

BEST PRACTICE 13: Residential Water Surveys and Evaluations Targeted at High Demand Customers

- Programmatic and customer support best practice (utility perspective)
- Customer side best practice - Implemented for water customers by water providers.
- Customer participation – Significant: customers must communicate and meet with utility representatives.

Overview

Water surveys and evaluations (frequently referred to as “audits”) that identify water savings opportunities and educate customers are a fundamental component of residential (and non-residential) water conservation programs. Although often offered to all customers, high volume customers should be targeted first to maximize water savings and minimize program expenses (Vickers 2001).

Why a Best Practice?

Residential water use evaluations cover both indoor and outdoor use and identify concrete methods for reducing water use in a home. Water surveys often reveal leaks and unintended water usage that some customers are simply not aware of. Water surveys are also an excellent way for water utilities to extend customer service beyond metering and billing and to help customers save water and money.

Targeting is essential because program budgets are limited and not all households can achieve measurable water savings. Once targeted, water surveys present utilities with the opportunity to work with their highest use customers to achieve meaningful demand reductions.

State Planning Requirements

Colorado statute requires that all covered entities (water providers that deliver more than 2,000 acre-feet per year) file a water conservation plan with the Colorado Water Conservation Board (CWCB). Entities that do not have an approved plan on file are not eligible to receive grant funding from the State. Under this statute, one of the water saving measures and programs that must be considered in a conservation plan is: “(VI) Dissemination of information regarding water use efficiency measures, including by public education, customer water use audits, and water-saving demonstrations” [CRS 37-60-126 (4) (a)].

Applicability

This best practice applies to high demand residential customers or customers that experience and unexpected spike in usage. High demand customers can be identified as the top quartile of water users on an annual or seasonal basis. Spikes in demand can be identified by comparing consumption against the previous billing period and the same billing period from the previous year. As a rule of thumb, identifying the top 10 – 25% of customers based on average winter consumption (AWC) targets high indoor water users; and selecting 10-25% of customers based on annual or summer demands targets high outdoor water users. Using three years of billing data, rather than one year, and discounting drought years can improve data used for targeting.

Water survey programs, with proper targeting, give utility staff a chance to educate high water using customers and address leaks, excess irrigation, and overall efficiency improvements at

selected residences. Water survey programs are also a good response to customer complaints about high water bills.

Implementation

The following steps are recommended when implementing a residential water survey program.

Pick Low Hanging Fruit - Target Customers with High Water Use Patterns

Targeting water surveys to high demand customers makes the most of limited program resources and improves water savings. Targeting is usually accomplished by querying the utility billing database, sorting all residential customers by annual demand and selecting the top 10 to 25% of water users. Spikes in demand can be identified by querying the utility database and comparing consumption against the previous billing period and the same billing period from the previous year for a given customer. Using three years of billing data, rather than one year, and discounting drought years can improve data used for targeting. This will likely identify the heavy irrigators since outdoor use is usually the dominant component of demand among large residential end users. Sorting the utility billing database by average winter consumption (i.e. average monthly water use over the months of December, January, and February when there is little or no outdoor use in Colorado) and selecting the top quartile will likely identify customers with high indoor water demands. Customers who are in the top quartile for both indoor *and* total use are probably the best candidates for a water survey since they may achieve significant savings both indoors and outdoors. It should be noted that there are often legitimate reasons for higher than average water use at any given property including: large family size (resulting in high indoor use), and large lot size (resulting in high outdoor use).

Invite Participants

Water surveys require willing participants. Utilities typically send an invitation offer to participate to the targeted customers, or the customers may be contacted through another means such as e-mail or telephone. The invitation should mention the fact that the customer was chosen for the program based on an analysis of historic water consumption that placed them among the highest users in the service area. Peer pressure has been found to be a tremendously powerful motivator for conservation-minded behavior change. Customers who learn that they are one of the largest water users in the area may be substantially more motivated to participate in the survey program and most importantly, to implement the recommendations from the survey. Even if these methods are implemented some customers will remain unwilling to participate.

Perform the Survey

A residential water survey typically takes between 30 and 90 minutes to complete depending upon the complexity of outdoor use at the site. The following steps from the *Handbook of Water Use and Conservation* can assist utilities in implementing cost-effective, residential conservation programs (Vickers 2001):

1. Explain purpose of evaluation.
2. Determine water use.
3. Test for and possibly repair leaks (Provided the leak is simple. Otherwise, customers are responsible for repairs).
4. Provide retrofit devices.
5. Evaluate lawn and irrigation characteristics and recommend design modifications.
6. Customize home irrigation schedule, if needed.

7. Evaluate other outdoor water uses. (*Detailed information on landscape efficiency is provided in Best Practices 7, 8, 9, and 10 in this guide book.*)
8. Identify all water conservation opportunities.
9. Evaluate water efficiency measures.
10. Educate customers.

1. Explain purpose of evaluation

Start with the basics: talk to the customer about the survey process. The purpose of the survey is to find potential water savings. Some water savings may come from hardware changes and some savings may come from changing behaviors such as more careful lawn watering and repairing leaks.

Education can also help customers become proactive about their water use. The California Urban Water Conservation Council and the EPA have created a website that shows water use in a typical home. This website shows homeowners different water-using appliances and makes recommendations for water conservation. The H2ouse website can be found at www.h2ouse.org/tour/index.cfm.

Provide information on other conservation programs for which the customer may be eligible. These may include retrofit rebates from other agencies such as the case of clothes washers that save energy as well as water.

2. Determine water use

Do some homework before the evaluation: look at utility bills and prepare a water budget for the site based on reasonable, efficient use (2,000 – 5,000 gallons per month or 65 – 165 gallons per household per day for a residential indoor³⁸; for outdoor budget calculation methods see Best Practice 7: Landscape Water Budgets in this guidebook). This information may be readily available from targeting efforts, but if not, try to obtain bills. Billing statements can give a longer-term picture of water use and a clearer sense of potential conservation.

Once on site, test fixtures for low water use. Flow bags can be used to measure faucet and showerhead flow rates. Note the age of toilets in the home (date stamps are usually located in toilet tanks and are occasionally stamped into the tank lid).

3. Test for and repair leaks

Visual inspection will help locate many leaks. Residents are often aware of leaks, so ask.

Leaks can be a major consumption of water. Measure leaks whenever possible. Calculate the amount of water a given leak uses per day, per month, and per year. Compare that to over-all water use. Share this information with the customer. Education is important as customers are the first responders to leaks which can appear at any time.

Toilet leaks are probably the biggest cause of indoor water waste. A leaky toilet can waste up to 500 gallons per day. Typically toilet leaks are caused by flappers that do not seal properly. Toilet leaks can be detected by placing dye (i.e. a dye tablet or drop or two of food coloring) in the tank. If dye is visible in the bowl within 15 minutes (usually less), there is a flapper leak. To fix this leak, the flapper must be either repositioned (usually a temporary fix) or replaced with a flapper that fits properly and maintains the flushing integrity of the toilet. Flapper information

³⁸ Assumes approximately 3 people per household.

for many brands and models of toilet can be found at www.toiletflapper.org/index.aspx. Consider carrying an adjustable flapper as part of the conservation evaluation tool kit. Many people are not aware that toilet flappers must be replaced every five years or so.

4. Provide retrofit devices

Small changes can make a big difference in water use. This is particularly true for flow-restricting devices, some of which are relatively inexpensive. Items to distribute as part of a water conservation survey program may include:

- Information and educational materials
- Low flow showerheads (2 gpm flow rating or lower)
- Faucet aerators for lavatory (0.5 – 1.0 gpm) and control-flow aerators for kitchen faucets (2.2 gpm).
- Automatic hose shutoff nozzle
- Dual flush retrofit device
- Replacement flapper for toilet
- Toilet leak test kit

5. Evaluate landscape and irrigation characteristics and recommend design modifications

In Colorado, urban landscape irrigation accounts for 50 percent or more of the total annual water demand for a utility and about 60% of a typical front range residence's water use (Mayer 1999). *Detailed information on landscape efficiency is provided in Best Practices 7, 8, 9, and 10 in this guide book.* Residential site surveyors should note:

- type(s) of landscaping materials,
- landscaped area (frequently determined in advance of the audit and verified on site),
- health of landscape (brown spots, etc.), and
- microclimates

6. Customize irrigation schedule, if needed

Irrigation controllers can be adjusted, but the emphasis should be on customer education so that they can make their own adjustments in the future.³⁹ While most people understand that water needs vary over the course of an irrigation season, they often don't take the step of adjusting irrigation timing in response to changing conditions. These adjustments can be done relatively easily using a percent adjust feature found on most controllers. Talk with the resident about strategies for remembering to make monthly changes to irrigation.

7. Evaluate other outdoor water uses

Other outdoor water use such as water features, pools and fountains will not be addressed by landscape surveys. Check for leaks, automatic shutoffs, auto fill features. Evaporation from pools can be reduced with the use of a pool cover.

8. Identify all water conservation opportunities

Keep track of observations noted during the site visit. Keep in mind potential conservation measures while in the field. Additional research may be performed off site once the survey is done.

³⁹ This applies to customers with an automatic in-ground irrigation system.

9. Evaluate water efficiency measures

For each water conservation measure identified, provide some assessment of the financial value of implementing the measure. Include one time costs (such as purchasing hardware), ongoing costs and maintenance costs (such as ongoing repairs to irrigation equipment). Balance these against potential water use reductions and cost savings. Include other possible customer-side savings such as reduced wastewater fees and reduced energy costs. Pair cost and benefit information for each measure and then calculate the payback time. These data should also be shared with the customer.

10. Educate customers

Education is a fundamental goal of a water audit program. Some conservation measures rely on changed habits rather than technological changes. Tell homeowners what the audit survey found. Detail potential water savings for each item discovered in the evaluation process. A checklist of remedies should also be included with the report.

For newer homes with more efficient fixtures, improved water use practices may offer the only reasonable water savings. Denver Water provides a list of good conservation practices every homeowner should embrace (from: www.denverwater.org/Conservation/TipsTools/Indoor/).

Bathroom

- Flush toilets only when necessary, and never use a toilet as a wastebasket.
- Spend five minutes or less in the shower. Showers use less water than baths.
- Fix all leaky toilets, faucets and pipes.
- Install a low-flow showerhead.
- Replace an old toilet with a high-efficiency toilet, which can pay for itself over time in water savings.
- Insulate your water heater and water pipes. Doing so will save energy and also will cut down on the amount of water that goes down the drain while waiting for hot water to flow.
- Catch water in a bucket or watering can while waiting for hot or cold water to run. Use the water on plants or use it to flush a toilet.
- Turn off the water while shaving, brushing your teeth and lathering in the shower.
- Shave with a small amount of water in the sink instead of running water.
- Replace or install a low-flow aerator on your bathroom faucet.

Kitchen and Laundry

- Wash only full loads in the washing machine and dishwasher. Try to wash two fewer loads per week.
- Wash vegetables and fruits in a bowl or basin using a vegetable brush instead of letting water run. Use the extra water on plants.
- Soak dishes that need to be pre-rinsed instead of running them under water.
- Scrape dishes instead of rinsing them off before putting them in the dishwasher.
- Chill drinking water in the refrigerator instead of running the faucet until the water is cold.
- Defrost food in the refrigerator, not in a pan of water on the counter or in the sink.
- Run garbage disposals only when necessary. Compost food waste instead.
- Replace your inefficient clothes washer with a high-efficiency model.
- Replace or install a low-flow aerator on your kitchen faucet.

Water Savings and Other Benefits

Range of Likely Water Savings: Varies

Visiting residences does not immediately equate to water savings. In fact, minimal –if any – water savings will result from visiting homes where water use is already efficient. However, with proper targeting to high demand customers, savings from site surveys can be significant. Eliminating inefficient water uses should be able to reduce annual consumption by 10 – 20% *after implementing the recommendations* of a carefully conducted site audit.

How to Determine Savings

For each recommended residential conservation measure, savings should be calculated as part of cost analysis. These savings should be extrapolated to the life of the measure (e.g. 30 years for a toilet retrofit, 14 years for a clothes washer, 10 years for showerheads and faucet aerators). Savings can be measured in aggregate by comparing before and after water bills.

Savings Assumptions and Caveats

Savings are only realized if the auditor makes physical changes at the home or if the residents take action. The impacts of this best practice frequently rely on customer education and the ability of education by itself to affect behavior change is uncertain. Additionally, some savings measures such as leakage repair may have short life – only a few months or years.

Goals and Benchmarks

Utility goals for residential site surveys should revolve around contacting and visiting a certain number of customers from the top 25% of water users in the system. The number of customers contacted will by necessity be based upon the available budget for the program. Ideally *all* customers in the top 10 or 25% of water users should be contacted and invited to participate in a site survey program over a number of years, but practical budgetary limitations will ultimately dictate program size and scope.

Other Benefits

While saving water may be one boon of the residential survey, secondary benefits may not be as apparent. Customers may not realize that sewage fees may decrease, and if heated water is leaking, their energy bills may also see improvement. Finding and stopping leaks may also prevent structural or landscape damage.

Costs

Utility Costs

Utility costs vary depending on the level of site survey conducted. A short, quick residential site survey may cost \$50 - \$100 per site to implement. More involved residential surveys, which include landscape analysis, cost between \$150 and \$500 to conduct depending upon site specifics. Costs from small hardware fixes included in the visit (such as faucet aerators, showerheads, or toilet retrofit devices) can increase the per household cost by \$5 - \$50. Utilities may wish to charge customers for a site survey (as do some electric utilities), but this will likely reduce participation.

Customer Costs

Customers may see significant costs from pursuing recommended conservation measures such as toilet or clothes washer replacement. However, if substantial savings are realized, customers may also see reasonable payback from water and wastewater savings. Additionally, utility sponsored rebate programs can offset some customer costs.

Resources and Examples

Resources

Education can also help customers become proactive about their water use. The Field Museum in Chicago has developed an excellent residential water use calculator:

<http://watercalculator.fieldmuseum.org/watercalculator>

Similarly, the California Urban Water Conservation Council and the EPA have created a website that shows different water-using appliances and makes recommendations for water conservation. This site also has a good water budget calculator. The H2ouse website can be found at

www.h2ouse.org/tour/index.cfm.

Repairing toilet leaks presents an opportunity for significant water savings. Finding the right flapper to fit a specific toilet is essential. Flapper information for many brands and models of toilet can be found at www.toiletflapper.org/index.aspx.

Examples

Survey Kit

Advanced preparation can help ensure that site surveyors have the right tools and equipment for field visits. Keeping a conservation kit ready to go can reduce the tendency to reinvent the wheel each time an evaluation is requested. Suggested kit contents are shown in Table 4-21.

Table 4-21: Site survey field kit items

• Site survey form (see below for template)	• Tape measure for measuring tubs and tanks
• Measuring cups of several sizes and stopwatch for measuring leaks.	• Low-flow aerators in several styles (if agency has budget for hardware)
• Clipboard and extra pencil (pencils don't run like ink might)	• Flow bags for measuring flow rates from showers and faucets.
• Low-flow shower heads (if agency has budget for hardware)	• Wheel for marking off larger distance such as pool dimensions
• Information (e.g. brochures) on water conservation practices	• Information (e.g. brochures) on fixture and appliance rebates
• Hand sanitizer	• Rubber gloves and shoe covers

INDOOR RESIDENTIAL AUDIT FORM

Customer Name _____

Service Address _____

Date of Audit _____ Time of Audit _____

Annual metered use (gal) _____ Year _____

Avg. Monthly Winter Consumption (gal)⁴⁰ _____

Estimated Annual Indoor Use (gal)⁴¹ _____

Estimated Annual Outdoor Use (gal)⁴² _____

1. Total number of full-time residents _____

Children (0-12 yrs) _____

Teens (13-19 yrs) _____

Adults (20+) _____

2. Number of part-time residents _____

3. Is there typically someone at home during the day? _____

4. If so, how many? _____

5. Year house built _____

6. Remodel: Year⁴³ _____ Room(s) _____

7. Number of:

Full baths _____ 3/4 baths _____ 1/2 baths _____

SURVEY QUESTIONS

8. How often do people in the home take baths? (*instead of or in addition to showers*)⁴⁴

Is there bathing of young children? _____ Size of bath (i.e. sink, partial tub fill, other)

9. Is there car washing at home? _____ Frequency _____

⁴⁰ Calculated using average use for December, January and February billing data

⁴¹ = Avg. monthly indoor consumption x 12

⁴² = Total annual use – Estimated annual indoor use

⁴³ Date of remodel can be compared against billing data for any notable changes in water use

⁴⁴ Note if it is standard size tub or Jacuzzi – get an idea of whether or not they fill the tub

10. Expected # of sidewalk/driveway washes per month _____

KITCHEN INFO

11. Dishwasher age _____ Energy Star _____

12. How often is dishwasher used? _____ How much hand washing of dishes, pots and pans?

13. Kitchen faucet flow rate _____ Aerator? (Y/N/DK) _____ Leak _____

14. Garbage disposal _____

15. Other water-using kitchen fixtures or appliances _____

UTILITY/OTHER

16. Clothes washer make _____ Model _____ Year (if known) _____ Energy Star _____

17. Utility sink(s)? _____ Leak _____

18. Home water treatment? (Y/N/DK) _____ Regenerating? _____

19. On-demand hot water? (Y/N/DK) _____ Make/model _____
(Recirculating hot water system)
Serving which fixtures? _____

25. Hot tub (not in bathroom)? _____ Length _____ Width _____ Avg. Depth _____

Fill method _____ Fill timing _____

26. Swimming pool? _____ Length _____ Width _____ Avg. Depth _____

Fill method: auto _____ manual _____ frequency _____

22. Other water using fixtures or items of note:

BATHROOM INFORMATION:

		1	2	3	4	5
23	Location (master, guest, kids)					
24	Size (full, ¾, ½)					
25	Toilet model (Std, ULF, HET)					
26	Tank size ⁴⁵					
27	Year of manufacture					
28	Problems (sticking handle, sticking flapper, poor flushing, etc.)					
29	Leaks (result of dye test)					
30	Fill line (high or low)					
31	Bath?					
32	Size of tub (length, width, depth)					
33	Jacuzzi (jetted)					
34	Shower? (Flow rate gpm)					
35	Type of showerhead (Multiple heads, hand held, rain dome, other)					
36	Leak (shower head or tub diverter)					
37	Sink? (Flow rate gpm)					
38	Aerator?					
39	Leak?					
40	Other?					

⁴⁵ The toilet volume can be estimated using the tank size for toilets that are not marked as ULF or HE