Ipswich River Watershed Summer Water Conservation Actions: Community-based Social Marketing Benefit and Barrier Research

June 2016

Report prepared for the Massachusetts Department of Ecological Restoration by

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Research • Social Marketing • Results

Executive Summary

The goal of this project was to conduct foundational research for the Massachusetts Department of Ecological Restoration (DER) on the ideal behaviors to reduce high summer water withdrawals of the Ipswich River. This report builds on foundational research that determined high-priority water-conservation behaviors. Those empirical data measured the current penetration (number of residents already doing the action), impact on water usage, probability of residents taking action, and applicability to the local community of a long list of behaviors. The results of that research identified these four behaviors as potential target behaviors for a water conservation program:

1. Stop watering grass during summer months
2. Fix leaks in irrigation
3. Install a weather-based controller on automatic irrigation
4. Fix pool leaks

The next step was to determine the barriers and benefits for each of the behaviors. Barriers represent concerns that decrease the likelihood that households would take these actions, and benefits represent reasons that increase the likelihood that households would take these actions. Understanding barriers and benefits to specific action is an essential component for developing a program that effectively motivates participation. To determine the barriers and benefits, a mail survey was sent to 800 residents in the towns of Topsfield and Wenham. A total of 355 surveys were completed representing an impressive response rate of 44%. The data were analyzed separately by behavior to determine the primary barriers and benefits perceived by target households. The highest rated perceived barriers and benefits are highlighted below.

1. Stop watering grass during summer months
    a. Primary perceived barriers: *Grass will die if not watered*; *not watering grass would not save much water*
    b. Primary perceived benefits: *Helps my community reduce water usage*; *it saves water*; *it saves money*
2. Fix leaks in irrigation
    a. Primary perceived barriers: *Do not have any leaks*; *do not know how to fix leaks; do not have the correct tools to fix leaks; do not know how to detect leaks*
    b. Primary perceived benefits: *It is the right thing to do*; *it saves water*; *it saves money*; *it is good for the environment*
3. Install a weather-based controller on automatic irrigation
    a. Primary perceived barriers: *Want to have control over my system; do not know how to install a controller; do not know where to buy one; do not use my automatic sprinkler system*
    b. Primary perceived benefits: *Helps my community reduce water usage; it is the right thing to do; it is good for the environment*
4. Fix pool leaks
    a. Primary perceived barriers: *Do not have the right tools; too expensive to hire someone to fix the pool leak; do not know how to tell if the pool is leaking; too difficult to fix a pool leak*
    b. Primary perceived benefits: *it is the right thing to do; it saves water; it saves money; it is good for the environment*

Recommendations

The present report uses the results of this research to distill a set of program and outreach recommendations that directly address the barriers and highlight the benefits for each behavior. The recommendations also draw insights from the social and behavioral sciences in order to leverage additional behavior change tools. In the next section we have included a strategy table that summarizes the recommendations for the behavior of *stopping summer lawn watering* and goes into greater detail on how these strategies could be operationalized. For the other three behaviors, the recommended strategies are elaborated in the report.

Strategy Table for "Stop Summer Lawn Watering"

Overall, the results indicated that the behavior of greatest interest to DER, stopping summer lawn watering, had clear outcomes that could be addressed using strategies and tools from Community-based Social Marketing to promote the action across residents in the Ipswich Watershed. The report contains an in-depth recommendations section for each behavior. Below is a summary table for the primary behavior of interest, "stop watering grass during summer months." The strategy table outlines the essential elements for removing the important barriers and emphasizing meaningful benefits, as well as potential communication channels and general resource estimate. However, ultimately the specific way a tool is compiled or operationalized in a program will be determined by practical and programmatic factors such as budget, resources, communication channels typically utilized by the target audience, etc.

Outcome Type	Research Outcome	Tools	Strategy Options/Operationalization	Channel/ Messenger	Resource Estimate
Barrier	Perception that grass will die if not watered	Education; Vivid communication	Provide information such as: • How much water is needed for grass to survive summer based on local weather conditions • How long of a dry spell can typical grass tolerate based on local information • Vivid images of stressed versus dying grass • Tips on effective watering with local images (e.g., sample lawn from local town household) • Communication of estimated water needs based on current weather conditions (e.g., report on social media stating that with the heavy rain there is no need to water) Use elements of effective communication, such as keeping information as brief as possible,	Flyers, Door Hangers	Low cost, Low time
				Social Media/Website	Low cost, Medium time
				One-on-One Communication	Medium-to-low cost, High time

			using images and stories, presenting information from trustworthy sources, and personalizing to the audience (e.g., information on specific town or county, rather than broad data)		
Barrier	Perception that grass will die if not watered	Commitment	A campaign must define exactly what behavior residents are committing to engage in, such as committing to following effective watering guidelines or only watering when grass really needs it. Commitment are strongest when they are written and public. They can take multiple forms, depending on resources available. For example: • A campaign could go door-to-door asking residents to sign a pledge and display a bin sticker or yard sign showing their commitment. • A mail campaign could send a commitment form, along with the bin sticker or yard sign. • Both could have an element the results are publicized (if the resident agrees to publicly committing), such as through a newspaper, website, or community announcement.	Flyers	Low cost, Low time
				One-on-One Communication	Medium-to-low cost, High time
				Reminder Stickers/Signs	Medium cost, Low time
				Public Recognition	Medium cost, Medium time
Barrier	Perception that grass will die if not watered	Social Norms; Feedback	Compare to lower water users in the same neighborhoods, or with similar property sizes Highlight survey results that 54% of local residents don't water grass Testimonials of local residents who do not water their grass in the summer	Flyer with Water Bill	High cost, High time
				One-on-One Communication	Medium-to-low cost, High time

			Lawn signs that residents who do not water can post, which provide a visible signal of how many residents already do not water their lawns.		
Barrier	Perception it won't save much water	Education	Provide typical grass watering impact data from a credible, local source (e.g., how reducing your watering from X to Y saves Z amount of water). As possible, this information should be presented in vivid and tangible way, such as an image of how much water (e.g., gallons that could fill a pool this size)	Flyers, Door Hangers	Low cost, Low time
				One-on-One Communication	Medium-to-low cost, High time
Messengers	Water department; local government	Credibility	Water department/local government branding	Logos Citing research	Low cost, Low time
Benefit	Helps the community save water	Social Norms	Frame message as a group effort to save water	Messaging in Outreach	Low cost, Low time
Benefit	Saves water, saves money	Highlight Program Benefits	Saving money, saving water, etc.	Messaging in Outreach	Low cost, Low time

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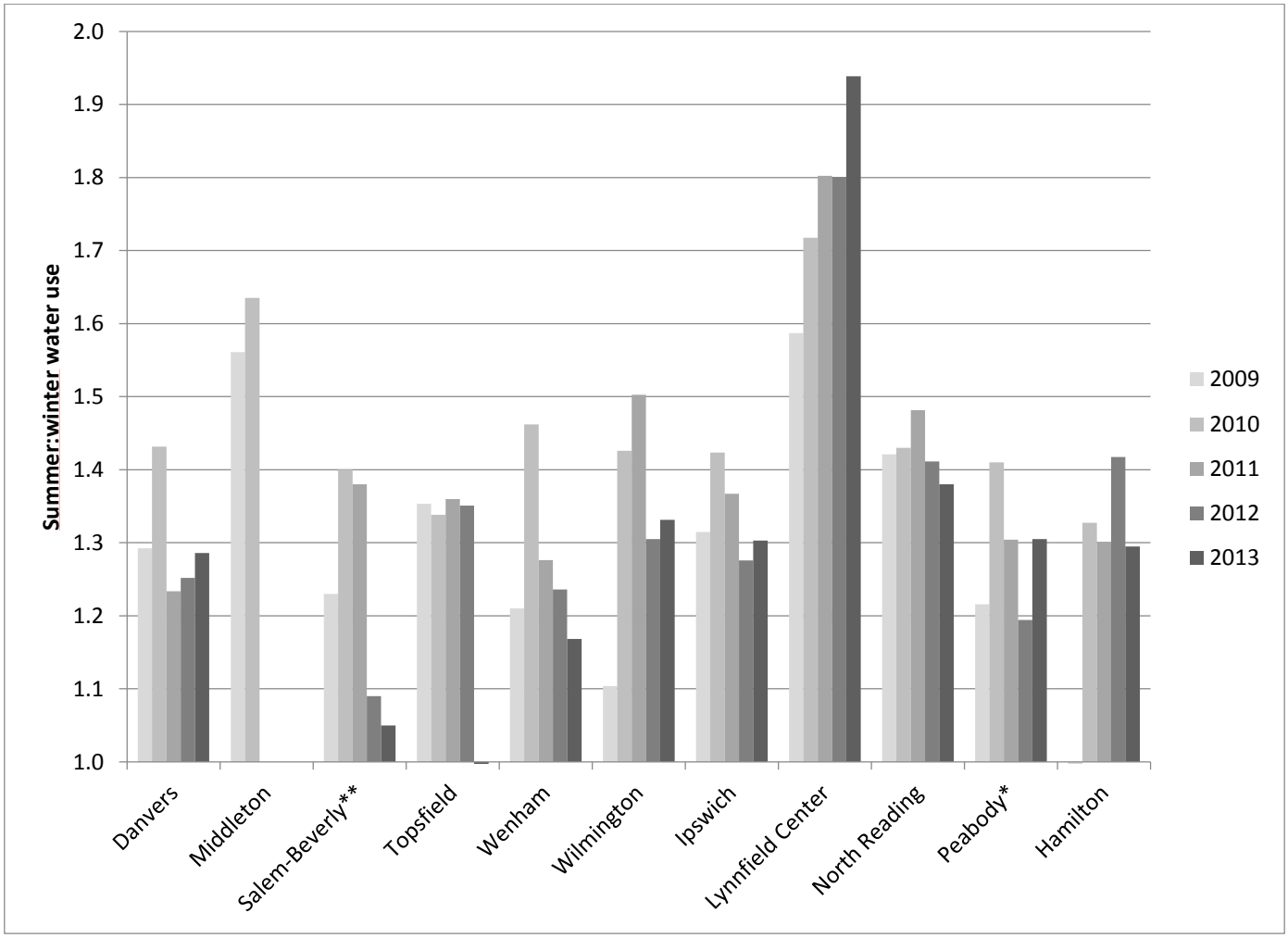
Background and Purpose

While Massachusetts receives a substantial amount of annual rainfall, several rivers, including the Ipswich River, experience periods of below normal and no flow in the summer. This project seeks to mitigate this issue by reducing summer water use/withdrawals by residential communities within the Ipswich watershed. This research focused on two communities in the watershed, Topsfield and Wenham. The towns of Topsfield and Wenham were chosen because they are representative of a typical community in the Ipswich watershed, with an average summer:winter[1] water use of approximately 1.3[2]. This ratio demonstrates the need for summer-specific conversation. Below, Figure 1 compares the summer:winter water use in eleven Ipswich Watershed communities, including Topsfield and Wenham.

Figure 1: Summer:Winter Water Use Ratio for Ipswich Watershed Communities



* Estimate uses storage reservoirs and not Ipswich river withdrawals.

**Estimate uses storage reservoirs and not Ipswich river withdrawals. No available data on WUR.

[1] Summer:winter water use ratio is defined as total water use in May through September (summer) divided by total water use in November through March (winter)

[2] The 2009-2013 summer:winter average for Topsfield was 1.35; Wenham was 1.27

This project focused solely on residential water usage behaviors due to the high proportion of water use by residential communities. In the towns of Wenham and Topsfield, residential water use comprises the vast majority of usage, with residential water use in Wenham accounting for 94% of total water use, while it comprised 87% of the total water usage in Topsfield.

Currently many communities in the Ipswich Watershed employ a variety of techniques to motivate reduced use, such as water use restrictions, informational campaigns, water rate structures, and ascending block water pricing. In Topsfield and Wenham, summer water use restrictions and education campaigns have been in effect for several years. Despite these efforts, water demand in the summer remains high. To go beyond these traditional programs, the Massachusetts Department of Ecological Restoration (DER) sought to set the foundation for a community-based social marketing approach to engaging local residents in water conservation practices during the summer months.

Community-based social marketing (CBSM) has emerged as an alternative to traditional education campaigns**.** CBSM packages basic principles of psychology with applied research methods in a way that provides a usable framework for practitioners working to promote behavior change across a variety of settings. Because the programs developed under this approach are piloted on a small scale, the program can be refined as needed until there is documented evidence to show that the program works before it is broadly implemented. In the present project, Action Research employed the first two steps of CBSM: (1) identify and prioritize target behaviors and (2) identify barriers and benefits to selected target behaviors.

Step 1: Behavior Selection

The first step resulted in a prioritized list of behaviors based on the impact of each behavior on water usage, the probability of each behavior being adopted by the target audience, the current level of participation in the behavior (penetration), and the applicability of each behavior to the audience.

To generate the initial list, a mail survey was conducted in February and March of 2016. The survey assessed the penetration and probability of the sixteen water-conservation behaviors. The sixteen behaviors on the list were deemed most likely to have a significant effect on water usage based on their overall impact and likelihood of being meaningful in the target communities. To determine the impact and applicability of the behaviors, a variety of credible sources were consulted and reviewed, including resources from the United States Environmental Protection Agency, University of Massachusetts, and the University of Massachusetts Extension Program. Furthermore, DER provided localized impact data based on studies in Reading, customer water use analysis in Topsfield and Wenham, and Massachusetts Water Conservation Standards, among other sources.

However, to understand the largest opportunities for behavior change, DER needed to go beyond impact and determine the probability of adoption and the current penetration of the behaviors of interest. Since these data were not available, a mail survey was conducted to collect these data. Specifically, the survey measured:

1. Current lawn care practices;
2. Willingness to install water saving devices and engage in water saving behaviors on their property;
3. Other practices for using water outside their home during the summer;
4. Willingness to engage in other, non-lawn related water saving behaviors; and
5. Demographics.

Based on the results of the initial survey, Action Research, DER, and the Ipswich River Watershed Association (IRWA) chose to focus on four water-saving behaviors that ranked highest for potential water savings, given their impact, likelihood of adoption, current penetration in the community, and applicability to the community:

1. Stop watering grass in summer;
2. Fix leaks in irrigation system;
3. Install a weather-based controller on automatic irrigation; and
4. Fix leaks in pool.

Step 2: Barrier and Benefit Research

For step two of the community-based social marketing process, we conducted a barrier and benefit mail survey to collect information for each of the four top-priority behaviors. The barrier and benefit research served as the foundation for the program recommendations presented in this report.

A barrier is anything that impedes an individual from engaging in a particular behavior. Barriers can be either internal to the individual (i.e., lack of knowledge) or external to the individual (i.e., no location to purchase technology). Barriers to one-time behaviors (e.g., installing a weather-based controller) are likely to be different than those to repetitive behaviors (e.g., not watering during the summer). Barriers to engaging in behaviors vary depending on the population, context, and behavior of interest.

Benefits are meaningful reasons an individual already sees for engaging in the behavior, and may also vary depending on contextual factors. Importantly, these barriers and benefits are *perceived* by the audience as real issues, and therefore need to be addressed. For example, even if one highly rated barrier is not a "real" barrier (i.e., while the audience thinks they must water to keep grass alive, that is likely not true), the results indicate a misperception that must be corrected.

Methodology

In May and June of 2016, a barrier and benefit mail survey was sent to 800 Topsfield and Wenham residents. For each town, the local water department provided an address list of single-family household water customers. Customers were randomly selected for inclusion in the survey. The survey examined barriers and benefits to four summer water-conservation behaviors and included questions on the following topic areas:

- Current yard characteristics and watering habits;
- Barriers and benefits to not watering the grass during the summer;
- Barriers and benefits to fixing leaks in the irrigation system in use;
- Barriers and benefits to installing a weather-based controller on automatic irrigation;
- Barriers and benefits to fixing pool leaks; and
- Demographics.

For the survey mailing, there were four points of contact to the residents: (1) a pre-notification postcard, (2) an initial survey mailing, (3) a reminder postcard for non-responders, and (4) a duplicate survey for non-responders. Overall, 355 surveys were returned for a response rate of 44%, with 1% refusing participation, and 1% returned undeliverable.

The present report includes the detailed survey results and distills a set of recommendations for outreach to increase resident engagement in water conservation actions. The topline data for each survey item is included as Appendix A. A table of responses to open-ended survey items is attached as Appendix B.

Sample Characteristics

Below are demographic results for the entire survey audience.

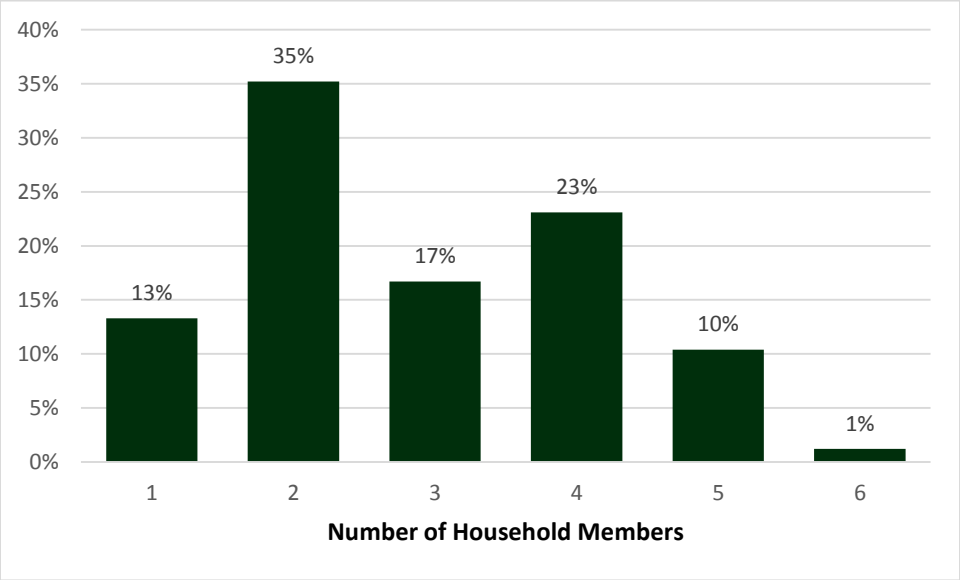
Age

The mean age of respondents was 57 years (*SD*=13; *N*=337) and ranged from 23 to 93 years.

Household Size

Respondents were asked about the number of members living in their household. The mean household size was 2.8 people (SD=1.28). In addition, the majority of respondents (68%) had no children under the age of 18 at home. See Figure 2.

Figure 2. Household Size



Length of Time at Residence

The mean number of years respondents had lived at their current residence was 21 (*SD*=16; *N*=346). The range was from one year or less up to 90 years.

Size of Lot

Most respondents lived on lots that were either between .50 to .99 acres (36%) or 1 acre to 1.99 acres (36%), with the remainder equally divided between less than half an acre (14%) and 2 acres or more (14%).

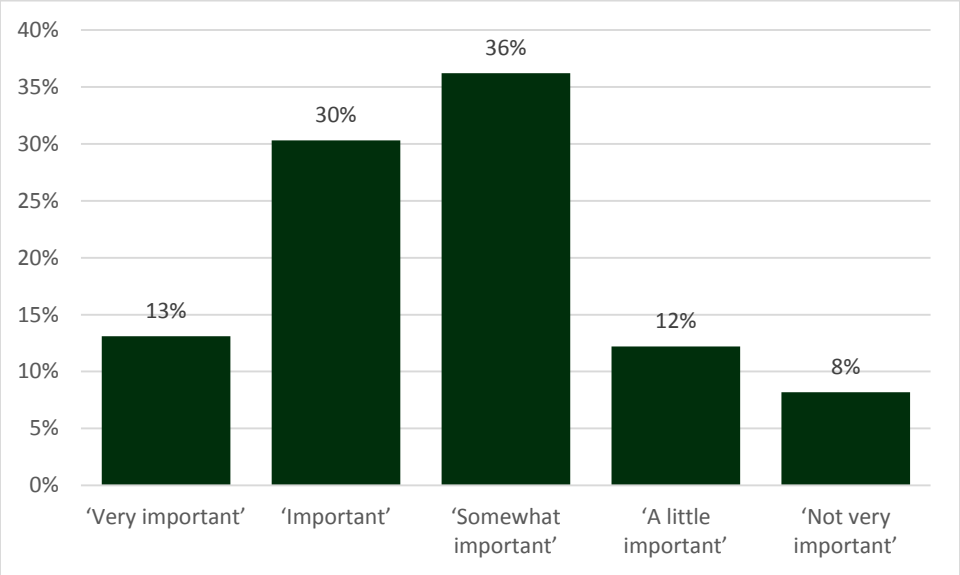
Lawn Make-up

The majority of respondents reported that their lawns were either mostly grass (57%) or an equal mix of grass and non-grass (24%). More than half of the respondents (53%) did not know if they had drought resistant grass, while less than a fifth reported they did have it (14%).

Importance of Green Lawns

Respondents were asked to rate how important a green lawn was to them. Nearly all respondents thought having a green lawn was at least somewhat important (80%). See Figure 3.

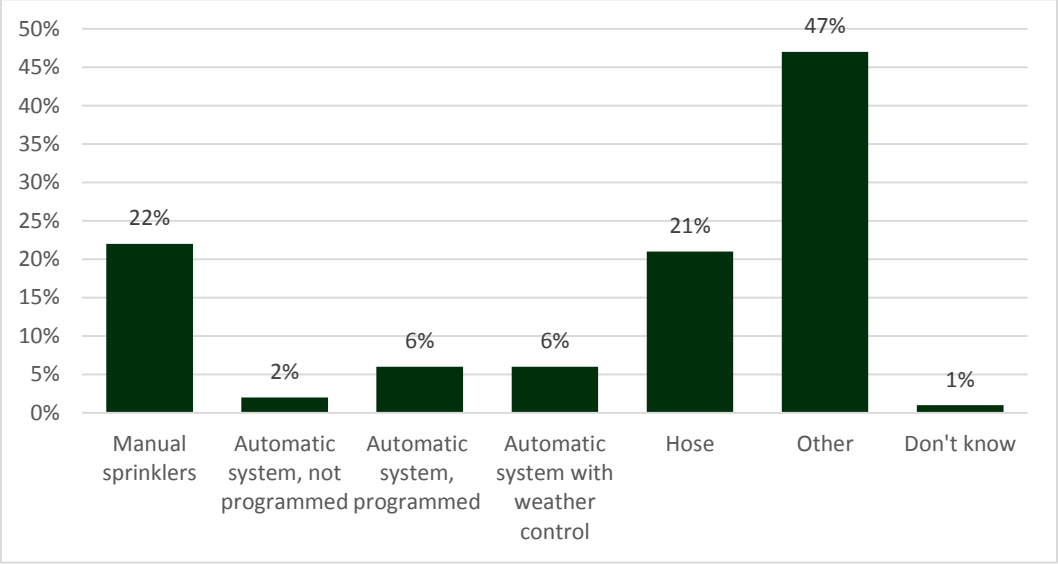
Figure 3: Importance of a Green Lawn



Irrigation Systems

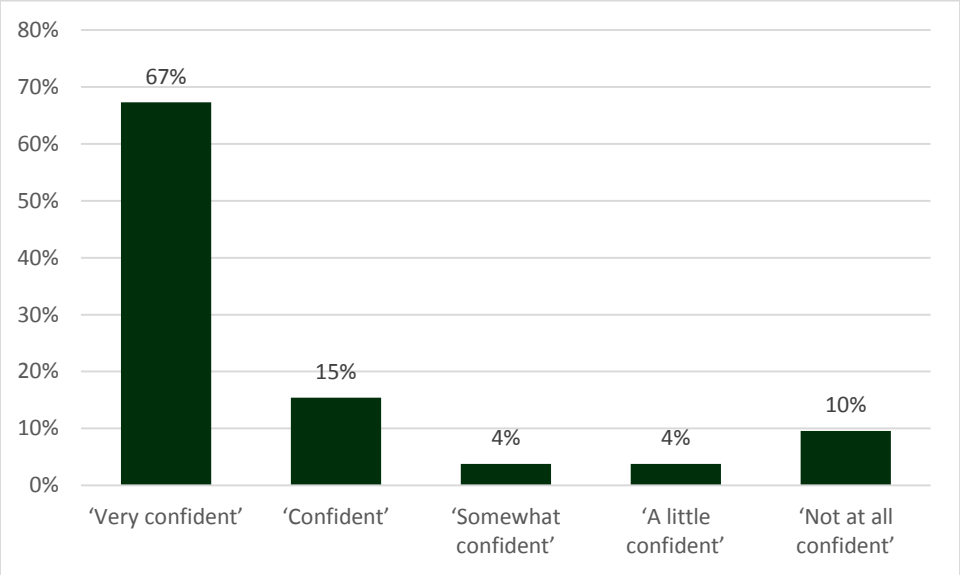
Respondents were asked to identify which irrigation system they used most often in the summer on their grass. Respondents' primary irrigation systems in use were hoses and manual sprinklers. As a note, it is unknown if the type of irrigation systems in use is influenced by the water restrictions. Most of the "Other" responses listed were that the respondent did not use any irrigation system and only let the rain water their grass. See Figure 4.

Figure 4: Irrigation Systems



Respondents who reported having an automatic irrigation system were asked a follow-up question about how confident they were in their ability to program their system. Most respondents (86%) were at least somewhat confident in programming their systems, with the majority reporting that they were very confident (67%). See Figure 5.

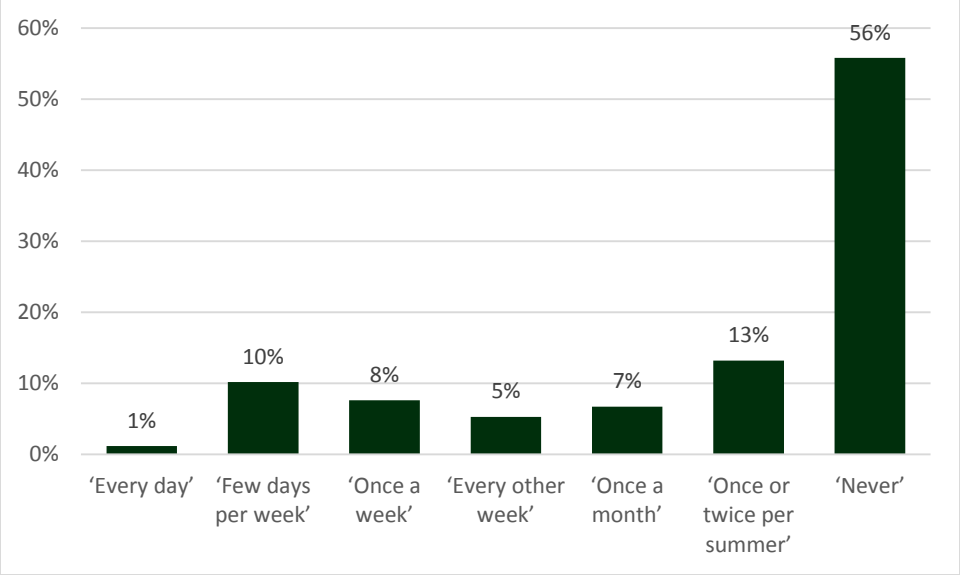
Figure 5: Confidence in Programming Automatic Sprinkler System



Frequency of Watering

Respondents were asked how frequently they water their grass in the summer. More than half of respondents reported that they did not water their grass in the summer (56%). A quarter of respondents watered at least every other week (24%), and the remainder watered only a few times during the summer (20%). See Figure 6.

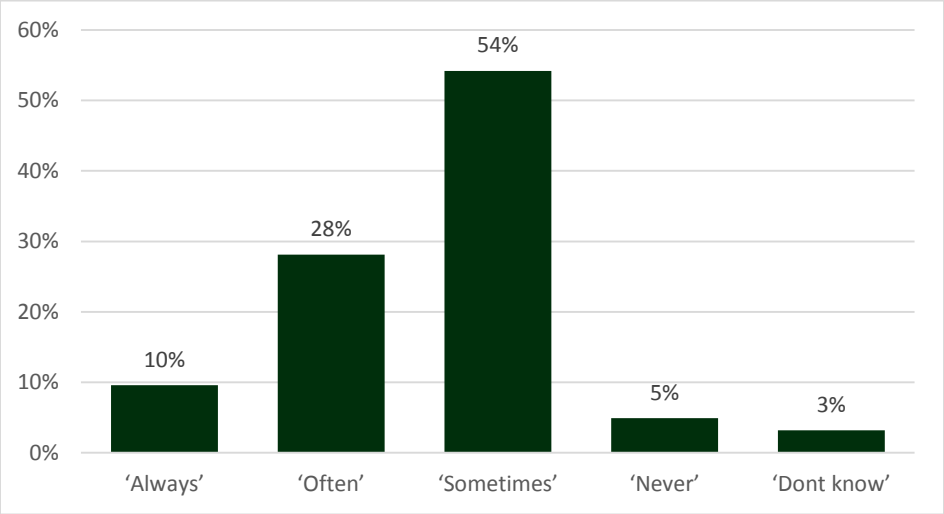
Figure 6: Frequency of Summer Grass Watering



Grass Stress

Respondents were asked to rate how often their grass showed signs of stress during the summer. Nearly all respondents (92%) stated that their grass at least sometimes showed stress in the summer, with 10% reporting their grass was always stressed. See Figure 7.

Figure 7: Perception of Frequency of Grass Stress in Summer



Exploratory Analyses

Next, exploratory analyses were conducted between the demographic results of interest to determine if there were any significant and meaningful relationships. Results are reported below.

Respondents who water their grass in summer at least every other week were significantly more likely to rate a green lawn as important ($p<.000$) and were also significantly more likely to have some type of automatic irrigation ($p<.000$). Respondents who rated a green lawn as important were also significantly more likely to have some type of automatic irrigation ($p<.000$). There was no relationship with frequency of watering or rating of importance of a green lawn to household size or lot size.

Barriers and Benefits

The primary goal of the survey was to determine local residents' perceived barriers and benefits to specific summer water conservation actions. The findings are displayed separately by target behavior, with the mean rating and the standard error bar to indicate if the barrier or benefit was rated significantly higher or lower than others.

Behavior #1: Eliminate Grass Watering during the Summer Months

About half of respondents (44%, N=151) reported that they water their grass during the summer to some degree. Respondents who reported watering in the summer were asked to rate their agreement with a list of potential barriers and benefits to **not** watering their grass during the summer using a scale from 0 to 10; (0 = strongly disagree, 10 = strongly agree).

The mean rating for each statement is presented below. For those who do water their grass in the summer, the highest rated barrier to not watering during the summer was that *the grass will die if not watered*. The next highest barrier was the belief that eliminating watering would *not save much water*. The highest rated benefits of not watering were: *saving water*, *being part of the community effort to reduce water usage*, and *saving money*.

See Figure 8 and Figure 9 below

Figure 8: Barriers to Not Watering Grass in the Summer Months

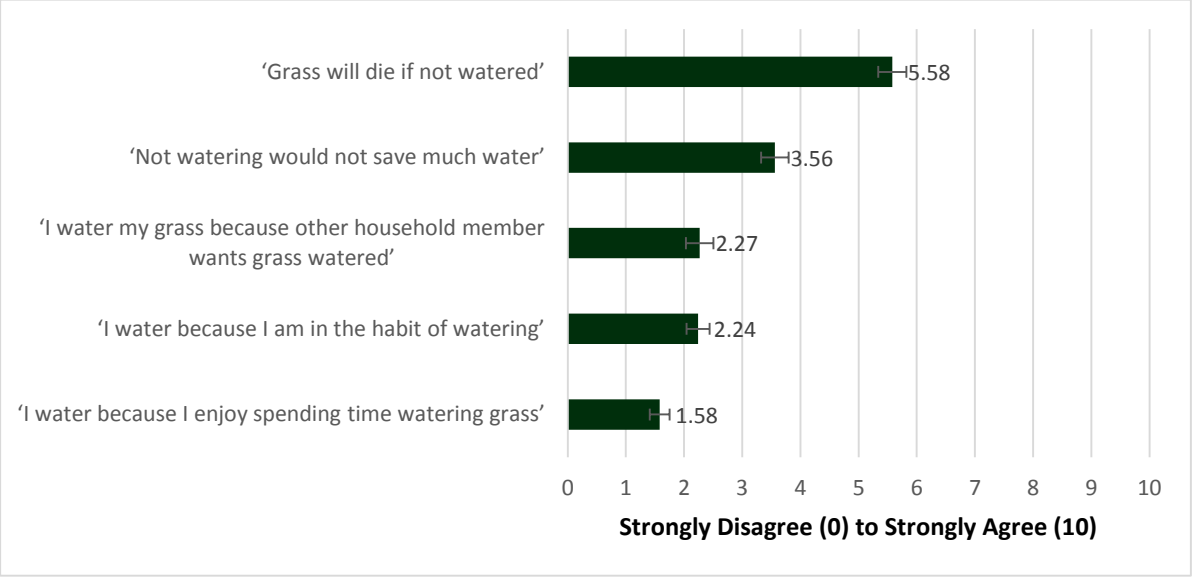
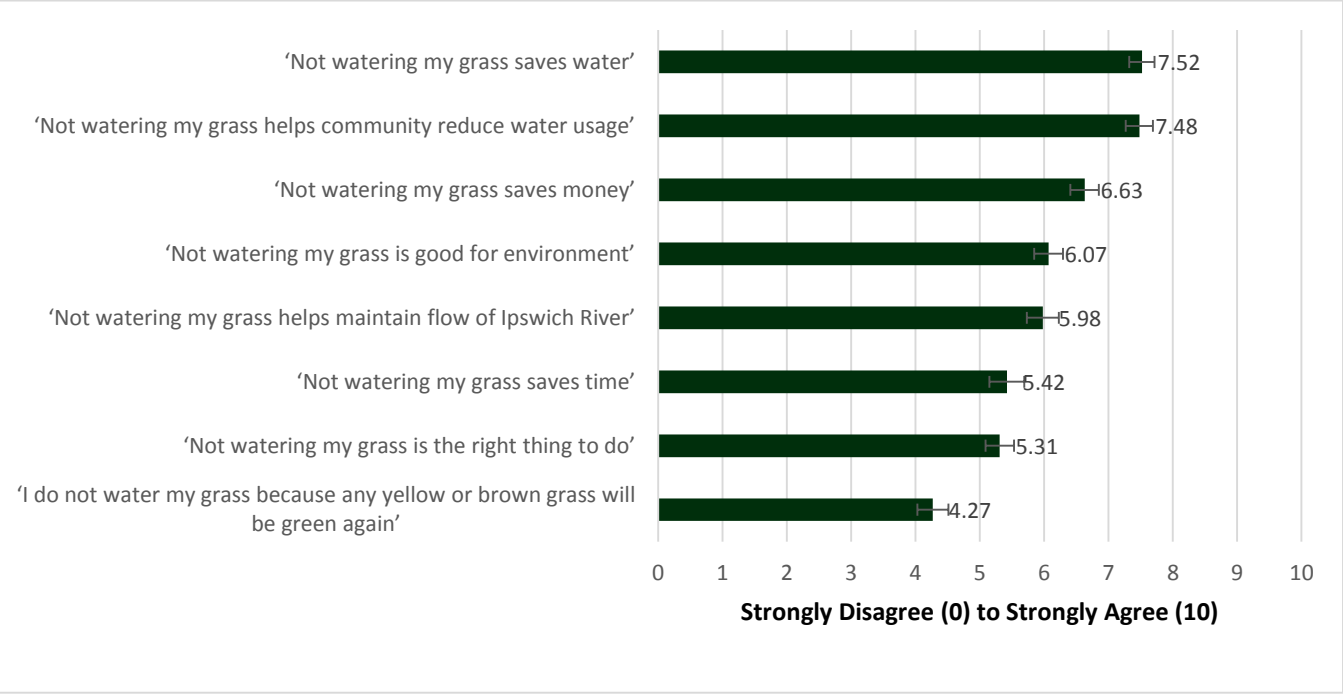


Figure 9: Benefits to Not Watering Grass in the Summer Months



Exploratory Analyses

Stopping summer grass watering is the behavior of highest interest to DER, both due to the high impact and promising results from this research. Given this strong interest, further analyses were conducted on the barriers and benefits, reported below.

Frequency of Watering

First, the barriers and benefits to not watering grass in the summer were analyzed by resident's reported frequency of watering to determine if audience members who reported watering their grass at least every week in the summer were more likely to rate any barriers or benefits differently. To reduce complexity, the frequency of watering was collapsed into three categories: Every other week or more often (N= 83), Once a month (N=23), and Once or Twice per Summer (N=53). The barriers and benefits in the graphs marked with a * indicate that there is a significant difference between groups ($p<.05$). Error bars are also included to demonstrate where results show a meaningful difference.

Figure 10: Barriers to Not Watering Grass in Summer Months Split by Frequency of Watering

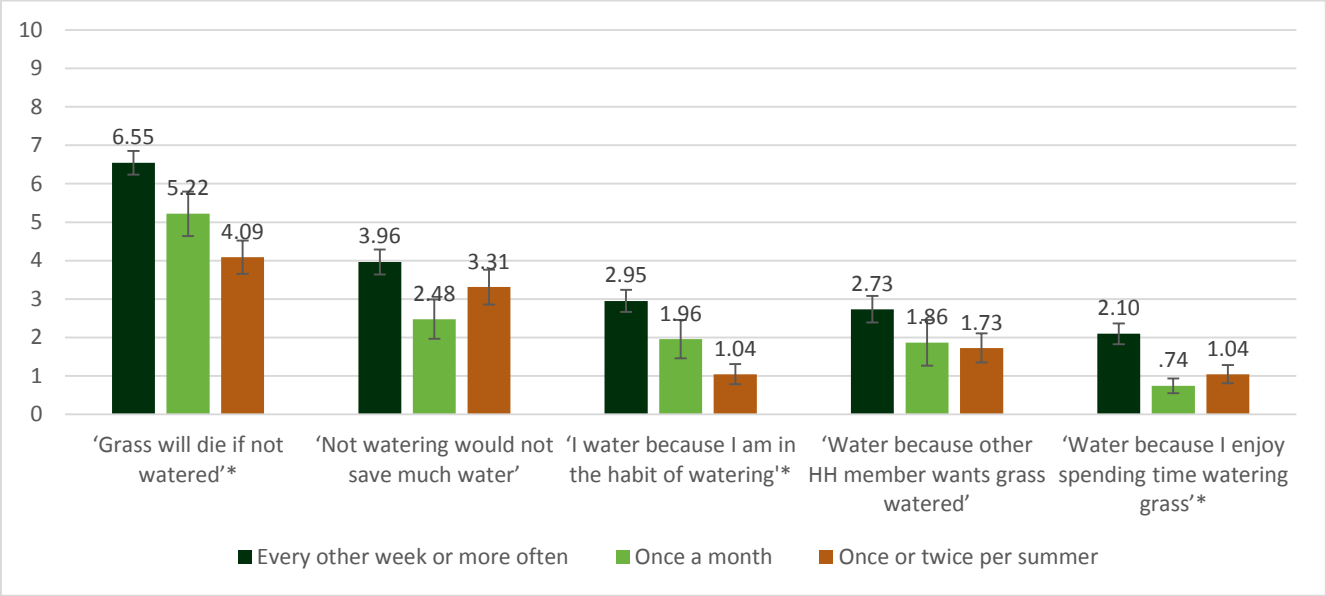
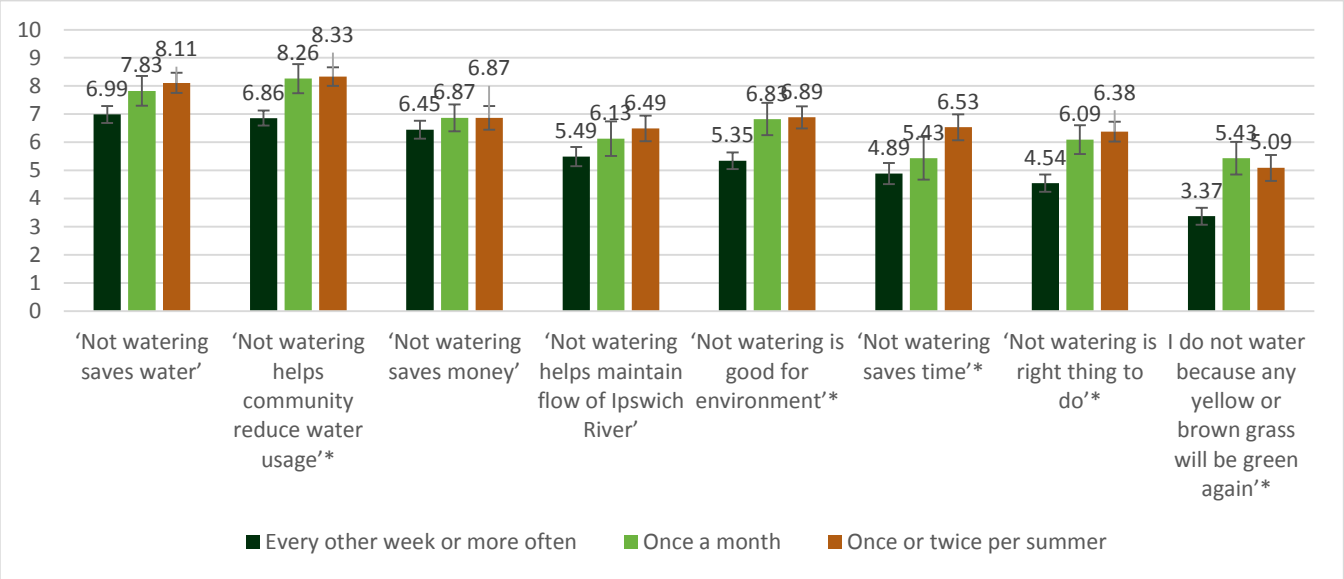


Figure 11: Benefits to Not Watering Grass in Summer Months Split by Frequency of Watering



Importance Ratings

Next, the barriers and benefits to not watering grass in the summer were analyzed by respondents' ratings of importance of green lawns to determine if audience members who reported a green lawn as important to them were more likely to rate any barriers or benefits differently. To reduce complexity, the importance ratings were collapsed into three categories: High Importance (N=103), Medium Importance (N=39), and Low Importance (N=13). The barriers and benefits with a * indicate that there is a significant difference between groups ($p<.05$). Error bars are also included to demonstrate where results show a meaningful difference. See Figure 12 and Figure 13.

Figure 12: Barriers to Not Watering Grass in Summer Months Split by Importance

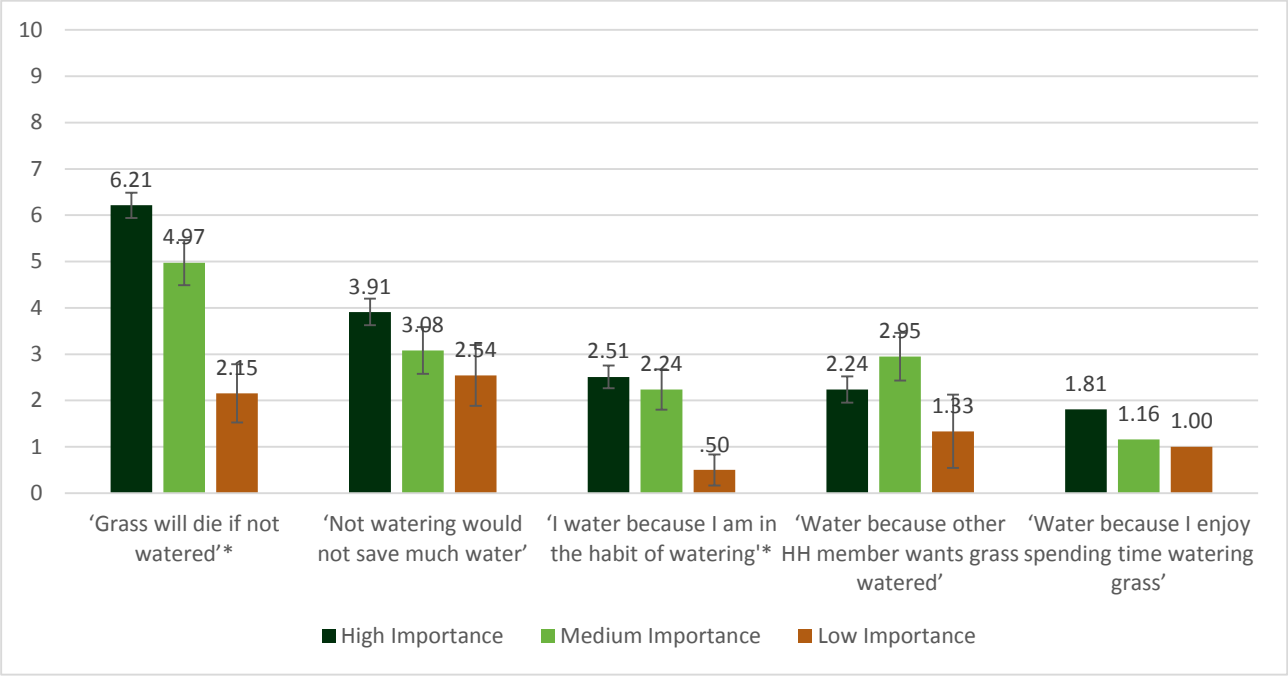
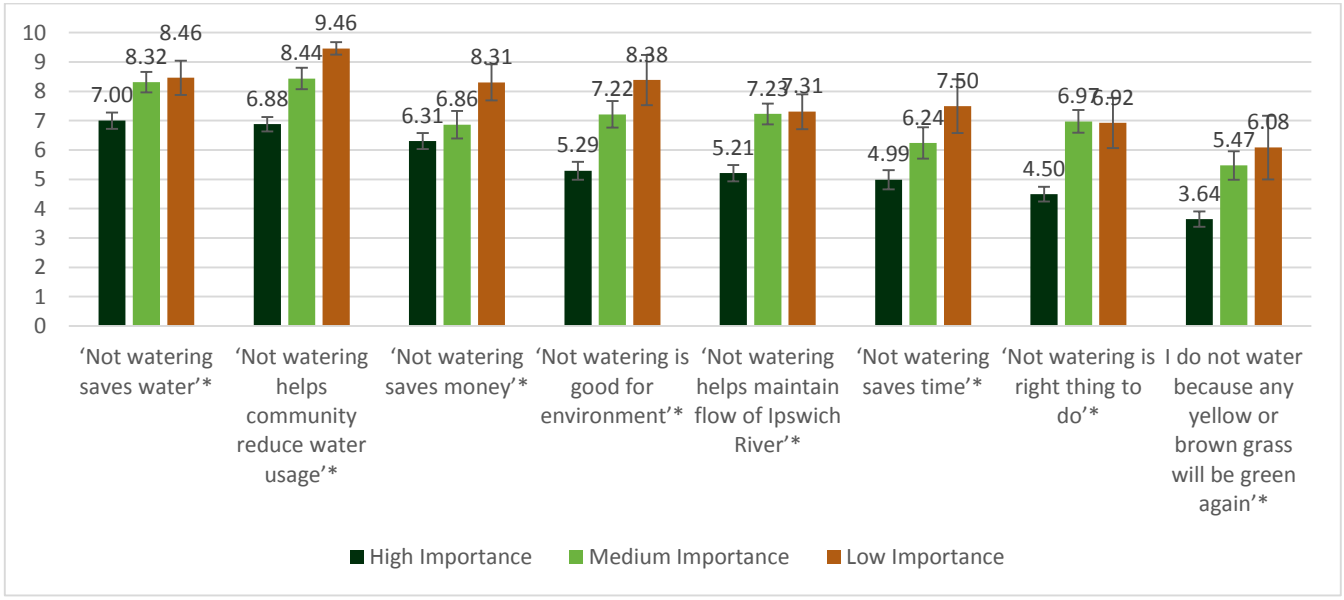


Figure 13: Benefits to Not Watering Grass in Summer Months Split by Importance



Behavior #2: Fixing a Leak in Irrigation System

The 44% of respondents (N=151) who reported watering their grass during the summer to some degree were asked a follow-up question to rate their agreement with a list of potential barriers and benefits to fixing a leak in their irrigation system using a scale from 0 to 10; (0 = strongly disagree, 10 = strongly agree). In Step 1 of the CBSM process, the impact of leaks was split into two categories—low (manual methods, such as hoses and manual sprinklers) and high (automatic irrigation). Therefore, the respondents were split into these two categories to examine the difference between these groups' barriers and benefits. The mean rating for each statement is presented below.

Manual Irrigation

Just over a quarter (27%, N=92) of respondents reported using manual irrigation. For those who watered their grass using manual irrigation during the summer, the primary barrier to fixing a leak was that respondents *did not have any leaks*. This was followed by *not knowing how to fix leaks, not having the correct tools to fix leaks,* or *not knowing how to detect leaks*. The primary benefits to fixing an irrigation leak were that it is *the right thing to do*, and that it *saves water*, *money*, and *the environment*. See Figure 14 and Figure 15 below.

Figure 14: Barriers to Fixing Manual Irrigation Leaks

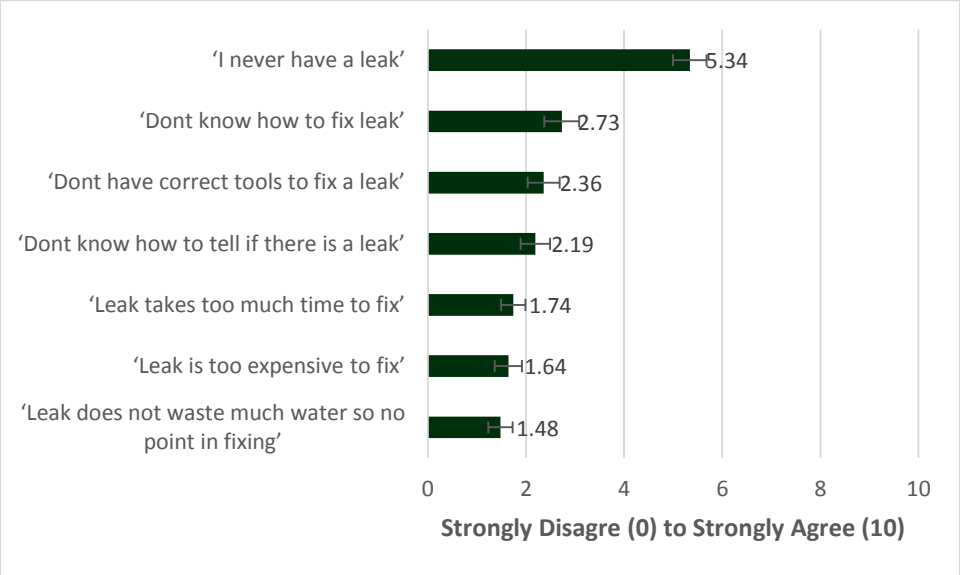
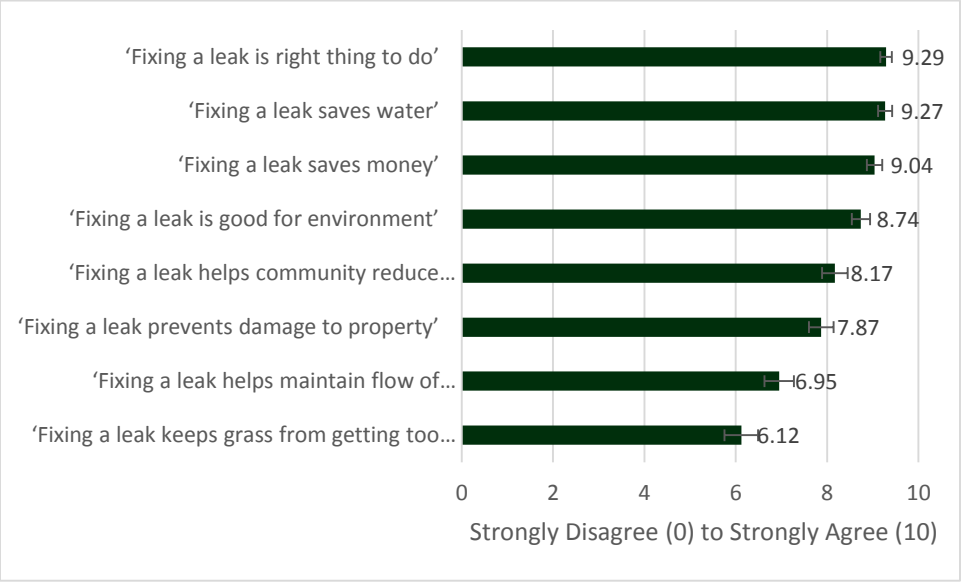


Figure 15: Benefits to Fixing Manual Irrigation Leaks



Automatic Irrigation

Eleven percent of the total respondents (N=96) reported using automatic irrigation and answered all of the barrier and benefit questions. For those who watered their grass using automatic irrigation during the summer, the primary barrier to fixing a leak was that respondents felt that they *did not have any leaks*. This was followed by *not knowing how to fix leaks, not having the correct tools to fix leaks,* or *not knowing how to detect leaks*. The primary benefits to fixing an automatic irrigation leak were that it is *the right thing to do*, and that it *saves water*, *the environment* and *money*. See Figure 16 and Figure 17 below.

Figure 16: Barriers to Fixing Automatic Irrigation Leaks

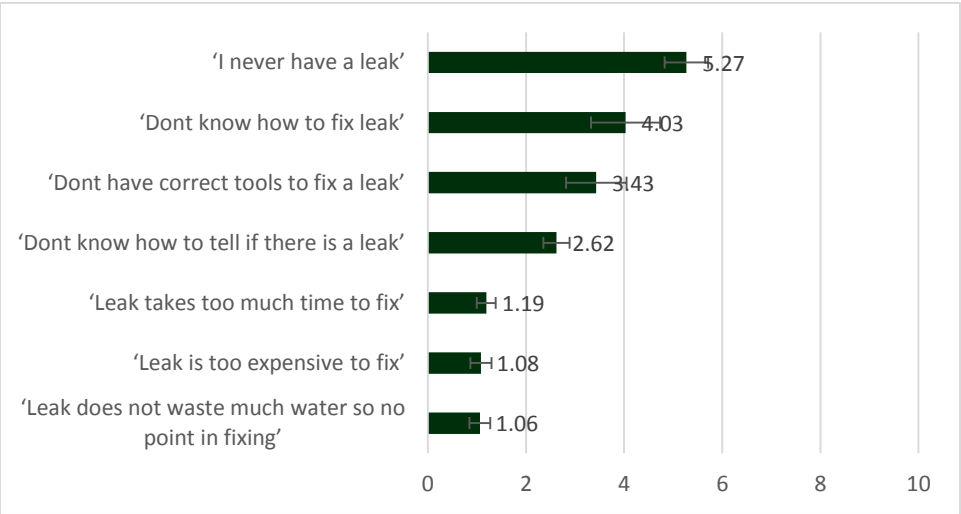
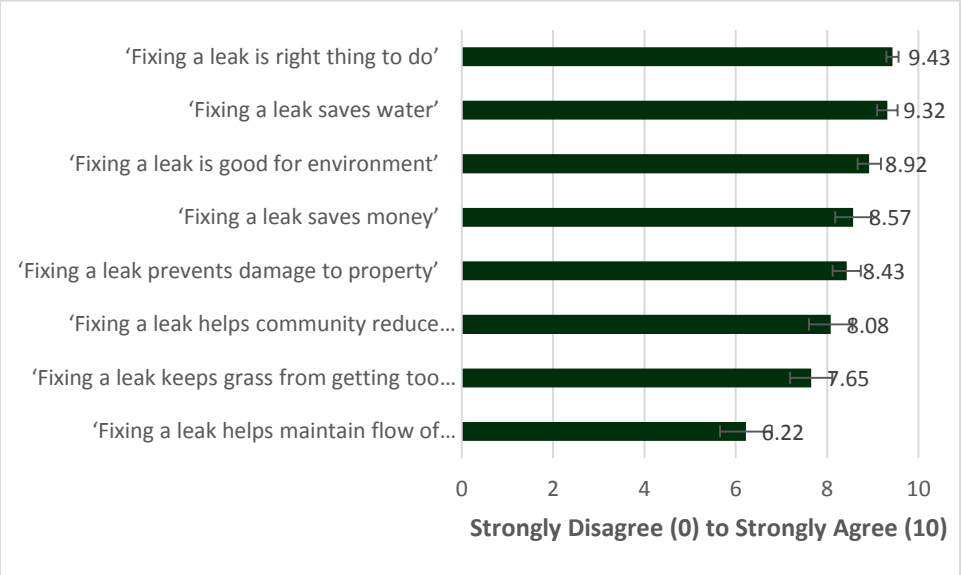


Figure 17: Benefits to Fixing Automatic Irrigation Leaks



Between the two groups, those who used automatic irrigation were significantly more likely ($p<.05$) to rate the barriers of *don't know how to tell if there is a leak* and *fixing a leak keeps grass from getting too much water* higher than those who used manual irrigation.

Behavior #3: Installing a Weather-based Controller on Automatic Irrigation

Fourteen percent of respondents reported having an automatic irrigation system, with 6% already having a weather-based controller. The remaining 8% of respondents (N=40) were asked to rate their agreement with a list of potential barriers and benefits to installing a weather-based controller using a scale from 0 to 10; (0 = strongly disagree, 10 = strongly agree). The mean rating for each statement is presented below.

For those who had an automatic irrigation system but no weather-based controller, the primary barriers were that the respondents preferred to have *control over their system,* they *didn't know how to install a controller,* they *didn't know where to buy one,* or they *didn't use their automatic sprinkler system.* The highest-rated benefits for installing a controller were that it would *help the community reduce water usage, it was the right thing to do,* and it would be *good for the environment*. See Figure 18 and Figure 19 below.

Figure 18: Barriers to Installing a Weather-based Controller on an Automatic Irrigation System

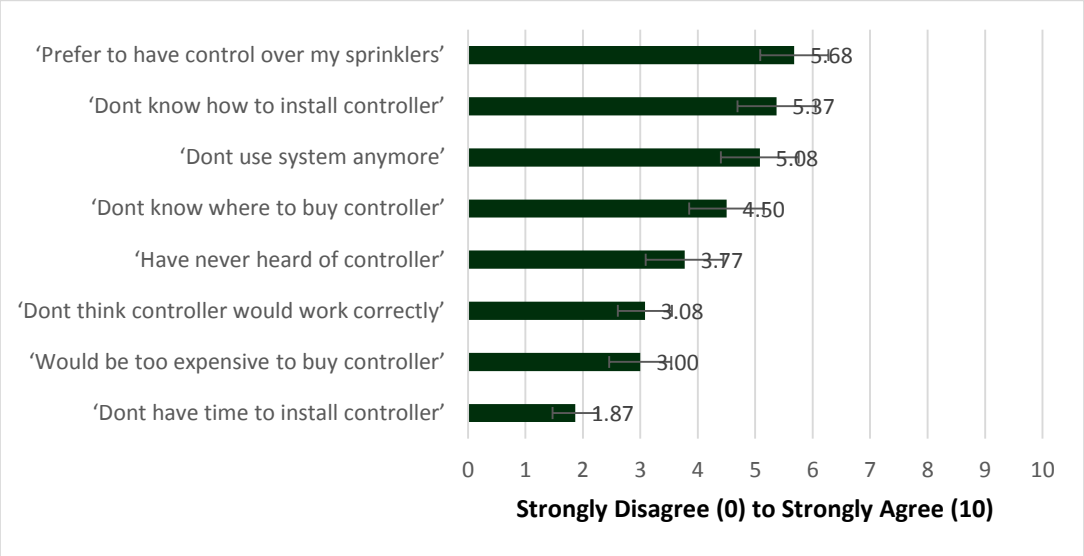
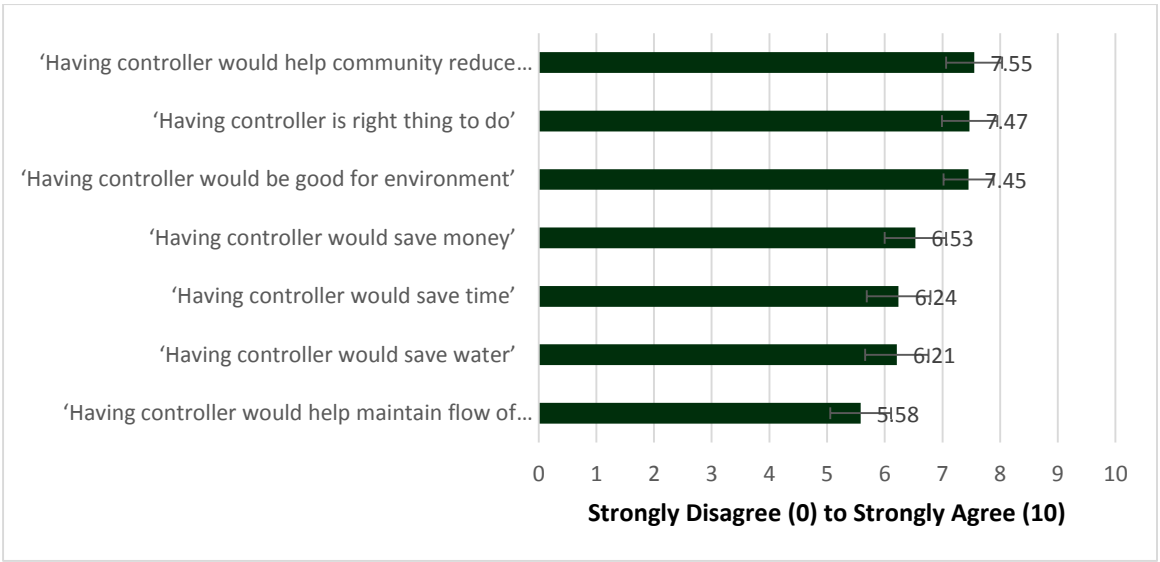


Figure 19: Benefits to Installing a Weather-based Controller on an Automatic Irrigation System



Behavior #4: Fixing a Pool Leak

A total of 16% of respondents (N=50) reported having a pool. Those respondents were asked to rate their agreement with a list of potential barriers and benefits to fixing a leak in their pool using a scale from 0 to 10; (0 = strongly disagree, 10 = strongly agree). The mean rating for each statement is presented below.

The highest rated barrier to fixing a pool leak was *not having the right tools,* follow by *it is too expensive to hire someone to fix the pool leak, don't know how to tell if the pool is leaking,* and *it is too difficult to fix a pool leak*. Respondents reported that the most important benefit for fixing a pool leak was that *it was the right thing to do,* followed by it will *save water, money,* or *the environment*. See Figure 20 and Figure 21 below.

Figure 20: Barriers to Repair Pool Leaks

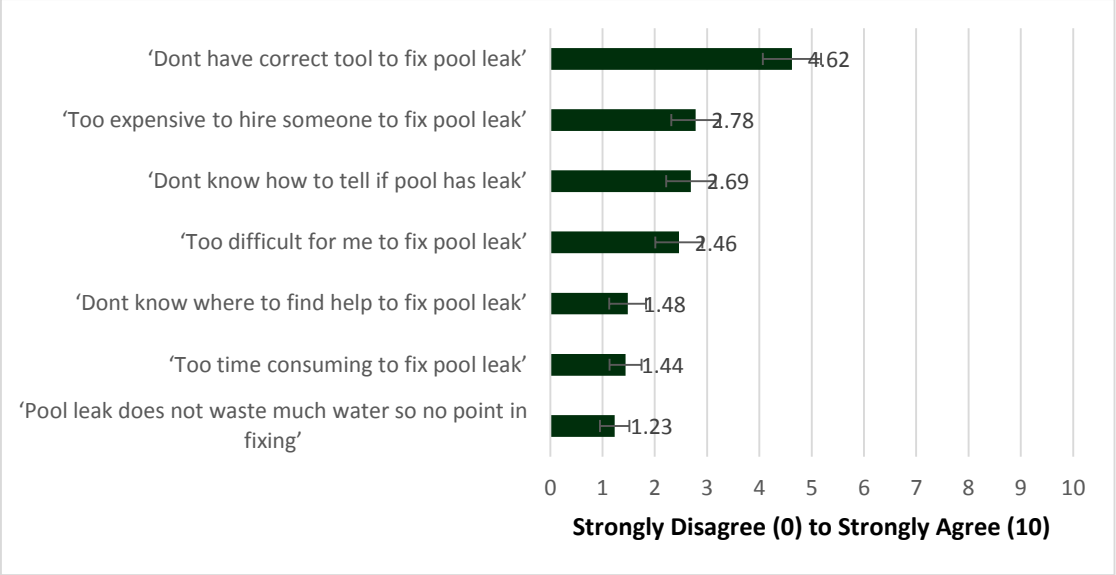
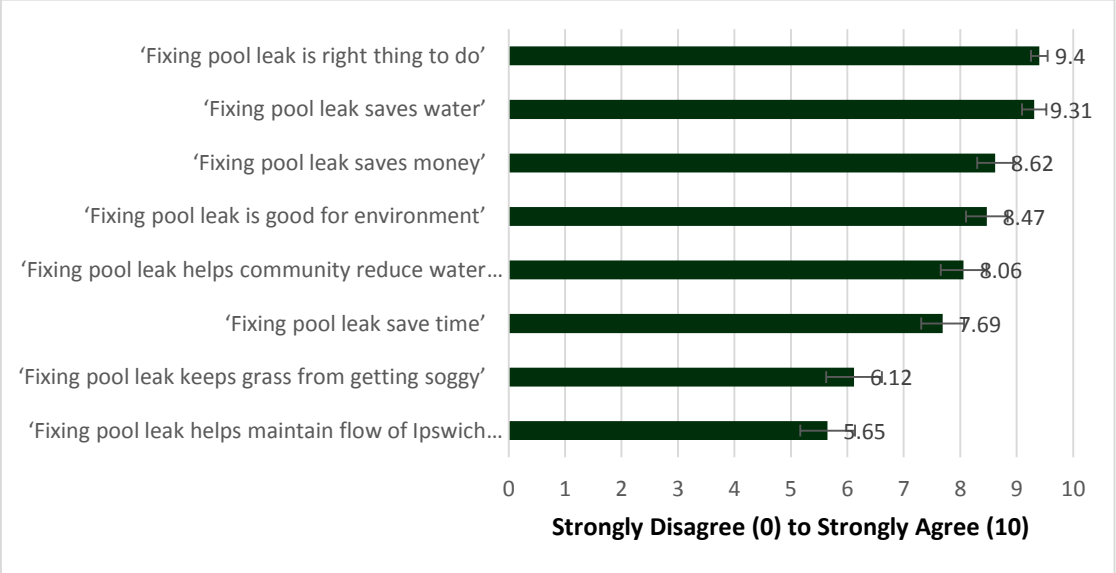


Figure 21: Benefits to Repair Pool Leaks



Recommendations

The survey results suggest that for each behavior, the respondents had moderate barriers to acting (ratings from 4 to 6) and fairly high benefits (ratings from 6 to 9). To motivate action, a program must reduce barriers to engaging in the target action, while simultaneously enhancing the activity's benefits. In the recommendations below, tools are suggested that will help overcome specific barriers and promote the benefits. Generally, the recommendations focus on barriers that were rated above a 3, though other barriers are included as it makes sense to address specific topics at the same time as others.

The recommended approaches focus on making it easy (convenience), commitment, education, feedback, prompts, social norms, and cognitive dissonance (a sense of inconsistency between one's values and one's behavior). It is important to remember that each behavior's barriers must be addressed specifically to provide the motivation and context that encourages residents to act. Below, the recommendations are displayed separately for each behavior.

Behavior #1: Eliminate Summer Grass Watering

Audience: Single family homes with grass lawns; those who value green lawns and water frequently

Barriers: Perception that grass will die; won't save much water

Benefits: Being part of a community effort; saving water and saving money.

Strategies

- **Education and Credibility**: Correct misunderstandings about the amount of water grass needs and provide credible information on grass health
- **Commitment:** Use local groups or city to create a sense of community effort
- **Other:** Emphasize other benefits, provide feedback on water savings

Communication Channels: Mail outreach; door hanger; community groups; social media; website; community newsletter; announcement boards

The survey results suggest that the primary barrier to not watering one's grass in the summer is the perception that *the grass will die*, followed by a belief that eliminating watering will *not save much water*. Massachusetts receives a fair amount of rain throughout the summer, and minimal-to-no watering is needed to keep grass alive. However, the grass will show signs of stress, which most participants had first-hand experience with, and participants may believe that their grass is dying or in dire need of water. Participants did, however, report significant benefits associated with not watering their grass, such as *being part of a community effort to save water, saving water,* and *saving money*.

Based on these results, the recommended approach is to employ education, commitment, positive framing, and feedback strategies.

Education and Credibility: The program should correct the misperception that residents have about the ability of their grass to survive with little-to-no water during the summer months. This could be done by communicating how a homeowner can recognize the difference between slight stress and grass that is dying and in need of water. This communication could also include data on how much water is used by different irrigation systems, with comparisons presented in easy-to-understand units (e.g., gallons). Any outreach could also emphasize the other positive benefits of not watering in the summer. For the communication to be effective, it must be credible to the audience, such as by having information that is as local as possible, branded and delivered by trustworthy organizations, and easy to interpret.

- **Communication Channels:** This type of communication could be mailed, distributed through door hangers, or disseminated through existing community communication channels. Local community groups could also provide in-person visits. Other approaches could include the city employing social media or a website to inform residents of how much rain was received locally and what that means for their grass' needs on a regular basis. The specific material type that would be most effective depends on the audience and available resources. General guidelines suggest that messages that are shorter, concrete, and personalized

to the individual are more effective. In-person communication is generally more effective than passive communication (e.g., flyers).

Commitment: The program could tap into the perceived benefits of being part of the community effort, saving water, and saving money by creating a commitment campaign at a local level. This campaign would ask residents to make voluntary public and durable commitments to stop watering their grass, or to follow guidelines set forth in the educational material. Commitment is a powerful behavior change technique as people feel a social obligation to follow through with their word, particularly if others are aware of their commitment. Commitments must be voluntary and are most effective when they are written and posted publicly in durable format, meaning the posting continues to be visible beyond when it originally goes up.

- **Communication Channels**: A pledge form could be mailed or distributed by local community groups through door hangers or in-person visits. In order to make the commitment public, the resident could also receive a sticker about their pledge that goes on their curbside bins or a lawn flag or ornament about their pledge that is durable to last through the summer. Residents that pledge could also be recognized in community newsletters or announcement boards.

Social Norms: The campaign could utilize data from this survey to ask residents to join the more than 50% of residents who already do not water their grass in the summer. The message that many already participate would also be important as water conservation and grass watering may be sensitive topics in these communities, shown by the comments from residents in Appendix B. This acknowledgment that the resident may already refrain from summer watering would help mitigate negative feedback.

- **Communication Channels:** This framing could be used on the educational outreach and/or on the commitment form.

Feedback: A program could employ normative feedback to provide more motivation. Feedback lets people know how successful they are at the desired behavior, and is most successful with high users. Providing a flyer or graph to each household, or with a focus on high water users, on how much water their household, neighborhood, or community has used as compared to a previous week, month, or year could provide motivation to act. This graph could also highlight the normative information. This technique must include other elements in order to be successful and avoid rebound effects. If not implemented correctly, normative feedback can encourage low water-users to use more water.

- **Communication Channels:** This material could be mailed, distributed by door hangers, or disseminated by local community channels or groups. Based on discussions with DER, the water department may be an appropriate messenger for this communication, as many of the targeted towns still receive a paper bill which is likely reviewed, unlike auto-paid online bills. Energy utilities, such as OPower, have found great success with distributing feedback with households' bills.[3]

Specific Audience: The barriers and benefits were split based on two audiences of interest: those who highly value green lawns and those who report watering their grass at least every other week in the summer. The same relative

[3] Vine, D., Buys, L., & Morris, P. (2013) The Effectiveness of Energy Feedback for Conservation and Peak Demand: A Literature Review. Open Journal of Energy Efficiency. 2:1. http://file.scirp.org/Html/2-2650028_28957.htm

ranking of barriers and benefits held for this audience—however, the barriers were held more strongly, and the benefits were weaker, suggesting they will prove more challenging to motivate. Therefore, we suggest that pilot materials are first tested with a focus group of residents who report holding these values, as it will be important to ensure that messages and materials resonate with this audience.

Behavior #2: Fix Irrigation Leaks

Audience: Single family homes with lawns; households with automatic irrigation

Barriers: Recognizing leaks; knowing what to do next

Benefits: The right thing to do; saving water, money, or the environment

Strategies:

- **Education and Make It Easy:**
  - Show tips to noticing leaks in different systems
  - Explain what to do when you have a leak
- **Commitment and Prompt:** Create commitment and a reminder.
- **Cognitive Dissonance:** Tap into self-image of doing the right thing.
- **Other:** Emphasize other benefits

Communication Channels: Mail outreach; door hangers; events; community groups; community newsletters; announcement boards

The top rated barrier to fixing either type of irrigation leaks is that residents believe that they *never have any leaks*, followed by *not knowing how to fix leaks, not having the proper tools*, and *not knowing how to recognize leaks*. It is unknown how many leaks go unfound and how many homes simply do not have any irrigation leaks. However, given the low amount of attention residents likely pay to their irrigation system and the lack of water sub-metering, we expect that there are a good number of leaks that go unnoticed. Participants did cite a wide range of benefits to repairing irrigation leaks, from it being *the right thing to do* to *saving water, saving money,* or being *good for the environment*.

Given these results, the recommended approach combines education, convenience, positive framing, commitment, and cognitive dissonance.

Education: First, the outreach can fill in respondents' missing "how-to" information: how to recognize a leak, how to repair a leak, and what tools are needed to do so. The information should be presented as straight forward and as easy-to-understand as possible, such as by employing vivid communication through real, high quality images of a person completing each step. The message could include framing that it may be difficult to notice a leak from one's water bill alone, so it is important to regularly go through the steps to detect leaks. This material should also be organized in a way that addresses the different needs of various irrigation systems. These materials could include positive information on the benefits of repairing leaks.

- **Communication Channels**: These materials could be delivered by mail outreach, door hangers, or distributed through existing community communication groups. Other kinds of vivid communication may prove effective to show to residents how to detect and fix leaks, such as through demonstrations at community events or in-person to homeowners. These events could be conducted at locations where any necessary tools or equipment could immediately be purchased, such as a home improvement store. General guidelines suggest that messages that are shorter, concrete, and personalized to the individual are more effective. In-person communication is generally more effective than passive communication (e.g., flyers)

Commitment and Prompt: The outreach campaign could also include a commitment and a reminder to check for and repair leaks on a regular basis and creating a commitment campaign at a local level. This campaign would ask residents to make voluntary public commitments to check for and repair irrigation leaks. Commitment is a powerful behavior change technique as people feel a social obligation to follow through with their word, particularly if others are aware of their commitment. Commitments are also most effective when they are written. For example, if a homeowner was unwilling or unable to commit to stop watering completely, they would be asked if they would commit to regularly checking their irrigation system for leaks and repairing them. If a homeowner commits to the action, they could be provided a small prompt that could be placed up by their irrigation system as a reminder to regularly check for leaks. The homeowner could then receive a follow up call to remind them of their commitment and ask if they had found any leaks, if they had been successful in repairing them, and if any further assistance was needed.

- **Communication Channels:** The commitment and prompt could be delivered through the mail, door hangers, or in-person communication through local community groups. Residents that pledge could also be recognized in community newsletters or announcement boards.

Cognitive Dissonance: The commitment campaign could also be designed to create a sense of cognitive dissonance, as survey respondents seem to believe they have no leaks, but that if they did have a leak, it would be the right thing to do to fix them. Research has shown that individuals find a sense of inconsistency between their values and their behavior (cognitive dissonance) to be unpleasant. Messages to residents reminding them of their priorities and urging them to check for and repair leaks could provide additional motivation.

- **Communication Channels:** This framework could be used in the outreach materials or recruitment for an in person demonstration, such as by starting off with a statement to the effect of "Think you don't have leaks in your lawn irrigation system? Learn more to find out how you can check" that call out that this disconnect. The commitment campaign could also employ this framework by building in a reminder that fixing leaks prevents waste, which is the right thing to do.

Specific Audience: The barriers and benefits were split by participants that reported having automatic irrigation and participants that reported having manual irrigation, as manual and automatic irrigation leaks are addressed differently and have very different potential impacts on water usage (with automatic irrigation leaks creating a much larger impact). Overall, the relative pattern of ratings of barriers and benefits was similar for the two groups. However, those with automatic irrigation reported significantly higher barriers related to *not knowing how to fix a leak* and *not having the proper tools*. Therefore, the education and communication for automatic irrigation may need to be more in-depth on addressing these knowledge gaps with a specific breakdown for automatic irrigation.

Behavior #3: Install a Weather-Based Controller on Automatic Sprinklers

Audience: Single family homes with a lawn

Barriers: Prefer control; lack of knowledge

Benefits: Helping their community save water; the right thing to do; saving water

Strategies:

- **Education and Convenience:**
  - Emphasize new technology waters lawn more efficiently and less wastefully
  - Easy guide to purchase and set up
  - Can still control system
- **Incentives:** Reduced price or coupons
- **Social Norms:** Convey information needed through stories
- **Other:** Emphasize other benefits

Communication Channels: Mail outreach**;** door hangers; community groups; events; social media

Automatic irrigation was not extremely common in our surveyed communities, but enough data was collected to gain a better understanding into the barriers and benefits of users who had systems without weather-based controllers. The most prevalent barriers were that respondents preferred to *control their systems*, followed by not *knowing how to install a controller* or *where to buy one.* Another prevalent barrier was that systems were *no longer in use*, but it is likely that the city would not want to campaign for residents to use their systems unless additional water data suggested that the systems would be more efficient than manual watering. The highest reported benefits were *being part of a community effort to save water, it being the right thing to do*, and *saving water*.

Given these results, a program should include education, convenience, incentives, and social diffusion.

Education and Convenience: Educational material should address the necessary knowledge, such as that one can still override their system if additional control is desired, where to buy a controller, and how to install it, presented in an easy-to-understand format, such as by including high-quality photographs of each installation step. These materials could also emphasize the other benefits residents perceived from installing weather-based controllers.

- **Communication Channels:** These materials could be delivered by mail outreach, door hangers, or distributed through existing community communication groups. Vivid communication may also prove effectives to demonstrate to residents how to install a controller, such as through demonstrations at community events or in-person to homeowners. These events could be conducted at locations where controllers could immediately be purchased, such as a home improvement store. General guidelines suggest that messages that are shorter, concrete, and personalized to the individual are more effective. In-person communication is generally more effective than passive communication (e.g., flyers).

Incentives: As installing a controller is a one-time behavior, rather than a habit, using an incentive along with the other strategies can provide additional motivation. While an incentive on its own is usually not enough to drive behavior change, it can help provide a small additional motivation.

- **Communication Channels:** As incentives are not generally motivating on their own and are best with one-time behaviors such as installing a weather-based controller, this element would be best delivered along with other outreach.

Social Norms: Finally, a program could also provide social norms, as one of the top benefits *was helping my community save water*. Outreach could use stories from actual local residents that currently are using a weather-based controller that speak to their motivations and ability to overcome challenges, such as how they still are able to control their system. Personal stories and conversations, particularly with those whom we trust and perceive as similar to ourselves, have an inordinate influence on our actions.

- **Communication Channels:** These stories could be created in short form to go alongside educational materials, or delivered in person at events or at demonstrations with one-to-one conversations. These stories could also be shared on relevant local community groups' social media, or along with communication about water restrictions.

Behavior #4: Fix Pool Leaks

Audience: Single family homes with a pool

Barriers: Recognizing leaks; knowing or affording what to do next; recognizing a leak; difficulty of fixing a leak

Benefits: Right thing to do; saving water, money, or the environment

Strategies:

- **Education, Make it Easy, and Incentive:**
  - Tips to noticing leaks in pools
  - What to do when you have a leak; deals to afford a professional
- **Commitment and Prompt:** Commit to check and provide a reminder.
- **Cognitive Dissonance:** Tap into self-image of doing the right thing.
- **Other:** Emphasize other benefits

Communication Channels: Mail outreach, door hangers, community groups, social media

The highest reported barrier to fixing a pool leak is *recognizing that a pool is leaking*, followed by *knowing how to fix it, affording hiring someone to fix it, don't know how to tell if the pool is leaking,* and *it is too difficult to fix a pool leak.* Respondents saw many benefits to fixing pool leaks, from *it being the right thing to do*, to *saving water, money, or the environment*. Estimations of the expected number of pools with leaks varies, from 5% to 30%.[4] However, as with any infrastructure, the older it is, the more likely it is to have structural issues, so older homes with longstanding pools may be more likely to have leaks.

Based on these results, we recommend a program that employs education, convenience, positive framing, incentives, cognitive dissonance, commitment, and a prompt.

Education and Convenience: First, educational materials could address tips on recognizing a pool leak (as compared to normal evaporation) and the best next steps for repairing a leak, depending on the reader's skill level and type of pool. As many homeowners likely do not possess the skills to repair a leak on their own, technical support will be important in making the process easy and feasible. If possible, DER or another local government body could subsidize or offer free leak detection checks to increase the convenience and affordability of the process. If not possible, the outreach could recommend how to find a qualified professional, or include an incentive deal with a local group for leak repair.

- **Communication Channels:** These materials could be delivered by mail outreach, door hangers, or distributed through existing community communication groups. The outreach could also be distributed through partnerships with local pool stores or professionals, to be given to their clients or posted on their social media. Working with local pool stores could help DER create a targeted campaign for pool owners. General guidelines suggest that messages that are shorter, concrete, and personalized to the individual are

[4] Scientific American Report on Water Wasters, http://www.scientificamerican.com/article/top-10-water-wasters/

more effective. In-person communication is generally more effective than passive communication (e.g., flyers).

Commitment and Prompt: As checking for and repairing leaks is a habitual behavior homeowners need to do throughout the life of their pool, the program could employ a commitment element that asks residents to commit to checking for and repairing pool leaks and provides a prompt that could be placed near their pool or in their home as a reminder. This outreach would tap into the perceived benefits of *doing the right thing, saving water, saving money,* or being *good for the environment.* As mentioned previously, commitment is a powerful behavior change technique as people feel a social obligation to follow through with their word, particularly if others are aware of their commitment, and commitments are most effective when they are written.

- **Communication Channels:** The commitment could be mailed, distributed through door hangers, or disseminated through existing community communication channels. Groups could also get signatures in public places and distribute the prompt after, or partner with local pool groups to provide the prompt and ask their clients to commit.

Cognitive Dissonance: The commitment campaign could also be designed to create a sense of cognitive dissonance, as survey respondents believe that it is the right thing to do to fix pool leaks. Research has shown that individuals find a sense of inconsistency between their values and their behavior (cognitive dissonance) to be unpleasant. Messages to residents reminding them of their priorities and urging them to check for and repair pool leaks could provide additional motivation.

- **Communication Channels:** This framework could be used in the outreach materials or recruitment for an in person demonstration, such as by starting off with a statement to the effect of "Think you don't have leaks in your pool? Learn more to find out how you can check" that call out this disconnect. The commitment campaign could also employ this framework by building in a reminder that fixing leaks prevents waste, which is the right thing to do. As a note, these types of messages are more effective as an in-person script than as a headline on outreach materials.

Appendix A: Detailed Survey Results

Section 1. This section is about the grass, plants, and watering systems you may have in your yard. Non-grass areas include flowers, shrubs, trees, mulched areas, pebbles, or rocks.

1. How would you describe your yard?

☐ All grass (10%)
☐ Mostly grass with some non-grass areas (57%)
☐ No grass ▶SKIP TO **SECTION 5** (1%)
☐ An equal mix of grass and non-grass areas (24%)
☐ Some grass, but mostly non-grass areas (8%)
☐ No yard ▶SKIP TO **SECTION 5** (0%)

2. Is your grass a "drought-resistant" type, such as fescue?

☐ Yes (14%) ☐ No (33%) ☐ Don't know (53%)

3. How important is a green lawn to you?

☐ Very Important (13%) ☐ Important (30%) ☐ Somewhat Important (36%) ☐ A little important (12%) ☐ Not very important (8%)

These questions are about how the grass areas of your yard are watered during the summer months (May-September).

4. Do you have an automatic sprinkler system installed in your yard?

☐ Yes (16%) ☐ No (84%) ▶SKIP TO **QUESTION 6**

5. In general, how confident are you in your ability to program your automatic sprinkler system?

☐ Very confident (67%) ☐ Confident (15%) ☐ Somewhat confident (4%) ☐ A little confident (4%) ☐ Not at all confident (10%)

6. Which method is used most often to water your grass?

☐ A manual sprinkler attached to a hose (sprinklers placed around your yard to be activated as desired) (22%)
☐ An automatic sprinkler system that is not programmed, but is turned on/off manually (2%)
☐ An automatic sprinkler system with a weather control that automatically turns off when it rains (6%)
☐ An automatic sprinkler system that is programmed to turn on and off (6%)
☐ A hose (21%)
☐ Other _____(48%)
☐ Don't know (1%)

7. During the summer months, how often does your grass show signs of stress (yellowing, not springing back)?

☐ Always (10%) ☐ Often (28%) ☐ Sometimes (54%) ☐ Never (5%) ☐ Don't know (3%)

8. During the summer months, how often is your grass typically watered?

☐ Every day (1%) ☐ A few days per week (10%) ☐ Once a week (8%) ☐ Every other week (5%)
☐ Once a month (7%) ☐ Once or twice per summer (13%) ☐ Never (56%) ▶SKIP TO **SECTION 4**

Section 2. These statements are about watering your grass during the summer months (May - September).

9. Using a scale from 0, *strongly disagree*, to 10, *strongly agree*, please rate your agreement with the following statements.

	During the summer months…	Strongly Disagree										Strongly Agree
a.	Not watering my grass is good for the environment. (M=6.07, SD=2.74, N=152)	0	1	2	3	4	5	6	7	8	9	10
b.	Not watering my grass helps my community reduce water usage. (M=7.49, SD=2.48, N=154)	0	1	2	3	4	5	6	7	8	9	10
c.	I water because someone else in my household wants the grass to be watered. (M=2.29, SD=2.87, N=149)	0	1	2	3	4	5	6	7	8	9	10

d.	My grass will die if I do not water it. (M=5.58, SD=2.99, N=153)	0	1	2	3	4	5	6	7	8	9	10	
e.	Not watering my grass saves money. (M=6.61, SD=2.77, N=152)	0	1	2	3	4	5	6	7	8	9	10	
f.	I water during the summer because I enjoy spending time watering my grass. (M=1.59, SD=2.12, N=150)	0	1	2	3	4	5	6	7	8	9	10	
g.	Not watering my grass would not save much water. (M=3.58, SD=2.93, N=150)		0	1	2	3	4	5	6	7	8	9	10
h.	I do not water my grass because any yellow or brown grass will be green again. (M=4.26, SD=2.94, N=150)		0	1	2	3	4	5	6	7	8	9	10
i.	Not watering my grass saves time. (M=5.41, SD=3.37, N=148)		0	1	2	3	4	5	6	7	8	9	10
j.	Not watering my grass is the right thing to do. (M=5.32, SD=2.72, N=151)		0	1	2	3	4	5	6	7	8	9	10
k.	I water during the summer because I am in the habit of watering my grass regularly. (M=2.25, SD=2.48, N=152)		0	1	2	3	4	5	6	7	8	9	10
l.	Not watering my grass saves water. (M=7.50, SD=2.59, N=153)		0	1	2	3	4	5	6	7	8	9	10
m.	Not watering my grass helps maintain the flow of the Ipswich River. (M=5.95, SD=3.06, N=154)		0	1	2	3	4	5	6	7	8	9	10

Section 3. These statements are about water leaks in your automatic irrigation system, manual sprinklers, or hose. Answer thinking of the method used most often to water your grass.

10. Using a scale from 0, *strongly disagree*, to 10, *strongly agree*, please rate your agreement with the following statements.

		Strongly Disagree										Strongly Agree
a.	I do not know how to fix a leak. (M=3.28, SD=3.78, N=138)	0	1	2	3	4	5	6	7	8	9	10
b.	Fixing a leak saves water. (M=9.23, SD=1.59, N=141)	0	1	2	3	4	5	6	7	8	9	10
c.	I never have a leak. (M=5.26, SD=3.12, N=137)	0	1	2	3	4	5	6	7	8	9	10
d.	Fixing a leak is good for the environment. (M=8.75, SD=1.96, N=141)	0	1	2	3	4	5	6	7	8	9	10
e.	Fixing a leak is the right thing to do. (M=9.34, SD=1.20, N=141)	0	1	2	3	4	5	6	7	8	9	10
f.	Fixing a leak prevents damage to my property. (M=8.07, SD=2.45, N=140)	0	1	2	3	4	5	6	7	8	9	10
g.	Fixing a leak saves money. (M=8.89, SD=1.98, N=141)	0	1	2	3	4	5	6	7	8	9	10
h.	I do not have the correct tools to fix a leak. (M=2.72, SD=3.39, N=141)	0	1	2	3	4	5	6	7	8	9	10
i.	I do not know how to tell if there is a leak. (M=2.64, SD=3.25, N=141)	0	1	2	3	4	5	6	7	8	9	10
j.	Fixing a leak keeps my grass from getting too much water. (M=6.51, SD=3.44, N=136)	0	1	2	3	4	5	6	7	8	9	10
k.	A leak does not waste much water, so there is no point in fixing it. (M=1.39, SD=2.22, N=141)	0	1	2	3	4	5	6	7	8	9	10
l.	A leak is too expensive to fix. (M=1.50, SD=2.37, N=141)	0	1	2	3	4	5	6	7	8	9	10
m.	Fixing a leak helps my community reduce water usage. (M=8.21, SD=2.69, N=140)	0	1	2	3	4	5	6	7	8	9	10
n.	Fixing a leak helps maintain the flow of the Ipswich River. (M=6.67, SD=3.29, N=138)	0	1	2	3	4	5	6	7	8	9	10
o.	A leak takes too much time to fix. (M=1.66, SD=2.32, N=141)	0	1	2	3	4	5	6	7	8	9	10

Section 4. These statements are about a weather-based controller for your automatic sprinkler system. This controller would turn off your sprinkler system automatically when it rains. If your household does not have an automatic sprinkler system or has already installed a weather-based controller, please check here ☐ and skip to Section 5.

11. Using a scale from 0, *strongly disagree*, to 10, *strongly agree*, please rate your agreement with the following statements.

		Strongly Disagree										Strongly Agree
a.	I do not use my automatic sprinkler system anymore. (M=5.08, SD=4.39, N=39)	0	1	2	3	4	5	6	7	8	9	10
b.	I do not think a weather-based controller would work correctly. (M=3.08, SD=3.52, N=38)	0	1	2	3	4	5	6	7	8	9	10
c.	Having a weather-based controller would save money. (M=6.53, SD=3.44, N=38)	0	1	2	3	4	5	6	7	8	9	10
d.	I do not have time to install a weather-based controller. (M=1.87, SD=2.55, N=38)	0	1	2	3	4	5	6	7	8	9	10
e.	I have never heard of a weather-based controller. (M=3.77, SD=4.57, N=39)	0	1	2	3	4	5	6	7	8	9	10
f.	Having a weather-based controller would help my community reduce water usage. (M=7.55, SD=3.16, N=38)	0	1	2	3	4	5	6	7	8	9	10
g.	Having a weather-based controller would save time. (M=6.24, SD=3.58, N=38)	0	1	2	3	4	5	6	7	8	9	10
h.	Having a weather-based controller would be good for the environment. (M=7.45, SD=3.13, N=38)	0	1	2	3	4	5	6	7	8	9	10
i.	I prefer to have control over my sprinklers. (M=5.68, SD=3.79, N=38)	0	1	2	3	4	5	6	7	8	9	10
j.	Having a weather-based controller is the right thing to do. (M=7.47, SD=2.82, N=38)	0	1	2	3	4	5	6	7	8	9	10
k.	It would be too expensive to buy a weather-based controller. (M=3.00, SD=3.08, N=38)	0	1	2	3	4	5	6	7	8	9	10
l.	I do not know where to buy a weather-based controller. (M=4.50, SD=4.13, N=38)	0	1	2	3	4	5	6	7	8	9	10
m.	Having a weather-based controller would help maintain the flow of the Ipswich River. (M=5.58, SD=3.34, N=38)	0	1	2	3	4	5	6	7	8	9	10
n.	Having a weather-based controller would save water. (M=6.21, SD=3.59, N=38)	0	1	2	3	4	5	6	7	8	9	10
o.	I do not know how to install a weather-based controller. (M=5.37, SD=4.42, N=38)	0	1	2	3	4	5	6	7	8	9	10

Section 5. These statements are about leaks in your pool.

12. Do you have a pool?

☐ Yes, in-ground (12%) ☐ Yes, above-ground (4%) ☐ No (84%) ▶SKIP TO SECTION 6

13. Using a scale from 0, *strongly disagree*, to 10, *strongly agree*, please rate your agreement with the following statements.

		Strongly Disagree										Strongly Agree
a.	Fixing a leak in my pool saves time. (M=7.65, SD=2.75, N=51)	0	1	2	3	4	5	6	7	8	9	10
b.	Fixing a leak in my pool keeps my grass from getting soggy. (M=6.04, SD=3.49, N=50)	0	1	2	3	4	5	6	7	8	9	10
c.	Fixing a leak in my pool saves water. (M=9.29, SD=1.55, N=51)	0	1	2	3	4	5	6	7	8	9	10
d.	I do not know where to find help to fix a leak in my pool. (M=1.51, SD=2.57, N=51)	0	1	2	3	4	5	6	7	8	9	10
e.	Fixing a leak in my pool helps maintain the flow of the Ipswich River. (M=5.57, SD=3.47, N=51)	0	1	2	3	4	5	6	7	8	9	10
f.	It is too difficult for me to fix a leak in my pool. (M=2.51, SD=3.26, N=51)	0	1	2	3	4	5	6	7	8	9	10

g.	A leak in my pool does not waste much water. (M=1.25, SD=2.04, N=51)	0	1	2	3	4	5	6	7	8	9	10
h.	Fixing a leak in my pool is the right thing to do. (M=9.38, SD=1.08, N=52)	0	1	2	3	4	5	6	7	8	9	10
i.	It is too time consuming for me to fix a leak in my pool. (M=1.47, SD=2.24, N=51)	0	1	2	3	4	5	6	7	8	9	10
j.	I do not know how to tell if my pool has a leak. (M=2.47, SD=3.37, N=50)	0	1	2	3	4	5	6	7	8	9	10
k.	It is too expensive to hire someone to fix a leak in my pool. (M=2.84, SD=3.19, N=50)	0	1	2	3	4	5	6	7	8	9	10
l.	I do not have the correct tools to fix a leak in my pool. (M=4.71, SD=3.92, N=49)	0	1	2	3	4	5	6	7	8	9	10
m.	Fixing a leak in my pool helps my community reduce water usage. (M=8.02, SD=2.98, N=52)	0	1	2	3	4	5	6	7	8	9	10
n.	Fixing a leak in my pool saves money. (M=8.60, SD=2.35, N=52)	0	1	2	3	4	5	6	7	8	9	10
o.	Fixing a leak in my pool is good for the environment. (M=8.44, SD=2.70, N=52)	0	1	2	3	4	5	6	7	8	9	10

Section 6. These questions are used for classification purposes only.

14. In what year were you born? _____ (M=57.17, SD=13.52, N=337, Min=23, Max=93)

15. Do you own or rent your home? ☐ Own (99%) ☐ Rent (1%)

16. For how many years have you lived at your current address? _____ (M=21.25, SD=16.47, N=346, Min=0, Max=90)

17. Including yourself, how many people live in your household? _____ How many are children under 18? _____
1 = 13%, 2=35%, 3=17%. 4=17%, 5=23%, 6=1% 0=68%, 1=10%, 2=16%, 3=6%

18. What is the size of your lot?

☐ Less than half an acre (14%) ☐ Half an acre to .99 acre (36%) ☐ 1 acre to 1.99 acres (36%) ☐ 2 acres or more (14%)

Appendix B: Survey Comments

19. If you have any comments about ways that we could help you reduce water usage and keep your property healthy and happy, please note them here:

Respondent Comments
Allow access to free compost outside of regular working hours; organize large group buys on mulch; use town hall lawn as a demo of low water gardening; seek other sources of water; limit development of large housing projects.
Allow some "modest" sprinkling but continue to price high household water usage.
Anything you can do to discourage the use of the automatic grass irrigation would be appreciated.
Because of the water ban in the spring and its continued ban through the fall, we rarely get the opportunity to use our sprinkler system.
Beverly and Salem use water to hose driveways, wash cars & boats, sprinklers that run in a rain storm! What's up with that?
Beverly gets its water from Wenham Lake - why doesn't our annual water ban apply to that city?
Continue to have water bans.
Do something about properties that have auto sprinklers going during a rainstorm or when the sun is high and burning hot.
Dredge the Ipswich River.
Because of water bans and for water conservation we only water new plants or trees. Allowed to hand water only from 5-9 pm.
Educate people on how to properly cut their grass.
Enforce the existing water ban.
Fine people using automatic sprinkler systems during drought.
Hand water in the evening.
Have not used the automatic sprinkler in 4 years due to water ban.
Help me find a plumber to fix my leaking spigots. Thanks.
I believe we here in Wenham are good stewards of the Ipswich River- but I have grave concerns of the efforts of the largest users of water, Salem and Beverly, to conserve use.
I do have a large garden (47x47), use soaker hoses to water when necessary.
I follow the water restrictions when posted. I hand water via hose 95% of the time. It's frustrating when I drive by homes on the next street over and see automatic in ground sprinkler systems going during the summer hot months, middle of day.
I get mad when I see properties with sprinkler systems that are not programmed or have a weather based controller and operate when it’s raining. Do you give out notices and warn them with a fine?
I have a well that I installed specifically to save town water, so most of these questions are irrelevant to my situation.
I like green grass, but I put the environment first. Wish the tap water was safer to drink! Much more important than a lawn.
I might water sometimes if the town of Wenham lifts the ban on watering.
I ranked questions about direct connections to the Ipswich River a 7 because although we are all “in the same bucket" our town's wells are below an aquitard and demonstrates to not be in direct connection to nearby surface water.
I see Beverly and Salem sprinklers watering the sidewalks and roads in the rain. Add all of the landscape and that's where our water is being wasted. All the small towns like Wenham have permanent water restrictions in place. Go pester those cities.

Respondent Comments
I think mandatory full time bans are not appropriate. A better approach is to ban sprinkler usage on specified days during the week and during specified hours. Any usage outside those permitted days/hours should result in significant fines/penalties.
I think we should be able to reuse grey water from sinks, dishwashers, and laundry. My husband claims that the town does not actually allow this practice - it seems pretty short sighted.
I use automatic sprinklers until water ban occurs & then I stop.
I wish the quality of drinking water was better. It stains my appliances and has a strong odor. It forces me to buy bottled water.
If you could work on education and incentives to get people to stop using chemicals for insects and weeds on their lawn it would make our ground water, water systems healthier. We should also have harsher guidelines/laws for sprinkler use.
Improve water quality. Topsfield water quality has deteriorated over the years. A well with appropriate filtering seems like a better choice now, or connection to MWRA.
Information on water conserving plantings.
Install compost and fescue grass; cut grass higher.
Install moisture sensors with automatic sprinklers.
Just moved in. Planted vegetable garden and will make changes to water use in the next few months.
Keep up your good work - drives me crazy when I see sprinklers on in the rain.
Let moss take over. There is so much shade it is ridiculous to plant vegetation that requires so much pampering. We need to honor the make-up of our environment and see what it wants to grow - within reason. Thank you for being concerned.
Low-cost rain barrels.
Monitor people who abuse water bans.
My husband is a plumber and we have four rain barrels attached to our house to conserve water. We collect about 2,500 gallons per season!
My strongest complaint is the water quality. We cannot drink, cook, or bathe safely in Topsfield water, yet we pay high cost. Watering the lawn is about all the water is good for.
My yard slopes, so if I could find something to hold the soil and is dog friendly, I will put it in in a minute.
Offer free rain catchers.
Only water to keep flowers blooming. Not concerned about grass.
Our flower garden is never watered except when it wilts, which is rarely (it is all perennials). The vegetable garden and potted plants are watered with a hand-held hose. Wenham has a sprinkler system ban except from 5pm to 9am.
Our grass is green with rain only. You don’t need sprinklers in New England!
Our town has a partial water ban each summer. Should impose this.
Our water quality is dirty. When my son takes a bath, the water is black and there is a black film on the bathtub.
Outlaw automatic sprinklers & swimming pools; outlaw spraying for mosquitoes; outlaw fluoride from drinking water; outlaw salting roads in winter time.
Plant more trees. Offer the residents free trees.
Please do something about the beaver dam.
Post construction, we are installing a new lawn. We will have to water to get it established but will not install an irrigation system.

Respondent Comments
Promote grass strains that are to survive in lower moisture conditions. Turf grass programs have delivered hybrid grasses capable of withstanding almost any condition, including occasional salt water exposure.
Promote rain barrels and down spout diverters for rain barrels.
Provide low cost rain barrels. Survey water quality.
Provide rain barrels at lower cost.
Provide rain barrels.
Publicize grass seed varieties; don’t water in summer; plant trees.
Rain barrels!
Rain water collection systems can be used for all garden and flower bed watering in most years.
Reduce the assessed land value for non-grass land. The town should provide water barrels to home owners that want them. Save the water from hydrant flushing to water town property. Provide rain gauges to homeowners.
Reduce the brown water that forces us to run faucets to purge the system.
Remove fluoride from the water.
Require Beverly and Salem to implement a water ban.
Sprinklers used as needed. I turn it off when it rains. Do not need automatic weather sensor. Never use my sprinklers when water bans are in place.
Start monitoring and finding households that disobey the water ban. Install dual flush toilets and low flow shower heads in all municipal buildings. Subsidize citizen's installation of dual flush toilets and low flow showers.
The town should consider discouraging lawn watering by establishing a high rate or fee structure for water use above the "average" family.
The Wenham Water Department were disinterested that I was losing water when my bill spiked. I went to them; a man came and found no leaks. I called my plumber and he found the toilets/sinks had poor washers and I had leaks that could not be heard!
Towns to provide rain water "catching" basins/tools. This water can then be used to water the yard, grass, flowers, etc.
Unfamiliar with data showing relationship between irrigation and Ipswich River. We manually control sprinkler system.
Use pipes that don't corrode and leak.
Washing machine in large household is a major water use.
Water efficient toilets and dishwashers.
Water garden with a manual sprinkler system.
Water used to water lawns stays in the ecosystem.
Watering lawns is a waste and it should be banned.
We are fine, but think the neighbors need to be educated on why lawns are bad for the environment. Not only water use, but pesticides that run into our water and environment, pesticides that kill bees and other living things.
We do have an in ground pool that has a leak. We have not opened the pool for 3 years since it is too expensive to repair. Instead, we will fill it in as soon as we can afford to do so. The pool is too expensive to run and maintain.
We do not water and don't cut the grass too short.

Respondent Comments
We don't really water our lawn much, but we do have a vegetable garden, an herb garden, and flower gardens that do need regular watering.
We had a lawn sprinkler system but abandoned it years ago. With the water restrictions always in place, it didn't make sense to keep it. We do however need to water plants and trees that are very expensive to replace, grass will grow back.
We mostly use our water for showers, laundry, and dishes. What are ways to conserve water for these activities?
We normally adhere to summer water ban but almost lost back lawn due to drought. I refuse to let our property devalue because of only watering by hand. We are watering as responsibly as possible to maintain balance between compliance and care for our home.
We occasionally water brown spots to prevent further burning of grass. We mulch our gardens in order to return the h20 we put on it by hand. Too much value is placed on grass - we are engaged in planting trees to improve the shade for existing grass.
We plant drought resistant shrubs and grass.
We recently purchased a low water washing machine, water saving shower nozzle and toilet. Being a retired couple our water usage is low.
Weather based controller, we have watering restrictions most of the dry season. This essentially prohibits watering. While I understand the logic behind weather based controllers it seems it would increase the water use relative to the baseline condition.
Wenham is on a water ban during the months of May-September.
Where is fix for the manganese issues?!
Yard is mostly weeds. Obey the restrictions but it would be nice to use a sprinkler once in a while where I am trying to get new grass to grow.