for offering incentives, securing relevant resources and generating social capital:

- Local nurseries and retailers that can provide climate-appropriate plants.
- Landscape companies for installation.
- Homeowner Associations.
- Water utilities

COMMUNICATIONS TACTICS

The more outlets that disseminate messaging the better the overall reach to recruit participants. The following communication tactics should be employed to help maximize this reach:

- Use an "umbrella" outreach strategy to garner participation, combining branded media messages with targeted and personalized door-to-door, direct mail, and in-person presentations to Homeowner Associations.
- Partner with local landscaping firms and DIY retailers to promote program.
- Encourage engagement and sharing through online and social platforms.

EVALUATION MEASURES

The effectiveness of the CBSM pilot will be demonstrated by measurable results. Specific parameters and data points to monitor and collect over the course of the pilot program include the following:

- In each of the two target neighborhoods, select pilot region of approximately 1000 households and a control region with similar demographics and property values. The selected pilot regions should have a large percentage of single-family properties with front yards, and the region should be among the highest water consuming area of the city.
- Create observation map of each home showing the square footage of grass in the front yard for each property (both for the pilot regions and the control).
- Obtain monthly water-consumption data for each of the households in the target region and control.
- Evaluate with number of program participants, square feet of grass for each home, and monthly water consumption. Evaluate at six months after campaign launch, and again at 12 months.
- Calculating the ROI using gallons saved in the pilot divided by the total program costs.

COST

The pilot programs should run for a minimum of six months, with 3-6 months of preparation prior to launch, and 6-12 months of post-evaluation data collected from the participating households. This pilot framework was designed so as not to exceed a budget threshold of $100,000. Keep in mind that cost is a factor of several variables such as size of the target audience; level of agency staff support from departments ranging from marketing and public relations, project management, field operations and IT; as well as sophistication of existing customer databases and metering technology. With a limited target audience size (approx. 100 participants per neighborhood), substantial staffing, and minimal outside technical support, testing two pilot neighborhoods could be accomplished with a budget approaching $20,000. Agencies who are seeking to implement a CBSM-based pilot program might benefit from partnering with a consulting team who specializes in CBSM program design, execution, and evaluation[15].

15 At the request of the CalWEP, Action Research prepared a rough order of magnitude estimate for technical services to support agencies in the development and implementation of a CBSM pilot, including assistance with administration of a pre-pilot survey. This estimate is dated July 21, 2017. Contact CalWEP for details.

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