



**CITIZENS' WATER ADVISORY COMMITTEE  
CONSERVATION & EDUCATION SUBCOMMITTEE**

3:30 p.m., Wednesday, April 13, 2016  
Director's Conference Room  
Tucson Water, 3<sup>rd</sup> Floor  
310 W. Alameda Street, Tucson, Arizona

**Legal Action Report**

**1. Call to Order/Roll Call**

The meeting was called to order by Chairperson Catlow Shipek at 3:36 p.m. Those present and absent were:

**Members Present:**

Catlow Shipek (Chair)	Representative, City Manager
Mark Murphy	Representative, Mayor
Ryan Lee	Representative, Ward 1
Michelle Crow *	Representative, Ward 2
Mark Lewis	Representative, Ward 5

\* Member Crow arrived at 3:48 p.m.

**Members Absent:**

Placido dos Santos	Representative, City Manager
Jean McLain	Representative, City Manager

**Tucson Water Staff Members:**

Melodee Loyer	Interim Business Services Administrator
Fernando Molina	Public Information Supervisor
Daniel Ransom	Water Conservation Supervisor
Eddie Lopez	Zanjero Program
Candice Rupprecht	Public Information Specialist
Kris LaFleur	Staff Assistant

**Others Present**

Brian Wong	CWAC
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**2. Announcements** – There were no announcements.

**3. Call to Audience** – Fernando Molina announced that “Beyond the Mirage” was screened at the Loft Cinema on Monday, April 11. He announced that a longer version of the feature would be broadcast on PBS on Friday, April 15.

**4. Review of March 9, 2016, Legal Action Report and Meeting Minutes** – Member Lewis moved to approve the Legal Action Report and Meeting Minutes of March 9, 2016. The motion was seconded by Member Murphy and carried by a vote of 4-0.

**6. Presentation: Zanjero Program update\*\*** – Tucson Water’s Eddie Lopez discussed the Department’s Zanjero Program. Topics discussed included audits performed by Tucson Water’s Zanjeros, staffing levels in the program, primary causes of water leaks on properties audited through the program, methods for resolving issues during audits, and program

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funding, among others. Mr. Lopez and Mr. Molina fielded and answered questions from the subcommittee.

- 7. FY16-17 Program Plan** – Daniel Ransom summarized progress on finalization of the FY16-17 Conservation Program Plan. He indicated that Tucson Water staff is developing a process for issuing rebates as a credit on customers' utility bill, rather than by check. He discussed monthly meetings taking place between Director's Office staff and Council aides, to discuss conservation issues, including a request by aides to pause development of a low-income loan program and neighborhood stormwater program. Mr. Ransom discussed the Department's collaboration with the Alliance for Water Efficiency, which is conducting a study on the role of conservation in determining water supply and rates. Mr. Ransom indicated that a related document, the Westminster Study, would be distributed to the subcommittee for review. He also indicated that the FY16-17 Program would include an expansion of the commercial efficiency program, implementation of a revised irrigation efficiency program, development of Spanish-language outreach, continued development of the Water Conservation Plan, and integration of sustainability and demand-management plans.
- 8. C&E Subcommittee mission & policy discussion, continued** – Members engaged in an extensive discussion about feedback received from the Mayor and Council Members regarding conservation priorities and the mission of the C&E Subcommittee. Chair Shipek indicated that he would revise the policy framework document created by previous C&E Chair Amy McCoy, to reflect changes suggested by the subcommittee. Member Murphy indicated that he would distribute an article to the subcommittee regarding public education, outreach, and behavior. Chair Shipek indicated that, rather than discussing mission and strategy, the Subcommittee would focus on setting definitions and evaluation metrics for Tucson Water's conservation and education programs.

Member Murphy departed at 4:46 p.m.

Chair Shipek asked staff to review the revised policy framework document and to provide feedback at the May C&E meeting, at which point the subcommittee would begin work to define metrics.

- 5. C2E Challenge update\*\*** – Chair Shipek and Candice Rupprecht invited members and staff to participate in a C2E Challenge, a friendly competition to determine who can save the most water from May 1 through December 31. Chair Shipek asked members and staff to sign up for the Conserve 2 Enhance program and, using the online C2E dashboard, compare their historic water usage to their usage during the Challenge.
- 9. Future meetings and agenda items** – The next C&E subcommittee meeting will be held on May 11, 2016. Items proposed for discussion at future meetings included:
  - Chair Shipek requested that staff review the C&E draft conservation definition and metric document for discussion in May.
  - Member Lewis requested a discussion on the Water Now Alliance. He indicated that he would send additional information to the subcommittee.
  - Member Crow requested an in-depth discussion about new programs

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- Member Crow requested details of toilet replacements in Ward 5 due to the HET program. Mr. Ransom indicated that staff would provide maps and data to satisfy the request.

**10. Adjournment** – The meeting was adjourned at 4:59 p.m.

\*\* These items were discussed out of order



# TUCSON WATER'S ZANJERO PROGRAM

Zanjero (sahn-HAIR-oh) n. water manager

## Schedule a FREE Zanjero Audit

Contact (520) 791-3242 or  
TW\_CustomerService@tucsonaz.gov



(520) 791-4331  
(520) 791-2639 TDD



[tucsonaz.gov/water/zanjero](http://tucsonaz.gov/water/zanjero)



[youtube.com/tucsonwater](http://youtube.com/tucsonwater)



Scan

*For materials in an accessible  
format or in a language other than  
English, call Tucson Water.*

*Si usted desea esta informacion en  
Español, por favor, llame al  
(520) 791-4331.*



A FREE WATER  
AUDIT TO HELP  
YOU SAVE WATER  
AND MONEY

ZANJERO PROGRAM



## A Home Water Efficiency Program

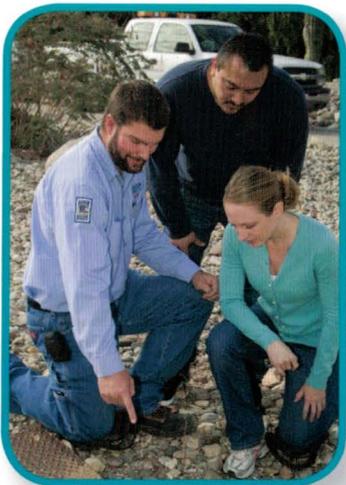
Tucson Water began its Zanjero Program in 1996 to offer its residential customers a free individualized water-use survey.

Tucson Water's specially-trained water efficiency experts – Zanjeros – will perform a comprehensive, two-hour inventory of your home water use including:

- how to locate and read a water meter
- an inventory of all water-using fixtures (dishwasher, clothes washer, water treatment systems, cooler, etc.)
- leak and flow rate inspections (bathroom, kitchen, utility room, etc.)
- an assessment of landscape areas and irrigation systems
- set and adjust irrigation controllers

Showerheads, aerators, and leaking toilet flapper valves will be replaced free-of-charge if needed.

You will receive the results of the analysis, along with information to help lower your water use and your water bills.



### What's Your Role?

- You must be a Tucson Water residential customer to participate in the Zanjero Program.
- You must be at home during your Zanjero water audit, which will be approximately two hours.

### Who is a Zanjero?

In the 1800s, southwest water users met each year to elect a Zanjero to see that water users irrigated fields according to the community-developed schedule. The Zanjero also ensured the canals were properly constructed and maintained so that water could flow to homes and farms. When water was scarce, the Zanjero had the authority to control its use for the benefit of the entire community.



### Schedule Your FREE Audit

Call (520) 791-3242 or e-mail  
[TW\\_CustomerService@tucsonaz.gov](mailto:TW_CustomerService@tucsonaz.gov)  
to schedule a free water audit.

AZ Time	Gallons	Cubic Feet
2/20/16 8:00 AM	0	0
2/20/16 7:00 AM	0	0
2/20/16 6:00 AM	0	0
2/20/16 5:00 AM	0	0
2/20/16 4:00 AM	0	0
2/20/16 3:00 AM	0	0
2/20/16 2:00 AM	0	0
2/20/16 1:00 AM	0	0
2/20/16 12:00 AM	0	0
2/19/16 11:00 PM	0	0
2/19/16 10:00 PM	0	0
2/19/16 9:00 PM	0	0
2/19/16 8:00 PM	0	0
2/19/16 7:00 PM	0	0
2/19/16 6:00 PM	0	0
2/19/16 5:00 PM	0	0
2/19/16 4:00 PM	0	0
2/19/16 3:00 PM	0	0
2/19/16 2:00 PM	0	0
2/19/16 1:00 PM	0	0
2/19/16 12:00 PM	0	0
2/19/16 11:00 AM	0	0
2/19/16 10:00 AM	0	0
2/19/16 9:00 AM	0	0
2/19/16 8:00 AM	0	0
2/19/16 7:00 AM	0	0
2/19/16 6:00 AM	0	0
2/19/16 5:00 AM	0	0
2/19/16 4:00 AM	0	0
2/19/16 3:00 AM	0	0
2/19/16 2:00 AM	0	0
2/19/16 1:00 AM	0	0
2/19/16 12:00 AM	0	0
2/18/16 11:00 PM	0	0
2/18/16 10:00 PM	0	0
2/18/16 9:00 PM	0	0
2/18/16 8:00 PM	0	0
2/18/16 7:00 PM	0	0
2/18/16 6:00 PM	0	0
2/18/16 5:00 PM	0	0
2/18/16 4:00 PM	0	0
2/18/16 3:00 PM	0	0
2/18/16 2:00 PM	0	0
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2/18/16 12:00 PM	0	0
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2/18/16 5:00 AM	0	0
2/18/16 4:00 AM	0	0
2/18/16 3:00 AM	0	0
2/18/16 2:00 AM	0	0
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2/18/16 12:00 AM	0	0
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2/17/16 8:00 PM	0	0
2/17/16 7:00 PM	0	0
2/17/16 6:00 PM	0	0
2/17/16 5:00 PM	0	0
2/17/16 4:00 PM	0	0
2/17/16 3:00 PM	0	0
2/17/16 2:00 PM	0	0
2/17/16 1:00 PM	0	0
2/17/16 12:00 PM	224.4	30
2/17/16 11:00 AM	254.32	34
2/17/16 10:00 AM	261.8	35
2/17/16 9:00 AM	261.8	35
2/17/16 8:00 AM	254.32	34
2/17/16 7:00 AM	246.84	33
2/17/16 6:00 AM	246.84	33
2/17/16 5:00 AM	254.32	34
2/17/16 4:00 AM	246.84	33
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2/17/16 1:00 AM	246.84	33
2/17/16 12:00 AM	246.84	33
2/16/16 11:00 PM	254.32	34
2/16/16 10:00 PM	246.84	33
2/16/16 9:00 PM	246.84	33
2/16/16 8:00 PM	246.84	33
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2/16/16 3:00 PM	246.84	33
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2/16/16 8:00 AM	246.84	33

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2/15/16 12:00 PM	0	0
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2/15/16 10:00 AM	119.68	16
2/15/16 9:00 AM	127.16	17
2/15/16 8:00 AM	119.68	16
2/15/16 7:00 AM	127.16	17
2/15/16 6:00 AM	119.68	16
2/15/16 5:00 AM	127.16	17
2/15/16 4:00 AM	127.16	17
2/15/16 3:00 AM	119.68	16
2/15/16 2:00 AM	127.16	17
2/15/16 1:00 AM	119.68	16
2/15/16 12:00 AM	127.16	17
2/14/16 11:00 PM	127.16	17
2/14/16 10:00 PM	119.68	16
2/14/16 9:00 PM	127.16	17
2/14/16 8:00 PM	127.16	17
2/14/16 7:00 PM	119.68	16
2/14/16 6:00 PM	127.16	17
2/14/16 5:00 PM	127.16	17
2/14/16 4:00 PM	119.68	16
2/14/16 3:00 PM	127.16	17
2/14/16 2:00 PM	127.16	17
2/14/16 1:00 PM	127.16	17
2/14/16 12:00 PM	119.68	16
2/14/16 11:00 AM	127.16	17
2/14/16 10:00 AM	127.16	17
2/14/16 9:00 AM	127.16	17
2/14/16 8:00 AM	119.68	16
2/14/16 7:00 AM	127.16	17

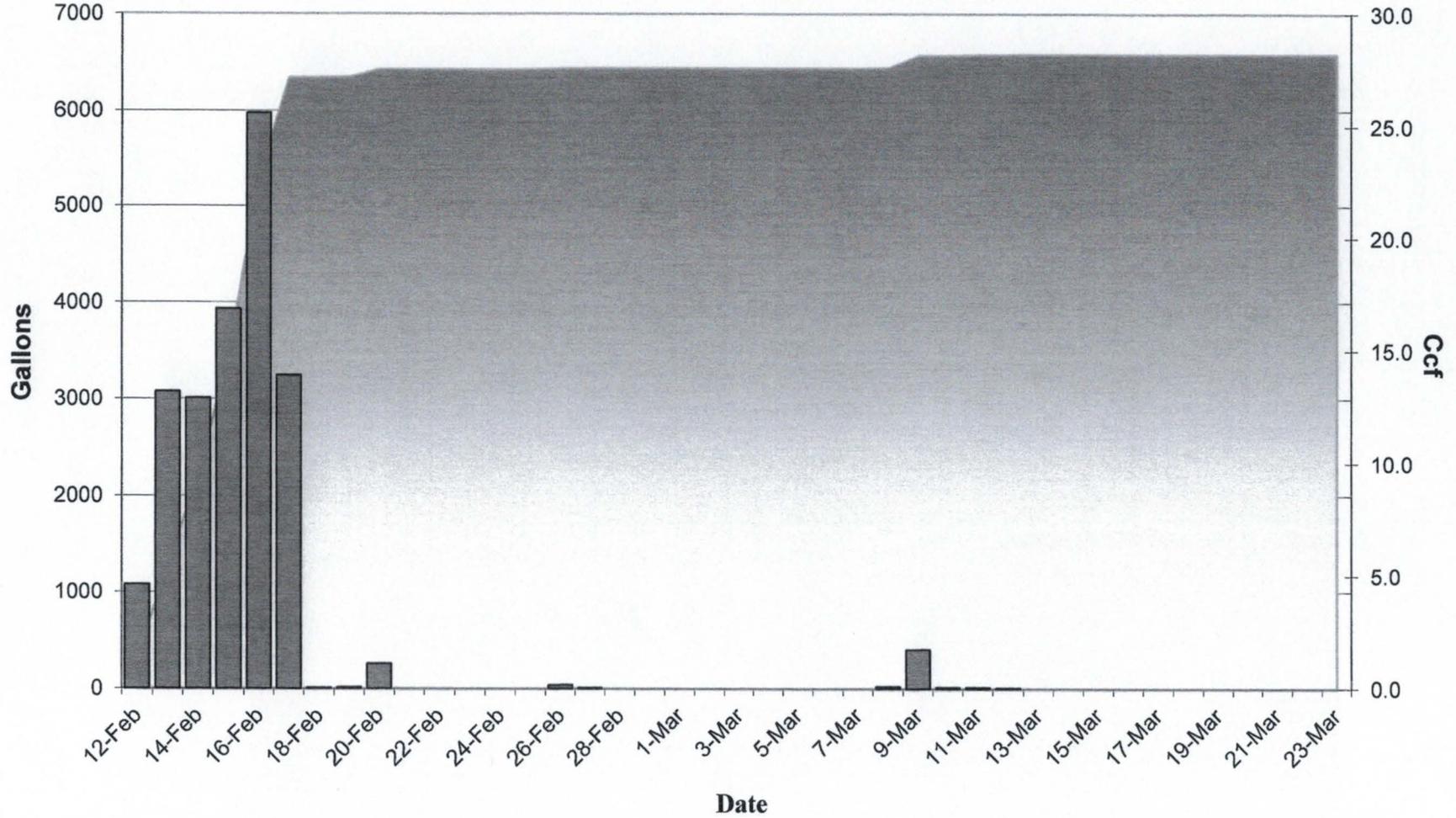
2/14/16 6:00 AM	127.16	17
2/14/16 5:00 AM	127.16	17
2/14/16 4:00 AM	127.16	17
2/14/16 3:00 AM	119.68	16
2/14/16 2:00 AM	127.16	17
2/14/16 1:00 AM	127.16	17
2/14/16 12:00 AM	127.16	17
2/13/16 11:00 PM	127.16	17
2/13/16 10:00 PM	127.16	17
2/13/16 9:00 PM	127.16	17
2/13/16 8:00 PM	127.16	17
2/13/16 7:00 PM	119.68	16
2/13/16 6:00 PM	127.16	17
2/13/16 5:00 PM	127.16	17
2/13/16 4:00 PM	134.64	18
2/13/16 3:00 PM	127.16	17
2/13/16 2:00 PM	127.16	17
2/13/16 1:00 PM	127.16	17
2/13/16 12:00 PM	127.16	17
2/13/16 11:00 AM	127.16	17
2/13/16 10:00 AM	127.16	17
2/13/16 9:00 AM	127.16	17
2/13/16 8:00 AM	134.64	18
2/13/16 7:00 AM	127.16	17
2/13/16 6:00 AM	127.16	17
2/13/16 5:00 AM	127.16	17
2/13/16 4:00 AM	134.64	18
2/13/16 3:00 AM	127.16	17
2/13/16 2:00 AM	127.16	17
2/13/16 1:00 AM	134.64	18
2/13/16 12:00 AM	127.16	17
2/12/16 11:00 PM	134.64	18
2/12/16 10:00 PM	127.16	17
2/12/16 9:00 PM	134.64	18
2/12/16 8:00 PM	134.64	18
2/12/16 7:00 PM	134.64	18
2/12/16 6:00 PM	134.64	18
2/12/16 5:00 PM	134.64	18
2/12/16 4:00 PM	142.12	19

# Daily Usage in Gallons and Cummulative Usage in Ccf

Address:

Account number:

2/12/16 4:00 PM TO 3/23/16 1:00 PM



# YOUR UTILITIES WASTEWATER

## ENVIRONMENTAL SERVICES

### Textiles or fabrics

Other textiles in your trash bin or fabric scraps, footwear, and landfills. You can recycle textiles. You can sell it at a garage sale, take it to the Salvation Army or a thrift store. Some shops and charities send them to be turned into eco-friendly rubberized playgrounds. None of your donated textiles

Here are some tools to help:

- Download the *My Waste* app at [www.my-waste.mobi/AZ-Tucson/](http://www.my-waste.mobi/AZ-Tucson/) to learn how to recycle and dispose of textiles and more.
- Click on the Recycling Directory at [www.tucsonaz.gov/es/know-where-to-throw](http://www.tucsonaz.gov/es/know-where-to-throw) and search on clothing. You'll find a list of 70+ resale stores, thrift stores, nonprofits and faith-based organizations with donation info.

## WASTEWATER RECLAMATION

...  
The toilet impacts our water quality, aquatic life, and the environment completely removed by the wastewater treatment process

plays an important role in the protection of our critical water while simultaneously protecting our children by reducing prescription drug abuse. It is an extremely effective example of Pima County and the City of Tucson working together to provide solutions for our community."



Jackson Jenkins, Director  
Wastewater Reclamation

For more information and disposal sites visit [www.disposeamed.pima.gov](http://www.disposeamed.pima.gov)



Like us on Facebook!

fees for your water, environmental services, and wastewater.  
Call (520) 791-3171 or visit [tucsonaz.gov/environmental-services](http://tucsonaz.gov/environmental-services)  
for more information. For more information contact the Department (PCRWRD) (520) 724-6500 or visit [www.pima.gov/wastewaterreclamation](http://www.pima.gov/wastewaterreclamation)

# ARE YOU WATER SMART?

During the summer, a pool will lose approximately \_\_\_\_\_ inches of water a week to evaporation.

- 2 inches
- 3 inches
- 4 inches

According to Tucson Water Zanjeros, a pool will lose approximately 2 inches of water a week.

Answer:



### Customer Question

How can I help Tucson win the National Mayor's Challenge for Water Conservation, April 1-30?

Go to [mywaterpledge.com](http://mywaterpledge.com) to make an online pledge to save water for Tucson in the 2016 National Mayor's Challenge for Water Conservation from the Wyland Foundation. Pledging is free, easy, and offers opportunities for prize drawings. There's no further obligation and you'll learn interesting information about sustainability. One pledge entry per e-mail address is allowed.



The Challenge is a friendly, nationwide competition. Go online and make your water pledge for Tucson and show why we are recognized nationally for our water efficiency.



# WATER MATTERS

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Water Smart: Quiz & Question 8

Meet Tucson Water Zanjero Orlando Ramirez, a water efficiency expert. He offers up info on home water audits and ways you can save water and inside and outside the home.

(See Working with Water, pg. 4 & 5)



# WORKING WITH WATER



Tucson native **Orlando Ramirez is a Tucson Water Zanjero**, a specially trained water efficiency expert who visits residential customer homes and performs a free home water use inventory. "I really love my job. It makes me feel good to know what I do makes a difference with customers. I educate people on how to save water and money." Ramirez offers up a slew of interesting info about Tucson Water's *Zanjero* Program:

**1. Zanjero** – pronounced *sahn-HAIR-o* – is Spanish for overseer of water supplies. In the 1800s, southwest water users elected a *Zanjero* to make sure that water was used for the benefit of the entire community.

**2. There are three Zanjeros** who conduct two to three water efficiency audits a day.

**3. Residential customers can schedule a free Zanjero** visit by contacting (520) 791-3242 or TW\_CustomerService@tucsonaz.gov. A customer must be at home during the audit.

**4. A water audit takes approximately two hours** depending on type of audit and the size of the property.

**5. Audits usually will have one of two goals:** educate the customer and investigate a high bill that's out of the norm. You'll receive written results of the audit, along with information to help you lower water use and reduce utility bills.

**6. Summer** – April through November – is the busiest season for water audits.

## A Free Zanjero Water Audit Includes

Reading and testing the water meter  
Conducting flow tests

Teaching you about your water meter  
Analyzing landscaping and irrigation system efficiencies

Setting the irrigation timer for the season  
Examining pool, spa and misting systems

Inspecting home water-use fixtures  
Detecting toilet leaks

Replacing showerheads, toilet flappers and aerators, if needed

Looking at home water treatment system  
Providing rebate and incentive info

**7. Leaky toilets are the biggest indoor water wasters.** A running toilet can cost someone thousands of dollars.

**8. Irrigation systems are the biggest outdoor** water wasters. I look at the type and age of the irrigation system, the soil, the plants, the season and timer settings.

**9. We use technology.** I use a handheld device to download the last 40 days of water usage from a water meter. I can review the info with a customer and email the file. I have a laptop to access data and print reports in the field.

**10. A great tip** – learn how to read your water meter to monitor flow and locate leaks. The water meter is the heartbeat of the property.

CLICK

tucsonaz.gov/  
water

WATCH



CALL

English & Español:  
(520) 791-4331

TDD

(520) 791-2639

SOCIAL



# WATER QUALITY INFO NET

YOUR WATER • CLEAN • CLEAR • SECURE

February 2016 – Main

To ensure your water is clean, safe and healthy, we test approximately 14,500 individual samples from the water distribution system – before it reaches your tap. We monitor 10 water quality zones for a wide

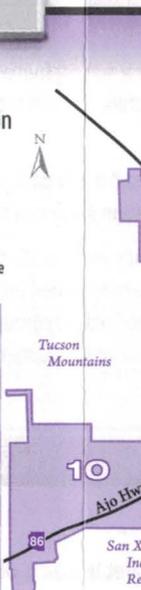
## Main Water System

About 95% of the water we deliver comes from renewable supplies. These test results reflect the main distribution system, divided into 10 zones:

## TEST RESULTS

Zones	Hardness (mg/L*) 80 SP	Sodium (mg/L*) 80 SP	Nitrate-N (mg/L*) 84 SP	Fluoride (mg/L*) 84 SP	pH Level (S.U.) 247 SP	Minerals (mg/L*) 247 SP	Temperature (deg°F) 247 SP
1	203	54	3.09	0.22	7.8	398	72.3
2	236	66	1.21	0.39	7.9	499	70.5
3	238	66	1.39	0.47	7.8	489	70.9
4	239	67	0.93	0.32	7.8	494	71.4
5	233	65	1.09	0.35	7.8	489	69.7
6	229	65	1.29	0.35	7.8	471	70.2
7	232	63	1.26	0.35	7.8	472	69.2
8	219	61	1.99	0.46	7.7	450	70.0
9	198	61	1.54	0.33	7.7	454	71.2
10	206	64	1.60	0.30	7.8	466	68.7
Avg	227	64	1.38	0.37	7.8	475	70.3

\* mg/L means milligrams per liter 1 mg/L = 1 teaspoon in 1,302 gallons  
S.U. = Sample Units deg°F = Degrees Fahrenheit



## COLIFORM

The U.S. Environmental Protection Agency (EPA) has primary standards for levels of coliform bacteria and the disinfectant chlorine.

EPA standards for positive samples  
Positive results 246 samples



# Conservation Limits Rate Increases for a Colorado Utility

**Demand Reductions Over 30 Years  
Have Dramatically Reduced Capital Costs**

NOVEMBER, 2013



## Authors

Stuart Feinglas  
Water Resources Analyst  
City of Westminster

Christine Gray  
Management Analyst  
City of Westminster

Peter Mayer, P.E.  
Principal  
Water Demand Management

## Why are my rates going up again?

“Why do you ask me to conserve and then raise my rates?” asked a concerned citizen at a public meeting in Westminster, Colorado in 2011.

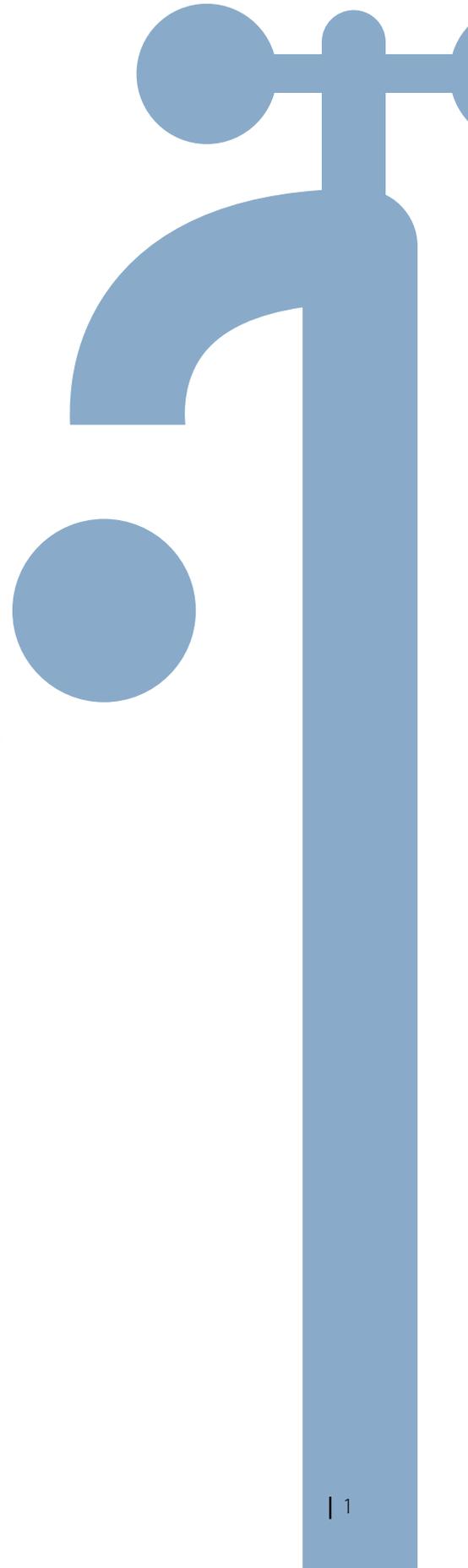
“Very good question,” pondered Westminster Utilities’ staff as they struggled with only limited success for a compelling answer. They knew water conservation has had a profound impact on the city by reducing demand, the amount of additional water needed to purchase and eliminating the need for expansion of facilities, but they didn’t have a good way to quantify the impacts and respond to the citizen’s question.

Similar tough questions have been posed to water utilities across the country as water and wastewater rates have increased faster than the Consumer Price Index (CPI) over the past 15 years, (Beecher 2013), (Craley and Noyes 2013). Managing the public response to and understanding of rate increases has taken on increasing significance in recent years as utilities grapple with the double edged sword of rising infrastructure costs and decreasing demands (Goetz M. 2013).

Rather than leaving the question of customer conservation and rates hanging without a satisfactory response, the Westminster staff decided to do some research to try and come up with some answers using data from their own system. The timing of the question was significant as the City is working towards completing a series of identified projects designed to meet the City’s needs at a projected buildout date of 2050 (using current and projected demands which include conservation).

To examine the impact of conservation on rates, the City looked at marginal costs due to the buildout requirements by removing conservation from the equation. The results of the City’s research were startling: Reduced water use in Westminster since 1980 has resulted in significant savings in both water resource and infrastructure costs, saving residents and businesses 80% in tap fees and 91% in rates compared to what they would have been without conservation.

The City’s research on water demands and rates since 1980 provided a useful response to the citizen’s question and revealed previously unexplored and under-appreciated benefits of long-term water conservation in reducing rate increases. Water rates in Westminster are much lower today than they would have been in the absence of demand reductions from conservation. Here’s how the City was able to reach this important conclusion.





## Change in Water Use

To explore the impacts of demand management on water rates and tap fees, Westminster staff examined water demand records, water rates, tap fees<sup>1</sup>, and capital project costs from 1980 through 2010 with the following question in mind: “What would our water rates and tap fees be today if per customer water demands remained unchanged since 1980?”. 1980 was chosen because it predated City related conservation programs and two levels of plumbing code related changes.

The first step was to examine water use patterns. To do this, Westminster staff examined water use patterns from 1980 – 2010 by taking total demand (all customer classes) and dividing by the best estimate of the service area population for each year. Westminster has a reclaimed water system that reuses treated wastewater for irrigation thus lowering the City’s impact on water

resources. To be conservative, reclaimed water was assumed to be a conservation measure. This consumption was added back into potable water use to reflect the full use of water without conservation. As shown in Figure 1 average gpcd, based on total City water use, was 21% higher 30 years ago, starting at 180 gpcd in 1980 and ending at 149 gpcd in 2010. Westminster attributes these changes in demand to three primary management factors:

1. Utility sponsored water conservation programs
2. The City’s inclining block and seasonal rate water billing structure
3. National plumbing codes implemented as part of the Energy Policy Act of 1992 (EP Act)

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<sup>1</sup> Tap fees, also called connection fees or development fees, are the costs paid by new customers to join the water system.

## Total Water Use Per Capita Since 1980

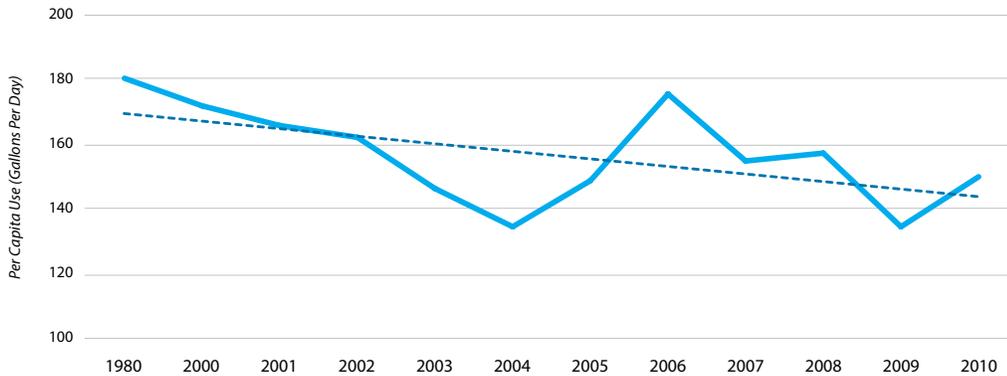


Figure 1: Average gpcd in Westminster, based on total water use 1980 – 2010

## New Supply Requirements and Cost

Once the changes in water demand were quantified, the Westminster staff were able to estimate what water use in 2010 would have been without the enactment of water conservation programs and policies. Through this analysis it was concluded that if per capita water use had not decreased by 21%, Westminster would have been required to secure an additional 7,295 acre-feet (AF) of additional water supply order to meet the customer demand while satisfying the City's reliability requirements.

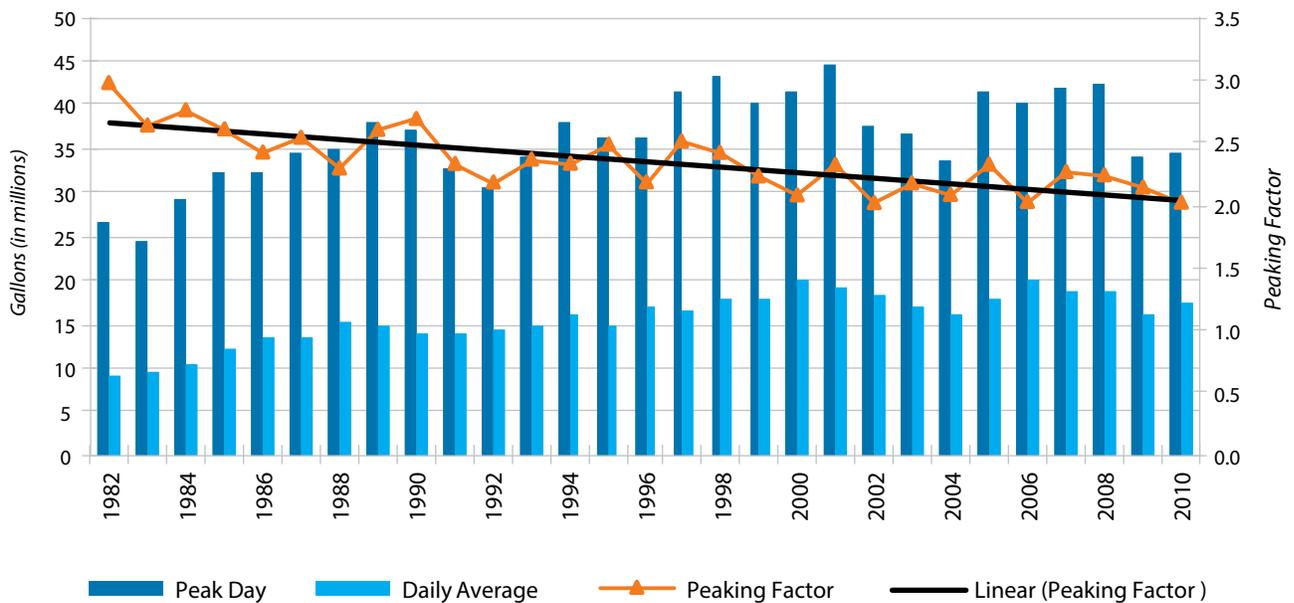
New water supply in Colorado's Front Range does not come cheap. Current market costs for new water supply average \$30,000 per acre-foot on Colorado's Front Range. Westminster pays close attention to the cost of new supply as it builds these costs into the tap fees of new customers so that the City can fully recover the expense of serving new customers without burdening existing customers with the cost of growth. The staff also concluded that had conservation from 1980 – 2010 not occurred, the City would have been competing with other water providers in the region to acquire more raw water, further tightening the market and making new water supply even more expensive. At this average price, the estimated cost of obtaining and delivering the required additional 7,295 AF of water would have required a capital investment of \$218,850,000. With this simple analysis alone, the cost savings associated with reduced water use became obvious, but staff realized this was only part of the story.

If per capita water use had not decreased by 21%, Westminster would have been required to secure an additional 7,295 acre-feet (AF) of additional water supply order to meet the customer demand.

## Additional Peak Demands and Infrastructure Costs

Peak demand in 2010 would also have been considerably higher had conservation not been implemented in Westminster over the past 30 years. The City has found that water conservation programs have altered irrigation patterns thus reducing the system’s peak day factor. In 1980 the peak to average day factor in Westminster was 3.0, but by 2010 changes in irrigation practices and reduced water demand cut the peak factor to 2.1 — a 30% reduction.

### Potable Water Production Peak Day, Daily Average, Peaking Factor



If 1980 demand levels had been perpetuated along with the 1980 peaking factor of 3, then the City’s peak requirement at buildout was estimated to be 52 MGD *higher* than the current planned maximum capacity. This level of peak demand would require the City to add an additional 52 MGD of treatment capacity at an estimated finished and installed cost of \$2,500,000 per MGD<sup>2</sup>. Developing the additional water treatment infrastructure to meet these higher demands would have required a capital investment by the City of approximately \$130,000,000.

2 Based on recent projects and engineering estimates

## Additional Wastewater Treatment Infrastructure Costs

If conservation were not taken and water demands had stayed at 1980 levels, staff determined that Westminster would have needed to add an additional 4 MGD of wastewater treatment capacity to their system. Adding wastewater treatment capacity costs the City an estimated \$5,000,000 per MGD<sup>3</sup>. Thus the additional 4 MGD of wastewater would have required a capital investment by the City of approximately \$20,000,000.

## Total Estimated Costs of Increased Demand

All estimated costs associated with the hypothetical increased demand were assembled into a single table and then the City added in the costs of debt financing charges which would certainly have been part of these capital construction projects, had they been implemented. As shown in Table 1, had the citizens of Westminster not reduced their water use, the estimated total cost to the City of the increased demand came to \$591,850,000 – more than half a billion dollars.



**Table 1: Estimated new infrastructure costs of increased demand**

Additional water treatment capacity	52 MGD total (\$2,500,000/MG)	\$130,000,000
Additional wastewater treatment capacity	4 MGD total (\$5,000,000/MG)	\$20,000,000
Additional water resources	7,295 AF total (\$30,000/AF)	\$218,850,000
Interest (on debt funding for all projects)*		\$223,000,000
<b>Total Costs</b>		<b>\$591,850,000</b>

\*For the purposes of this analysis it is assumed that debt would have been issued, and the resulting debt service would have been paid through rates. Those costs were included in the impacts to rates.

3 Based on recent projects and engineering estimates

Next the staff examined the increases in operating costs that the City estimates it would have incurred to handle the increased demand and associated additional infrastructure. While no additional staff personnel were assumed to be necessary, it was assumed that operating costs (power, chemicals, and other annual costs related to water and wastewater treatment, distribution and collection) would increase proportionally to the demand increases as shown in Table 2. From this analysis, it was estimated that Westminster would have incurred an additional \$1,238,000 per year on average in operating costs associated with the additional demand.

**Table 2: Estimated additional operating costs of new demand\***

Additional annual operating cost of water treatment facilities	21% increase	\$480,400
Additional annual operating cost of wastewater treatment facilities	20% increase	\$757,600
<b>Total estimated additional operating costs</b>		<b>\$1,238,000 per year</b>

*\*No additional staff personnel were added*



## Impact to Water and Wastewater Rates and Tap Fees

Once the cost estimates were completed, the question of how to recover the additional costs through rates and fees was examined. Westminster Utilities has just two sources of revenue that it must use to pay for all costs associated with running the water and wastewater systems: (1) Water and wastewater rates; and (2) Tap fees. In theory, water and wastewater rates are set by the City so that the revenue generated covers operations and maintenance of the system as well as some of the repair and replacement costs, and debt service. Tap fees are set to cover the costs of buying into the existing system based on current value plus any new infrastructure (capital projects), and water resources required by growth.

In practice, existing customers build the City's water and wastewater systems before new customers arrive so that growth can occur. Infrastructure must be planned for future demands and not constructed as needed. When new customers connect and pay their tap fees, current customers are reimbursed for their investment in the City's existing systems. Those funds pay for capital improvement projects including repair and replacement, thus reducing the costs to existing customers. Therefore, both rates and tap fees are impacted by the same projects.

Working from this basic division of costs between rates and tap fees, Westminster developed an estimate of what 2012 water and wastewater rates and tap fees for single-family customers would need to be to cover the additional costs incurred as a result of the hypothetical additional supply requirements. In 2012, the average single-family customer in Westminster paid a total of \$410 for water and \$245 for wastewater service. To cover the single-family sector's share of the additional annual costs associated with the increased demand considered in this analysis, the average single-family customer would have to pay an additional \$553 per year for water service and \$43 per year for wastewater service. The weighted average of these additional costs means that the average single-family customer would pay combined water and wastewater rates that are 91% higher than they are today if 1980-level water demands were perpetuated over the past 30 years. These results are shown in Table 3.



**Table 3: New single-family rates and fees required to pay for additional demand**

	Total Avg. Per Customer Charges in 2012	Additional Charges Required to Cover New Costs	New 2012 Annual SF Water/Sewer Bill	% Increase in Charges from Additional Demands
Water	\$410	\$553	\$963	135%
Sewer	\$245	\$43	\$288	17%
Total	\$655	\$596	\$1,251	91%

A similar analysis was conducted to examine the impact of increased demands on tap fees for new customers in Westminster. In 2012 the average tap fee for a new customer (residential and non-residential combined) was \$21,229, of which 77% was for water and 23% was for wastewater components. The combined cost of new infrastructure, new water resources, and repair and replacement associated with the increased demand modeled in this analysis would require an 80% increase in the average tap fee, up to \$38,181 as shown in Table 4.

**Table 4: New tap fees required to pay for additional demand**

	Avg. Per Customer Tap Fee in 2012	Additional Tap Fee Charges Required to Cover New Costs	New 2012 Avg. Tap Fee	% Increase in Charges from Additional Demands
Water	\$16,325	\$16,086	\$32,411	99%
Sewer	\$4,904	\$866	\$5,770	18%
Total	\$21,229	\$16,952	\$38,181	80%



## With Conservation Rates Go Up, But Not Nearly as Much

There is a commonly held belief in the water industry that declining per capita usage due to water conservation has “forced an increase to rates to account for fewer units of volume billed” (Craley and Noyes 2013). But the rate increases necessitated by conservation are actually much smaller than the rate increases that would be necessary to account for population growth in the absence of conservation. The 21% reduction in average per capita water demand that Westminster has experienced over the past 30 years has resulted in significant benefit to its customers and reduced the rate of increase in water and wastewater rates. While water and wastewater rates and tap fees have increased over that 30 year time period, they have increased much less than they would have. Customers in Westminster have avoided increasing their water rates by 99% and their wastewater rates by 18% had this level of water conservation not been achieved. New customers in Westminster have also avoided an 80% increase in water and sewer tap fees. Yes rates have gone up, but because of the costs associated with new water supply and infrastructure, they have gone up much less than they would have.

An answer to the citizen’s question about water conservation and rates had been found and the result was far more dramatic than the staff had anticipated. The next time a question was posed about the relationship between conservation and water rates, the Westminster staff was prepared with an answer: Water rates are going to increase with or without water conservation because the costs of operating and maintaining the water system continue to increase. However, water rates increase at a much slower rate if citizens conserve because the city does not need to purchase expensive new water supply and construct expensive new infrastructure. The net results of water conservation is a significant cost savings to the customer in water and wastewater rates and in tap fees.

Each water system is unique, so the results from Westminster may not be applicable to everyone. Utilities could perform a similar analysis to see the real value of conservation. However, the over \$590 million dollar cost associated with the additional 7,295 AF of demand reveals the significant hardship associated with expanding water resources supply and wastewater treatment infrastructure in today’s environment. The high cost also highlights the tremendous value that is inherent in a utility’s water treatment, wastewater treatment and delivery infrastructure. Imagine the cost of obtaining water rights and constructing an entire water supply system today. The cheapest water (by far) is the water we already have and the best way to keep rates and tap fees low is to conserve the water we already have. The cost of water to providers may vary by region but the cost of infrastructure remains more consistent. The least expensive infrastructure to build, operate and maintain is the infrastructure that isn’t needed in the first place. Conserve water or don’t conserve water – your rates will go up – but if conservation is the lowest cost source of new supply (and it almost always is) then your rates will go up less than they would have without conservation.

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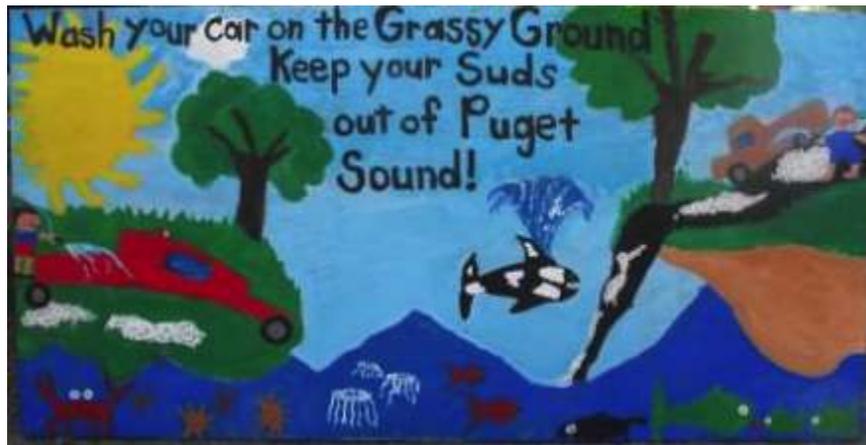
# Effectiveness of Public Education and Outreach Programs for Reducing Impacts of Stormwater on Rivers and Streams

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# Effectiveness of Public Education and Outreach Programs for Reducing Impacts of Stormwater on Rivers and Streams

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## Key Findings

- Many people in Puget Sound are very aware of stormwater issues and how they relate to the health of Puget Sound. Many are willing to do more and pay more to protect the Sound.
- Public education and behavior change programs work: behaviors can be changed and pollutants can be reduced.
- Increased awareness of an issue does not necessarily lead to a positive change in behavior; nonetheless, awareness may be a prerequisite for a successful behavior change program.
- Behavior change programs are more successful when they target specific behaviors and audiences.
- Studies are more likely to measure whether behavior has changed rather than whether the health of the water body has improved.
- The Puget Sound Partnership and King County have developed and tested indexes to identify target audiences and measure behavior change at a regional and local scale.

## Context for this Document

The Washington Municipal Stormwater Permits for Phase 1 and 2 jurisdictions require an education and outreach program that targets specific audiences to change polluting behaviors associated with, for example, yard care, storage of chemicals, pet waste, auto maintenance, and prevention of illicit discharges (Department of Ecology, 2012a,b).

The Stormwater Work Group (SWG) is a group of stakeholders representing local, state, and federal governments, environmental and business organizations, tribes, and agriculture. The goal of the Work Group is to reduce the harm caused by stormwater to the Puget Sound ecosystem. The SWG's Regional Stormwater Monitoring Program (RSMP) will be implemented through municipal stormwater permits.

During 2011-2012, the Stormwater Work Group identified 22 questions about the effectiveness of various stormwater management practices for reducing the impact of stormwater on water resources. To answer these questions, the Stormwater Work Group commissioned a series of literature reviews to evaluate which of those questions have already been answered. The purpose of this document is to provide just enough context in order to answer and evaluate the questions asked by the SWG. This document addresses 4 of the 22 effectiveness monitoring questions related to public education and outreach (See Appendix 1 for complete list of questions).

This document includes:

- 1) A description of how social marketing principles are used in public education and outreach;
- 2) Results from local surveys and research to answer the specific questions from the Stormwater Work Group about whether public education can reduce pollutants in stormwater, increase awareness about stormwater issues, and change negative behaviors;

- 3) Recommendations for future effectiveness studies; and
- 4) Descriptions of other groups working to change public behavior to reduce the impacts of stormwater in Puget Sound.

## Model for Behavior Change

In recent years, the ideas of social marketing have changed how public education is implemented (Allred et al., 2011). Social marketing has had a profound impact on social issues in the areas of public health, injury prevention, and the environment (Lee and Kotler, 2008). The guiding principles of social marketing are 1) allocate resources to change a specific behavior, 2) conduct activities aimed at the target audience, 3) test for the response of the audience, and 4) ultimately measure indicators in the environment to test for change (Figure 1). In California, stormwater permits are written using the framework of community based social marketing.

Many nonpoint sources of pollution in stormwater derive from common human behaviors; thus, there exists a huge opportunity to reduce stormwater pollution if a large number of people make even a small change in their behavior. Earlier models of public education were based on the idea that if people knew more about the issues, they would make rational decisions that are good for the environment.

The new idea is to change behavior by identifying the barriers to change and working to remove the barriers. Behavior change campaigns tailored specifically to people that are performing negative behavior are more effective than a scattershot approach to everyone. Research has shifted away from understanding the problem, toward identifying which behaviors cause the biggest problems, and which people are doing them. Social marketing emphasizes the value of knowing your target audience, that is, what is important to people whose behavior you want to change (Ryan, 2009). This conceptual model is the foundation for many of the documents reviewed here.

### Example of Social Marketing Model for Fundraiser Car Washes

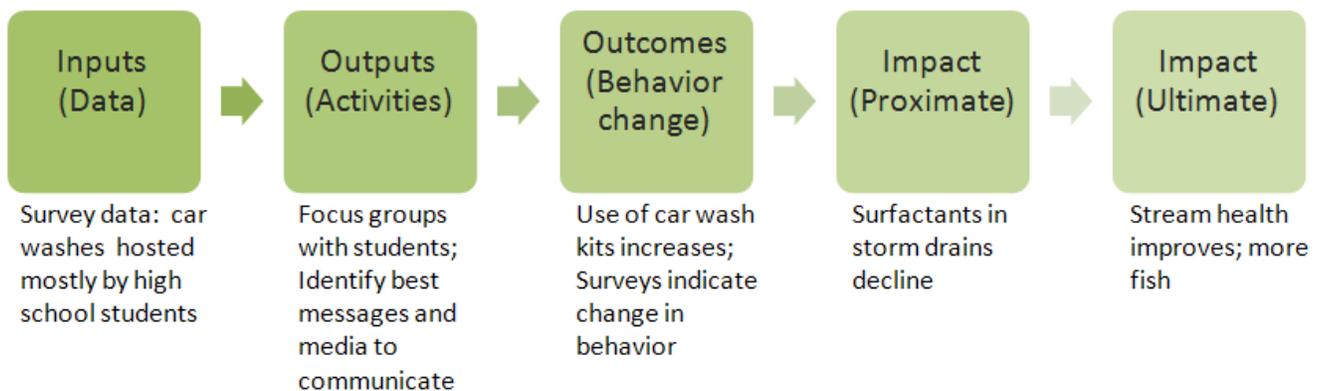


Figure 1. Social marketing model with example activities for fundraiser car washes.

## Testing for Effectiveness of Behavior Change

There are multiple points in a (simple) model of behavior change where we can test for the effectiveness of public education and outreach programs (Figure 1). As an example, fundraiser car washes can result in hundreds

of gallons of untreated water going in to storm drains. At the output step, we can evaluate whether planned activities were successful, specifically, did people read or hear the message and understand it. At the outcome step, changes in behavior are typically reported. Surveys are often used and people are asked to about their behavior. One caveat here is that self-reported data can be overly optimistic (Taylor and Wong, 2002). At the other end of the model, detecting a change in stream health can be challenging because of the many influences in a watershed. For this reason, intermediate outcomes are often best because they avoid self reporting bias and provide an objective measure of effectiveness. Intermediate outcomes include counting the number of car washes that use kits to prevent waste water from going down the drain.

## **Prioritizing Behaviors for Change**

For a single identified problem, this approach is straightforward although not necessarily simple. For a multidimensional problem like stormwater, a larger frame may be needed to first select among the various behaviors that affect stormwater. A project in Ontario to reduce phosphorus in agricultural waterways provides an example of a simple, structured approach to prioritize behaviors (Lura Consulting, 2010). For this study, at the input step, a literature review identified all sources of phosphorus related to local farming practices. An expert panel shortened the list according to how widespread the negative activity was and the amount of impact a change in behavior was likely to have. At the output step, focus groups of farmers prioritized the list of behaviors according to potential barriers and benefits. Finally, they created a graphic plot with impact on streams as one axis and probability of behavior change as the other. The highest scoring behaviors were targeted with additional education programs.

The WRIA 8 Salmon Recovery Council used a similar approach to prioritize public behaviors for change programs by first developing a rough ranking of the behaviors most important to salmon recovery and next ranking behaviors according to how easy they are to change (Sage Enviro, 2009a). From this matrix they developed specific behavior change activities for target audiences.

Worth noting here is that the list of possible behaviors developed for WRIA 8 salmon recovery was more inclusive and more tightly connected to the ultimate desired outcome of healthy watersheds than a list of possible behaviors typically derived from stormwater permits. The regulatory framework of the Clean Water Act has historically focused on water quality parameters such as nutrients and bacteria. In contrast, the Endangered Species Act has a greater focus on habitat. Within the context of Chinook recovery, WRIA 8 stakeholders identified key outcomes related to landscape design of shorelines, native plantings, and removal of invasive plants, along with outcomes more typically associated with stormwater management (Sage Enviro, 2009b).

The questions developed by the Stormwater Work Group for this project reflect the historic emphasis on water quality measures even though the Clean Water Act's goals emphasize protection of the "chemical, physical and biological integrity" of rivers and streams. Thus, behaviors related to habitat management might also be considered for public education.

## **Answering Questions from the Stormwater Work Group**

The questions about effectiveness monitoring developed by the Stormwater Work Group represent a successful process to work as a group to make regional decisions about stormwater management based on the best available science and the professional expertise of group members.

This document is organized to align with the questions posed by the Stormwater Work Group. Each of the four general questions is addressed first and followed by responses to the more specific questions in each section. For the more specific questions, I document whether the question has been answered already, whether it is the

right question to ask, and how we might ask a better question. Under each question I review related journal articles and local, unpublished reports prepared by regional consultants and stormwater professionals that address the topic of the question.

### 3. Does public education decrease pollutants in stormwater?

This is a great question that has not been well answered. Two studies documented a reduction in nutrients as a result of lawn owners changing their behavior (see question 3.b. below). Another study showed that bacteria declined significantly in a Kitsap County stream as a result of an education campaign (see question 9.b. below). In WRIA 8, stakeholders are designing studies to connect human behavior with changes in stream condition at a watershed scale, but results are not yet available.

In general, the effectiveness of public education campaigns is typically measured in terms of behavior change rather than the ultimate impact of the project on stream health. In the language of social marketing, measures of effectiveness are typically done for *outputs* rather than *outcome* (see Figure 1). When testing for the effectiveness of an education program, change in behavior is typically measured. Measures are usually based on surveys where people self-report their behavior. Taylor and Wong (2002) caution that self-reporting can be overly optimistic and that direct measures of behavior are more reliable.

It is both difficult to measure and to compare the relative effectiveness of nonstructural best management practices (BMPs) such as public education, city planning, and regulatory ordinances. Taylor et al. (2007) note that there is very little published guidance for measuring the effectiveness of nonstructural BMPs.

A recent assessment of stormwater needs for Puget Sound municipalities found there was not enough information available to evaluate the effectiveness of public education programs at the level of the stream (Bissonnette and Parametrix, 2010). Measuring the effectiveness of public education is an emerging field of research with great opportunities to make an impact.

#### *a. Are fecal coliform levels in stormwater reduced after pet waste education?*

This is a good question about outcomes and I found no studies that tested for a decline in fecal bacteria as a result of pet waste education.

Regional surveys of behaviors indicate that dog owners dispose of waste properly most of the time. A survey of 2000 Puget Sound residents found that 87% of dog owners usually or always pick up dog waste and 45% usually or always put it in the trash (PSP, 2012b). A similar survey in King County found an increase in proper dog waste disposal from 52% in 2008 to 74% in 2011 (Tarnai, 2011). From a survey of Kitsap County residents, about half of dog owners pick up waste every time while walking (54%) and others pick up most of the time (19%). Answers to these questions did not change from 2008 to 2011 (CEC, 2011a). A seven-city survey in Puget Sound found that 90% of dog owners reported they always pick up dog waste (Klima and Buttenob, 2009). Results from these surveys indicate that residents of more urban areas were more likely to dispose of dog waste properly than residents of rural or suburbanizing areas.

#### *b. Are nutrient levels in stormwater reduced after natural yard care education?*

Two studies compared nutrient levels in stormwater drains after phosphorus fertilizers were restricted. In a before/after study design, Lehman et al. (2009) documented the effects of public education programs and a city ordinance banning lawn fertilizer in Ann Arbor, MI near the Huron River. Within one year of the ban, they documented a 28% decrease in phosphorus loading measured at stormwater drains. Results were based on weekly samples from May to September. A similar study in Minnesota used paired watersheds to test whether restricting the use of fertilizers containing phosphorus reduced phosphorus in stormwater (Vlach et al., 2010). For watersheds with fertilizer restrictions, the study documented a significant reduction (25%) of phosphorus as

measured by stormwater concentrations in the catch basin. Data comparison was complicated because concentrations had to be adjusted for flow, impervious cover and watershed size.

A related study in Ontario looked at phosphorus reduction in an agricultural setting (Lura Consulting, 2010). This study is a very good example of community-based social marketing techniques and includes an excellent example of how to prioritize behaviors for change. Scientific experts identified sources of phosphorus and their relative impact. Farmers with the most potential for reducing phosphorus use (the target audience) were identified and they developed a list of possible behaviors to reduce phosphorus. The list of behaviors was ranked according to the potential impact on phosphorus reduction and the probability of the preferred behavior being adopted. Unfortunately, the effectiveness of the program, which included education, workshops and individual contact, has not been reported.

Here in Puget Sound, a survey of 2000 residents found that 51% report that they never or seldom use fertilizer (PSP, 2012b). In Kitsap County, self-reported chemical fertilizer use declined dramatically from 52% in 2008 to 21% in 2011; use of Weed and Feed also declined from 54% to 40% (CEC, 2011a). In King County, a similar survey found an even more dramatic decline in reported use of chemical lawn fertilizer with 84% of respondents saying they never use chemical lawn fertilizer compared to 11% in 2005 (Tarnai, 2011). Changes in behavior indicate that education and social marketing programs were effective in King and Kitsap Counties.

*c. Are pesticide concentrations and number of hits reduced in an urban stream after general awareness?*

This is a good question about outcomes. I found no studies that directly tested the link between changes in pesticide concentrations and public education. However, a recent report tested for changes in pesticide concentrations in urban and agricultural watersheds and found significant decreasing trends for some pesticides in Thornton Creek, an urban creek in King County. Although the study did not relate observed changes in pesticide use to public education efforts, outreach and behavior change programs are ongoing in Seattle.

A regional survey of 2000 Puget Sound residents found that a majority of yard or garden owners seldom or never use pesticides (78%) or weed killer (65%; PSP, 2012b). A survey of Kitsap County residents found a dramatic decline in pesticide use from 74% in 2008 to 16% in 2011; clearly, whatever methods are being used in Kitsap County are effective (CEC, 2011a). A seven-city survey of 700 residents found that nearly all (97%) respondents reported that they applied insecticide and weed killer at the recommended rates, but did not ask how often they were applied or how many used them (Klima and Buttenob, 2009).

On a related note, Washington State Department of Agriculture planned to mail surveys about pesticide use to 15,000 Puget Sound residents in February 2013 to evaluate how they are used.

*d. Does establishing a spill hotline result in reduced stormwater pollutants?*

This is a good question about outcomes; I found no studies that related a spill hotline to concentrations of stormwater pollutants.

A 2009 survey of residents in seven cities of Puget Sound found that 34% did not know who to call to report illicit discharges (Klima and Buttenob, 2009). To determine what type of information is needed, Kitsap County funded a study to interview focus groups (N = 21 people) about their use of a Stormwater Hotline (CEC and GRG, 2008). They showed them examples of educational materials and asked them to rate what types of information would be most effective. When asked what would make them change their behavior of not reporting spills, they said the most compelling messages were related to children safety or public health.

Kitsap County established the Water Pollution Hotline and received 118 calls from citizens and municipal staff in 2009-2010. Of these calls, 79% (93) were confirmed to be an illicit discharge (Fohn et al., 2011). A

more recent survey of Kitsap County residents found that although most would report a spill (76%), many do not know the correct number to call (CEC, 2011a). Other respondents didn't know what to do or would probably do nothing.

*e. Does fundraiser car washing education reduce surfactants in stormwater?*

This is a good question about outcomes. Behavior and attitudes about car washing have changed in recent years, but I found no studies that evaluated whether surfactants have been reduced.

The preferred behavior is to use a commercial car wash that treats the wastewater; second best is to wash on the grass or use a car wash kit to capture the run-off. A survey of Puget Sound residents found that 77% of respondents know that washing cars on the street is harmful; and 60% report that they seldom or never wash cars on the street (PSP, 2012a,b). A similar survey in King County found a steady increase in appropriate car washing from 54% to 62% from 2005 to 2011 (Tarnai, 2011). Although the number of people who washed cars at home in Kitsap County increased (from 58% to 75%), the good news is that the number who let waste water run to the street or a storm drain decreased by 21% (from 47% to 26%; CEC, 2011a).

Fundraiser car washes continue to be popular. A recent phone survey of ~800 residents of Kitsap County found that 55% of respondents use them and that number did not change from 2008 to 2011. Nonetheless, there was a big change in attitude: an increase of 22% of respondents thought car washes should be restricted to places where the stormwater and run-off is treated (42% to 64%; CEC, 2011a).

Issaquah, Bellevue, Woodinville, Reston, and Redmond lend car wash kits to charity events and businesses (Sage Enviro, 2009b). Bellevue found too much human error associated with the kits and Redmond is currently evaluating their program. One problem with fundraiser car washes is that 67% of people surveyed believe that biodegradable soap is safe to use for washing cars on the street, it's not (seven-city survey, Klima and Buttenob, 2009)

## **9. Does public education increase awareness and change behavior?**

The answer is yes. The peer-reviewed literature broadly supports the idea that public education is effective (Taylor and Wong, 2002). As an example, in Puget Sound a recent survey found that 96% of 2000 respondents reported that they never flush chemicals such as paint thinner down the drain; and 94% never flush prescription drugs (PSP, 2012b). Past education campaigns for these issues, such as *Puget Sound Starts Here*, were obviously effective.

Residents of Puget Sound are also highly aware of stormwater problems and how they threaten the health of Puget Sound. A survey of 2000 residents in Puget Sound found that 61% believe that clean up is urgent (PSP, 2012a). A majority of respondents know that lawn chemicals (89%), car washing on the street (77%), weed and feed (77%), and leaving dog waste (63%) are all harmful to Puget Sound (PSP, 2012a). Demonstrating a similar knowledge of local issues, a focus group in a Kitsap County study was able to name all the behaviors associated with stormwater runoff problems (CEC and GRG, 2008).

Two recent studies document a change in Puget Sound residents' attitudes and behaviors. When residents of Kitsap County were surveyed in 2011, they showed a 33% increase in awareness of ways that people can prevent water pollution since 2008 (40% to 73%; CEC, 2011a). Clearly education campaigns are increasing awareness.

Experts emphasize that awareness is not equal to behavior change; nor is a change in awareness a good predictor of a change in behavior (PSP, 2012a; Taylor and Wong, 2002). For example, in Pierce County no relationship was found between awareness of the correct behavior and the actual behavior related to lawn chemicals and lawn care (Elway, 2009). The reverse is also true, people may do the right behavior without

knowing why it's the right thing to do. For example, small business owners can reliably be taught not to put pollutants down the storm drain without knowing that stormwater is untreated (CEC, 2011b).

For these reasons, public surveys have shifted to questions about specific behaviors rather than attitudes. A comparison of responses by ~800 Kitsap County residents from 2008 to 2011 found that self-reported chemical fertilizer use declined dramatically (31%); pesticide use declined dramatically (47%); and organic fertilizer use increased (12%; CEC, 2011a). Car washing behavior also changed with more respondents washing cars away from storm drains and streets. In King County a similar survey of ~2000 residents showed a dramatic decline in the reported use of chemical lawn fertilizer (73%) from 2005 to 2011; and a 22% increase in dog owners who always pick up waste (Tarnai, 2011).

Puget Sound Partnership's recent regional survey identified a group of respondents described as "ready and willing." They represented 50% of respondents and agree that Puget Sound is in poor condition and it's going to get worse. They believe clean up is extremely urgent and they know what's harmful to water quality and want to do all they can to protect the environment (PSP, 2012a). Furthermore, 83% of respondents agreed with the statement that one person's actions can make a difference. These are the people who could be asked to do more.

*a. What is the change over time of various target audiences willing to make a simple change in their daily lives to help Puget Sound?*

This question is very general; a better question would focus on specific behaviors and whether there has been a change in the behavior, rather than the willingness to change.

A survey of Pierce County 700 residents found that 43% of respondents were willing to change their behavior to prevent water pollution even if it involves sacrifices; another 40% were willing to make changes if they are easy (Elway, 2009). In Snohomish County, a survey of 400 residents found that 78% were willing to do more to reduce their impact on rivers and streams (33% very and 43% somewhat willing); however, many were not sure what to do (Grove Quirk Insight, 2002). Focus groups were not effective in that learning about problems did not change participants' willingness to do more.

*b. What is the change over time of various target audiences willing to invest over \$1,000 to make a change in their property to help Puget Sound?*

This question is very general and not focused on a specific behavior change. I found no surveys of the change in residents' willingness to pay a specific amount to change their property. Related surveys suggest that respondents are willing to pay more money to protect Puget Sound. A survey of Puget Sound residents in 2008 found that 46% of respondents were willing to pay more to clean up Puget Sound (Elway, 2008). In Pierce County, a survey of 700 residents found that most respondents (60%) support additional fees for surface water management projects (39% somewhat supportive and 21% strongly supportive; Elway Research, 2009).

A survey of small business owners found they were not interested in applying for grants or being provided with government help to make structural changes (CEC, 2011b). Many small contractors don't want to be involved with government programs and prefer to keep a low profile. In contrast, small farmers in Kitsap County pursued grants and funding to clean up animal waste and the result was a measureable reduction of fecal bacteria in Dogfish Creek (Puget Sound Action Team, 2005).

*c. What is the change over time of car owners to fix leaks?*

This is a good question because it focuses on specific behavior that can be measured. I found no studies that compared the change in this behavior over time. In a survey of 1800 residents of King County, the majority reported in 2011 that they always fix car leaks (67%) and others sometimes fix car leaks (10%; Tarnai, 2011). A

similar survey of 900 people living in seven cities in Puget Sound found that 90% of respondents reported that they fix car leaks within three weeks (Klima and Bittenob, 2009). Stormwater Outreach for Regional Municipalities (STORM), City of Seattle, King County ECO Net, and the Puget Sound Partnership are actively working on this issue.

*d. What is the change in stormwater drain awareness of various business sectors involved in commercial property maintenance inspections?*

This question asks about awareness rather than behavior change. A better question would be: What types of educational materials are successful in promoting the desired changes in behaviors?

A summary of programs targeting businesses was reviewed by CEC (2011b) for Kitsap County. The study addressed social marketing strategies for grocery stores, mobile painters and cleaners, automotive businesses, and restaurants. Several studies asked participants about which types of education are most effective. Simple graphic posters and photographs of the preferred behaviors were rated most highly. Interviews and focus groups support the idea that these methods are more effective in changing behavior because many small businesses are hard to reach with mailed or written materials, workshops, or offers of grants to make changes (CEC, 2011b). The review did not clarify which businesses are involved in property maintenance inspections.

*e. Does a fundraiser car wash education program decrease the number of fundraiser car wash events?*

Behavior and attitudes about car washing have changed in recent years, but it's not clear if the actual number of car washes has declined. See more detail about car wash behavior above under question 3.e.

## **16. Does public education of lake property owners reduce summer algae blooms?**

*a. Are summer algae blooms due to excess runoff or recycling of nutrients?*

This question is somewhat outside the scope of this review; however, a recent review by Schindler (2012) summarizes the evidence for causes of eutrophication and concluded that the only proven way to reduce algal blooms is to reduce the input of phosphorus. The Department of Ecology agrees that for Western Washington lakes, phosphorus is generally implicated more than nitrogen in algal lake blooms. The good news is that it may not be necessary to reduce nitrogen as well, which can be more difficult to eliminate than phosphorus. On the legislative side, in 2011 Washington State passed the "Clean Fertilizers, Healthier Lakes and Rivers" legislation (ESHB 1489) into law. The legislation manages the sale of phosphorus in fertilizers.

*b. Can education and prevention of phosphorus loads from runoff influence the frequency and duration of lake algae blooms?*

This question goes right to the ultimate desired outcome, reducing lake algal blooms. I found no studies that directly measured the impact of education on algal blooms. On related topics, other studies evaluated the impact of education programs to reduce phosphorus in urban areas and farms. See detail on phosphorus reduction under Question #3.b. above.

## **17. Does storm drain stenciling increase awareness about untreated stormwater?**

*a. What is the level of awareness of adjacent land owners to storm drain stencils compared to landowners with no storm drain stencils?*

This is a very general question, and assumes that an increase in awareness will cause a change in behavior. One study found that some people assumed all unmarked drains meant the stormwater was treated. Fortunately,

most people (>75%) in Puget Sound know that that they should not use lawn chemicals or wash cars on the street (PSP, 2012a), even if they don't know precisely why. A seven-city survey found that only 44% knew that most stormwater is untreated (Klima and Bittenob, 2009).

A better question about the effectiveness of monitoring would be more specific and measure closer to the outcome. For example, Do people living near stencils put fewer chemicals in the drains? Or, Are fewer chemicals found in stenciled drains? Or, ultimately, Are nearby water bodies healthier? The reality is that testing for these types of affects are expensive while funding a volunteer drain stencil effort is relatively cheap and creates other benefits such as community engagement (Taylor and Wong, 2003).

## **Regional Connections – Groups Working on Behavior Change**

Stormwater Outreach for Regional Municipalities (STORM) is a coalition of city and county governments that is working with Puget Sound Partnership to design and manage behavior change programs. Membership includes more than 50 municipalities, both Phase 1 and Phase 2 permit holders. Their mission is to improve surface water quality by reducing non-point source pollution. STORM fulfills this mission by advancing public behavior change through the promotion of targeted, measurable actions. STORM is working to create a “menu” of options for specific pollutants and behaviors so that new programs can take advantage of lessons learned from programs that are working.

The Puget Sound Partnership has developed a Sound Behavior Index and a Social Capital Index to measure change in behavior and attitudes every two years. The Sound Behavior Index measures 29 behaviors related to yard care, vehicles, home maintenance, pet waste, septics, livestock and boats. The Social Capital Index includes 35 measures related to trust in people and groups, trust in government, public affairs, participation, social media, and feelings about self.

The Puget Sound Partnership formed ECO Net (Education, Communication and Outreach Network) which is a Sound-wide network devoted to building and strengthening relationships among organizations committed to enhancing public awareness, involvement and environmental education. ECO Net's membership is comprised of teachers, program coordinators, public outreach specialists, and volunteers. These groups work on a variety of behavior change projects, many are related to stormwater.

The Stewardship Program at Puget Sound Partnership is compiling literature regarding the scientific basis, usage and public perceptions of Weed and Feed. They will launch a behavior change initiative related to lawn care and pesticide practices this year.

The Department of Ecology uses Chemical Action Plans (CAPs) as the vehicle to reduce threats caused by toxic chemicals and metals. Current CAPs rely partially on behavior change programs to be successful, e.g., addressing lead paint, reducing engine idling and woodstoves, fixing automobile drips, reducing mercury use, and reducing backyard burning.

In their Three-Year Work Plan, the WRIA 8 Salmon Recovery Council identified 10 priority activities to support outreach and education programs and incentive-based support for land use and habitat protection regulations representing a \$15 million funding need.

The Modeling Work Group of the Puget Sound Ecosystem Monitoring Program (PSEMP) includes members that have extensive experience with regional models. They could be a resource for understanding the relative importance of nutrients and toxics in stormwater.

## Recommendations

1. Recognize the importance of public education and the potential impact at a regional scale of a small behavior change made by a large number of people. Recognize that a large percentage of people are “ready and willing” to do more.
2. Define the desired behavior change, determine who needs to change, identify benefits and barriers to change, remove barriers and test for changes in behavior. Work with experts to create a targeted communication campaign (Clark, 2012).
3. Identify objective, intermediate measures that can be used to measure the effectiveness of public education and behavior change programs. An example of an intermediate measure for proper disposal of dog waste could be counting the number of free dog waste bags used in public places
4. Partner or coordinate with STORM and other existing public education programs to 1) measure the effectiveness of ongoing programs or 2) design new projects that complement (and do not duplicate) existing education and outreach efforts.
5. Build on the framework of the Sound Behavior Index; specifically, assess changes in attitudes and behavior using measures of the index, target specific audiences using existing data, and frame effectiveness monitoring questions to support ongoing, regional education campaigns.

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*Note: Many of the unpublished results of surveys, focus groups, and local research can be found on the Puget Sound Partnership's web site:*

[http://www.mypugetsound.net/index.php?option=com\\_mtree&task=listcats&cat\\_id=104&Itemid=326](http://www.mypugetsound.net/index.php?option=com_mtree&task=listcats&cat_id=104&Itemid=326). Special thanks to Emily Sanford and Dave Ward (Puget Sound Partnership) for gathering many of these materials from diverse sources and posting them. The web site is being updated and the easiest way to find these titles is to search with Google.

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## Appendix 1. Effectiveness Study Topics and Questions from the Stormwater Work Group

Stormwater management topics related to public education and outreach and their relative rank of importance compared to all the proposed effectiveness study topics. Out of a total of 22 ranked topics, 4 were related to public education and outreach. Shown also are questions related to each topic.

Rank	Effectiveness Study Topic Null Hypothesis (H <sub>0</sub> )	Potential Questions that could be addressed by an RFP
3	Permit-required public education programs do not result in decreased levels of pollutants in stormwater.	<ul style="list-style-type: none"> <li>• Are fecal coliform levels in stormwater reduced after an extensive pet waste education program?</li> <li>• Are nutrient levels in stormwater reduced following an extensive natural yard care education program?</li> <li>• Are pesticide concentrations and number of hits reduced in an urban stream following general awareness?</li> <li>• Does establishing a spill hotline result in reduced stormwater pollutants?</li> <li>• Does a fundraiser car washing education program result in reduced surfactants in stormwater?</li> </ul>
9	Permit-required public education programs promoting behavior change do not result in increased awareness and behavior change.	<ul style="list-style-type: none"> <li>• What is the increase or decrease over time of various target audiences willing to make a simple change in their daily lives to help Puget Sound?</li> <li>• What is the increase or decrease over time of various target audiences willing to invest over \$1,000 to make a change in their property to help Puget Sound?</li> <li>• What is the increase or decrease over time of car owners to fix leaks?</li> <li>• What is the increase or decrease in stormwater drain awareness of various business sectors involved in commercial property maintenance inspections?</li> <li>• Does a fundraiser car wash education program decrease the number of fundraiser car wash events?</li> </ul>
16	Public education of lake property owners about residential pollutants will not reduce summer algae blooms.	<ul style="list-style-type: none"> <li>• Are summer algae blooms due to excess runoff or recycling of nutrients?</li> <li>• Can education and prevention of phosphorus loads from runoff influence the frequency and duration of lake algae blooms?</li> </ul>
17	Storm drain stenciling does not raise awareness about where stormwater goes or that it is not treated.	<ul style="list-style-type: none"> <li>• What is the level of awareness of adjacent land owners to storm drain stencils compared to landowners with no storm drain stencils?</li> </ul>

Home

## Dashboard

[upload billing data](#)

### March 2016 Water Use Report



**748 Gallons**  
Water Saved

**1,496 gal.**  
March Use

**2,244 gal.**  
Baseline Use

**25 gal./day**  
Current  
Indoor Use

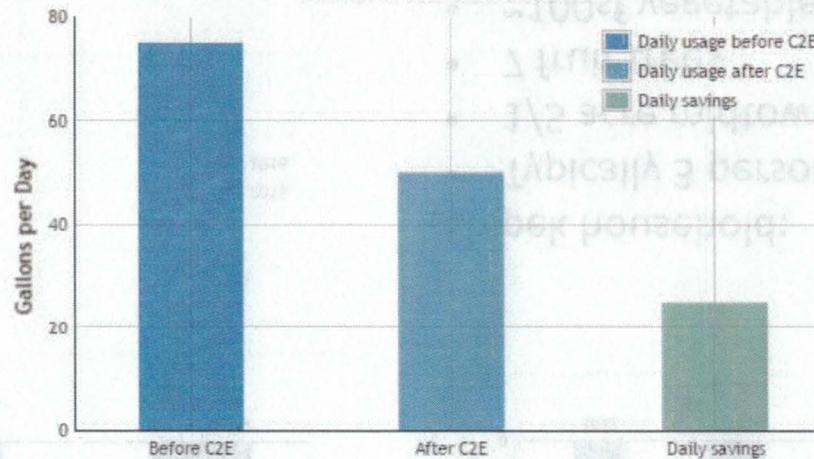
**25 gal./day**  
Current  
Outdoor Use

**51,553 gal.**  
Total Savings  
Since Joining

**748 gal.**  
Next Month's  
Use Target

You can save more water indoors. Check for leaks! Visit [How to Conserve: Indoors](#) for efficiency tips.

### Change in Daily Water Use



### Donation Summary

**\$80.00** donated since joining C2E.

You have an active recurring donation of

**\$10.00** every month.

Based on your savings, we suggest a **\$8.00** donation this month.

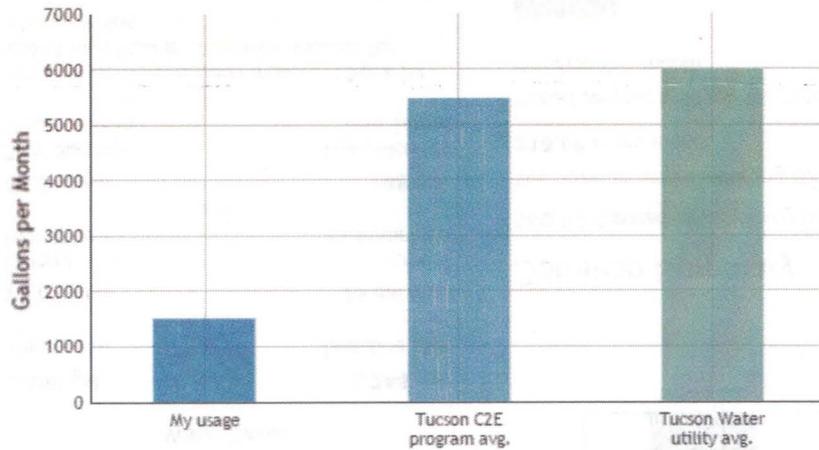
[Donate](#)

### Conservation Tip:

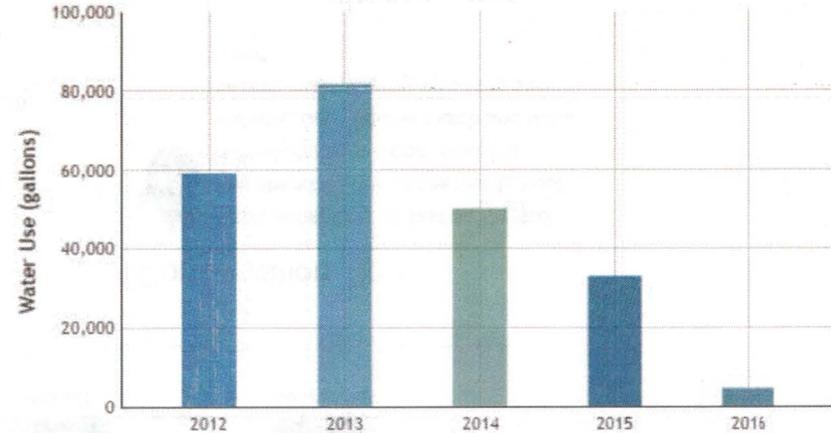


Apply water only as fast as the soil can absorb it. If water begins to pool around plants or runoff, slow the watering rate. Adding mulch and more organic material may also help slow runoff.

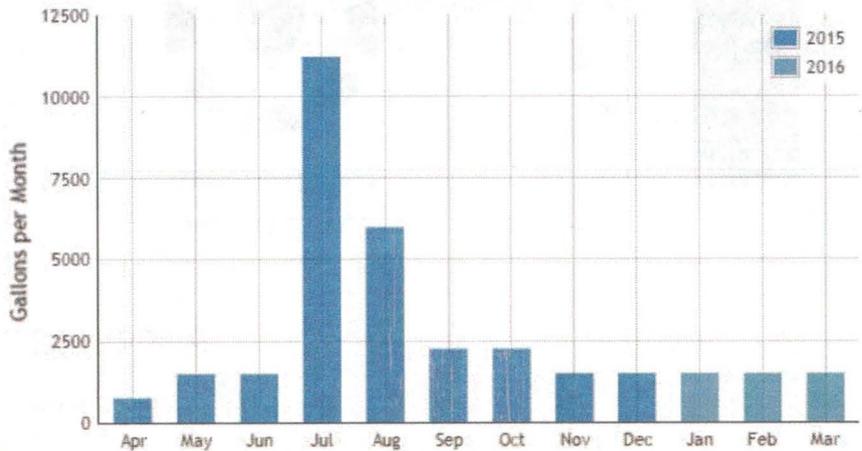
How My Water Use Compares



Annual Water Use



Historic Water Use



Shipek household:

- Typically 3 persons
- 1/5 acre midtown lot
- 7 fruit trees
- ~100sf vegetable garden (extent varies seasonally based on water supply)
- 8 chickens
- 7 native shade trees
- Lots of native plant understory

*Draft: per 13 April 2016 C&E Subcommittee meeting*

### **Proposed Conservation and Education Framework for Tucson Water**

To support Plan Tucson it is proposed that Tucson Water's conservation and education encompasses:

- a) holistic use of alternative water supplies (rainwater, greywater, stormwater) to reduce stress on potable supplies,
- b) demand reduction to increase life of infrastructure and increase long-range water security,
- c) education to develop stewardship and community connection to water supplies/resources,

through:

- design of conservation targets to inform long-range planning,
- investment of water to improve community health by meeting unmet community needs (social, economic, and environmental), and
- policy to incentivize conservation and promote groundwater security.

