

This presentation premiered at WaterSmart Innovations

watersmartinnovations.com



Designing the Ultimate Affordable Water Efficient Home

Mary Ann Dickinson
President and CEO

Water Smart Innovations Conference
October, 2010



Alliance *for* Water Efficiency

A VOICE AND
A PLATFORM
PROMOTING THE
EFFICIENT AND
SUSTAINABLE
USE OF WATER





Energy Bill Balancing Energy Production and Water Efficiency Advances

Congress acted on a comprehensive energy bill last week as the Senate Energy and Natural Resources Committee advanced legislation. The legislation highlights the nexus between water resources and energy production and begins to integrate decision-making related to both resources. [Learn more here.](#)



AWE Testifies Before Senate Subcommittee on Water and Wildlife

The Alliance for Water Efficiency urged Congress to ramp up the funding for WaterSense, the federal government's three-year-old program to promote and label more water efficient appliances and plumbing products. [Learn more here.](#)

American Recovery and Reinvestment Act Signed by President Obama

The Act signed by President Obama allocates \$6 billion for local clean and drinking water infrastructure improvements. For more information on taking action to seek stimulus funding for your water






Calendar of Events



- 7/28/2009 A National Water Policy Event
- 8/18/2009 World City Water Forum 2009
- 9/13/2009 Water/Energy Sustainability Symposium at the GWPC Annual Forum 2009
- 9/21/2009 2009 ENERGY STAR Appliance Partner Meeting
- 10/6/2009 WaterSense & Water Efficient Products Committee Meeting

Latest Information

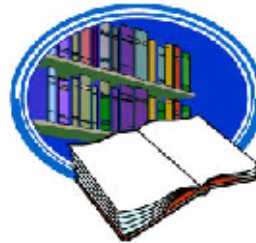


-  Water Efficiency Watch Newsletter July 2009
-  Water Use Efficiency Guide for New Businesses
-  New 13th Edition MaP and UNAR Toilet Testing Results and Info
-  AWE Launches Major On-Line Water Efficiency Information Library
-  NRDC Report - Increasing Water Efficiency in California's Oil Sector



Resource Library

Welcome to the Alliance for Water Efficiency's Resource Library. AWE strives to provide the best on-line resources on water conservation and efficiency. Search through our collection and discover the wealth of useful, technical information assembled. Enter keyword(s) in the search box below or select an library section from the list on the right. Search instructions and tips are available [here](#).



Resource Library Search Tool

Use the tool below to search the Alliance for Water Efficiency library:

Basic Search

Site

[Definition of Terms](#)

Recent Library Updates



- 10/30/2008 Water Efficiency Watch Listing
- 10/30/2008 Szann, A (2008) Australia - Water Wastage of Instantaneous Gas Water Heaters
- 10/30/2008 Tucson rainwater ordinance
- 10/30/2008 Heinrich, M (2008) New Zealand - Water Use in Auckland Households
- 10/29/2008 Commercial Food Service Introduction

AWE Library Sections



-  Residential Water Efficiency
-  Landscape and Irrigation
-  Commercial Institutional and Industrial
-  Non-Residential Fixtures, Appliances and Equipment
-  Alternate Water Supply
-  Codes and Standards
-  Drought

Resource Library

Welcome to the Alliance for Water Efficiency's Resource Library. We provide the best online resources to provide the best online resources for water conservation and efficiency through our collection of a wealth of useful, technical information assembled. Enter keywords in the search box below or click on the search box below.

Resource Library

Use the tool below to search the Alliance for Water Efficiency library:

Basic Search | **Advanced Search**

Site Search

- Residential Efficiency
- Landscape and Irrigation
- Commercial Water Efficiency
- Non-Res. Equipment
- Alternate Supply
- Codes and Standards
- Drought
- Metering
- Conservation Programs
- Water Loss Control
- Water Rates
- Toilet Testing
- Green Building



Recent Library Updates



10/30/2008	Water Efficiency Watch Listing
10/30/2008	Szann, A (2008) Australia - Water Wastage of Instantaneous Gas Water Heaters
10/30/2008	Tucson rainwater ordinance
10/30/2008	Heinrich, M (2008) New Zealand - Water Use in Auckland Households
10/29/2008	Commercial Food Service Introduction

AWE Library Sections



-  Residential Water Efficiency
-  Landscape and Irrigation
-  Commercial Institutional and Industrial
-  Non-Residential Fixtures, Appliances and Equipment
-  Alternate Water Supply
-  Codes and Standards
-  Drought



[home](#) » [resource library](#)

AWE Resource Library

Residential Water Use, Fixtures, and Appliances

Residential water use, both single-family and multi-family, is often the largest single demand sector for a water utility. The AWE Resource Library pages listed below offer information on residential water use and conservation savings as well as links to the latest research and information about this important end user category.

Indoor

[Evaporative Cooling](#)

[Faucet Fixtures](#)

[Home Water Treatment](#)

[Hot Water Distribution Systems](#)

[Humidifiers](#)

[Residential Clothes Washers](#)

[Residential Dishwashers](#)

[Residential Leakage, Detection, and Mitigation](#)

Outdoor

[Landscape and Irrigation Library Content Listing](#)

[Swimming Pools and Spas](#)

[Water Brooms](#)



[home](#) » [resource library](#)

Toilet Fixtures Introduction

Toilet fixture replacement has been a staple of the water industry's initiatives to reduce potable water consumption since the late 1980s. It still represents one of today's most popular water efficiency initiatives, as the first "program of choice" by water providers embarking on their initial foray into hardware-related conservation. In these programs, older 3.5- and 5.0-gallons per flush (gpf) toilet fixtures in residences are replaced with 1.6-gpf fixtures. Today, some water providers with aggressive replacement programs are already approaching a level of "saturation" in their residential sector wherein the majority of toilet fixtures are 1.6-gpf models. Therefore, a number of water providers have moved on to other more-efficient products and higher priorities in their conservation programs.

Density of Use - Residential

As the number of bathrooms in housing steadily increases, and, in some cases, the number of occupants decreases, development of cost-effectiveness information related to toilet replacement programs must address just which toilets within a residence should be replaced, e.g., all of them, the most-used toilet, the oldest toilet, the toilet with the highest flush volume, or some other replacement criteria. To aid in this analysis, we have compiled some national numbers on toilet "density" in residential housing. [Download the table that shows the increase in density during the period from 1970 to 2003.](#)



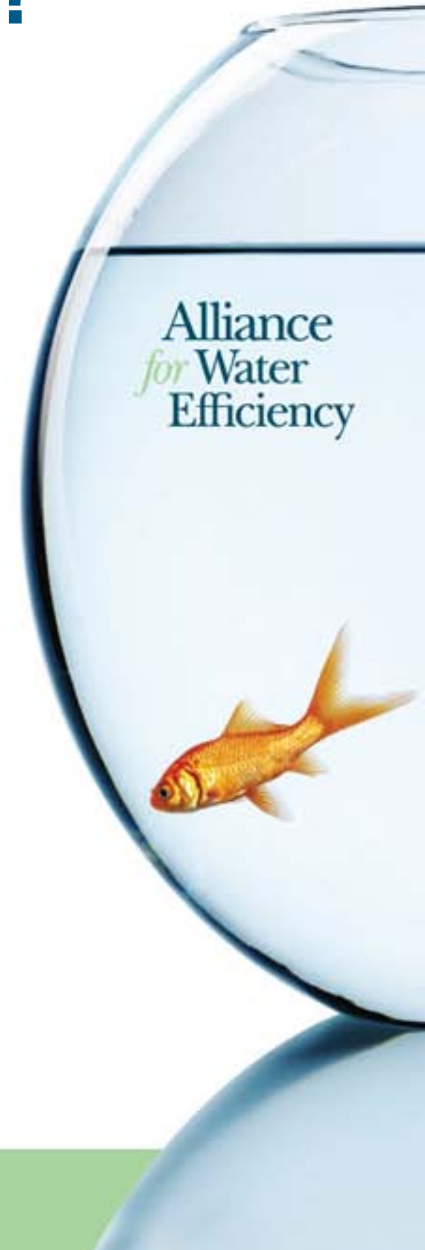
What is Missing From the Site?

Information for Consumers

- Consumer web page March, 2011
- Consumer media campaign January, 2012

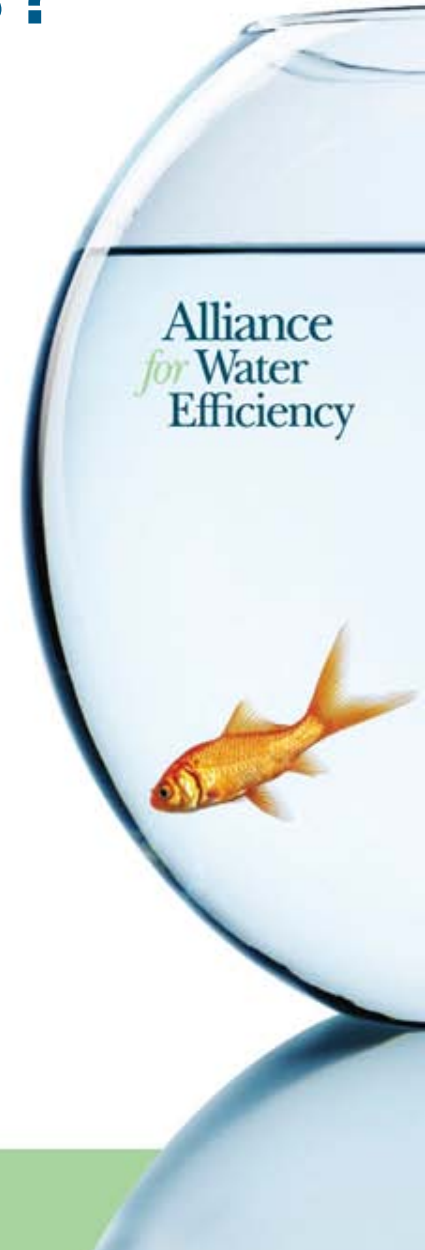
Information for Builders

- Green Building historically weak on water but this has been dramatically improved
- AWE web pages include green specs
- Specific design advice for builders and homeowners still needed



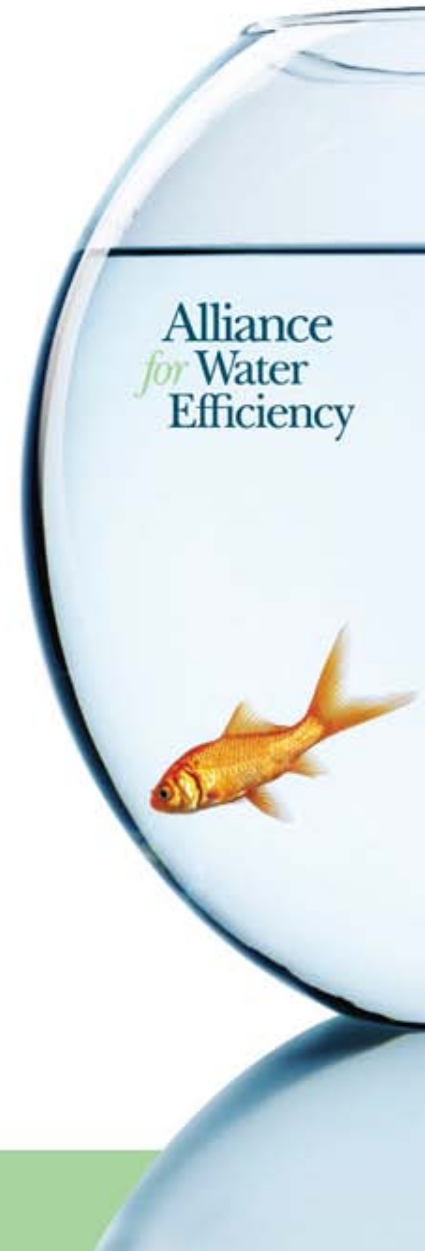
What About Affordable Homes?

- Numerous examples of affordable home designs already exist
- Habitat for Humanity
- Southface and Earthcraft House
- Global Green
- Smart Communities Network
- Green Communities Initiative
- But are they truly “super water efficient”?



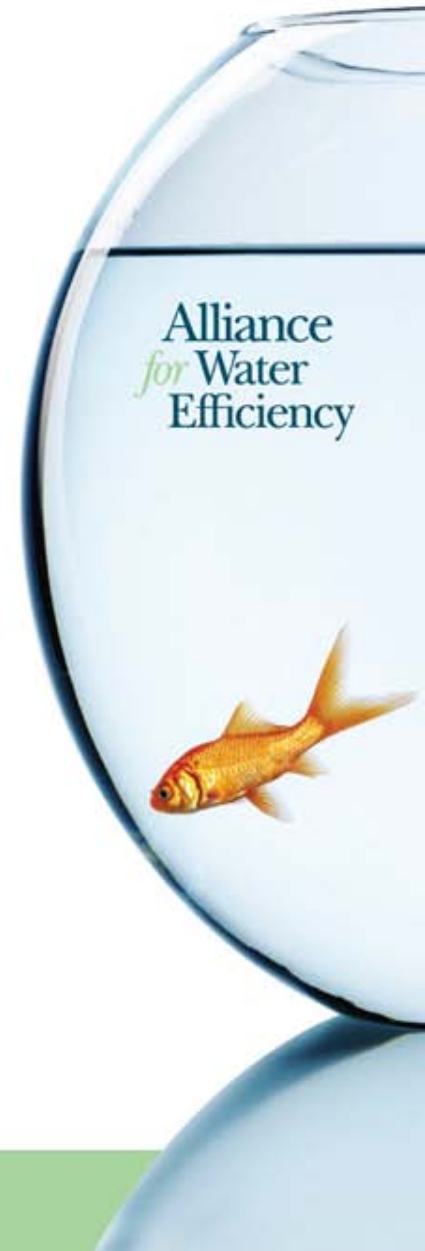
Our Project Goal

- Water efficiency historically viewed as just the latest generation plumbing fixtures
- Gray water and rainwater capture designs have not always been truly low cost options because of high installation costs
- Hot Water delivery systems plumbed as usual – no structured plumbing
- **AWE goal:** Design a “super” water efficient affordable home with structured plumbing solutions and integrated gray water options that are low-tech enough to be affordable



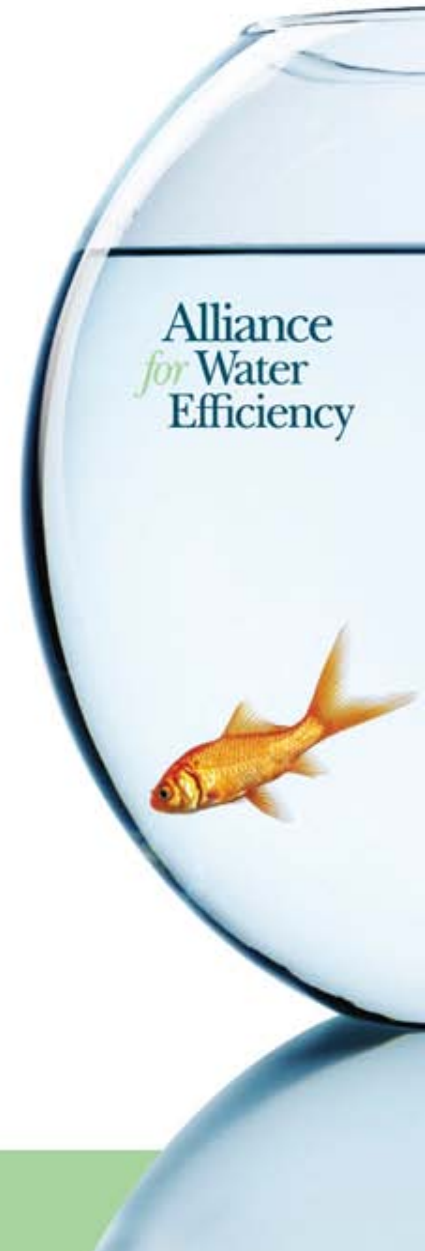
Home Depot Foundation

- Funded \$75,000 to prepare design recommendations for builders on an affordable home platform for both single family and multi-family
- Not design plans, but concept plans
- Team Members:
 - *John Koeller*
 - *Gary Klein*
 - *Rick Thomas*
 - *Wayne Bowser*



Project Schedule

- Initiated in late 2009
- Still underway and will be completed by January, 2011
- Detailed report soon to be published and will be available on line as a PDF



Project Focus

1. Hot Water Systems and Hot Water System Designs
2. Interior Plumbing Fixtures and Appliances
3. Exterior Landscape and Irrigation
4. Gray water Capture and Reuse

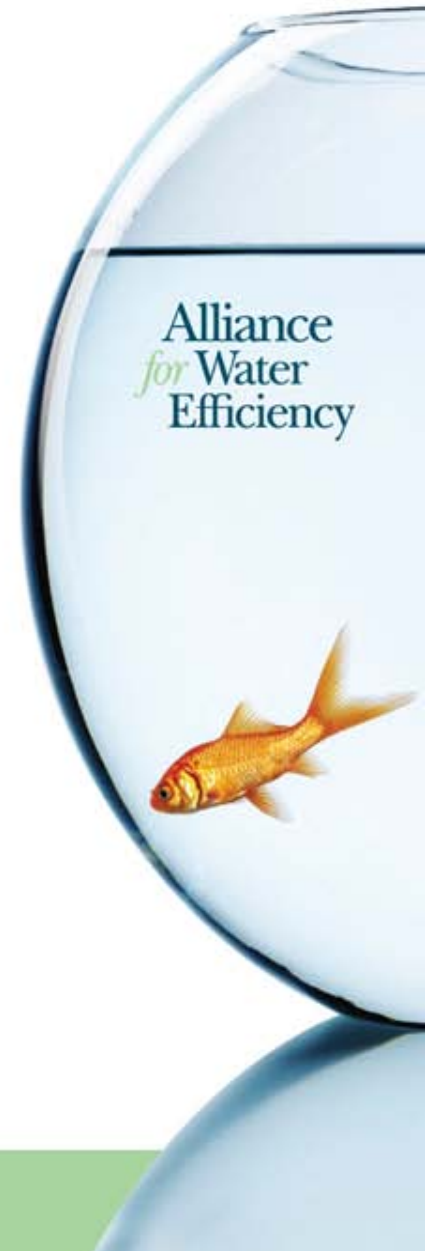
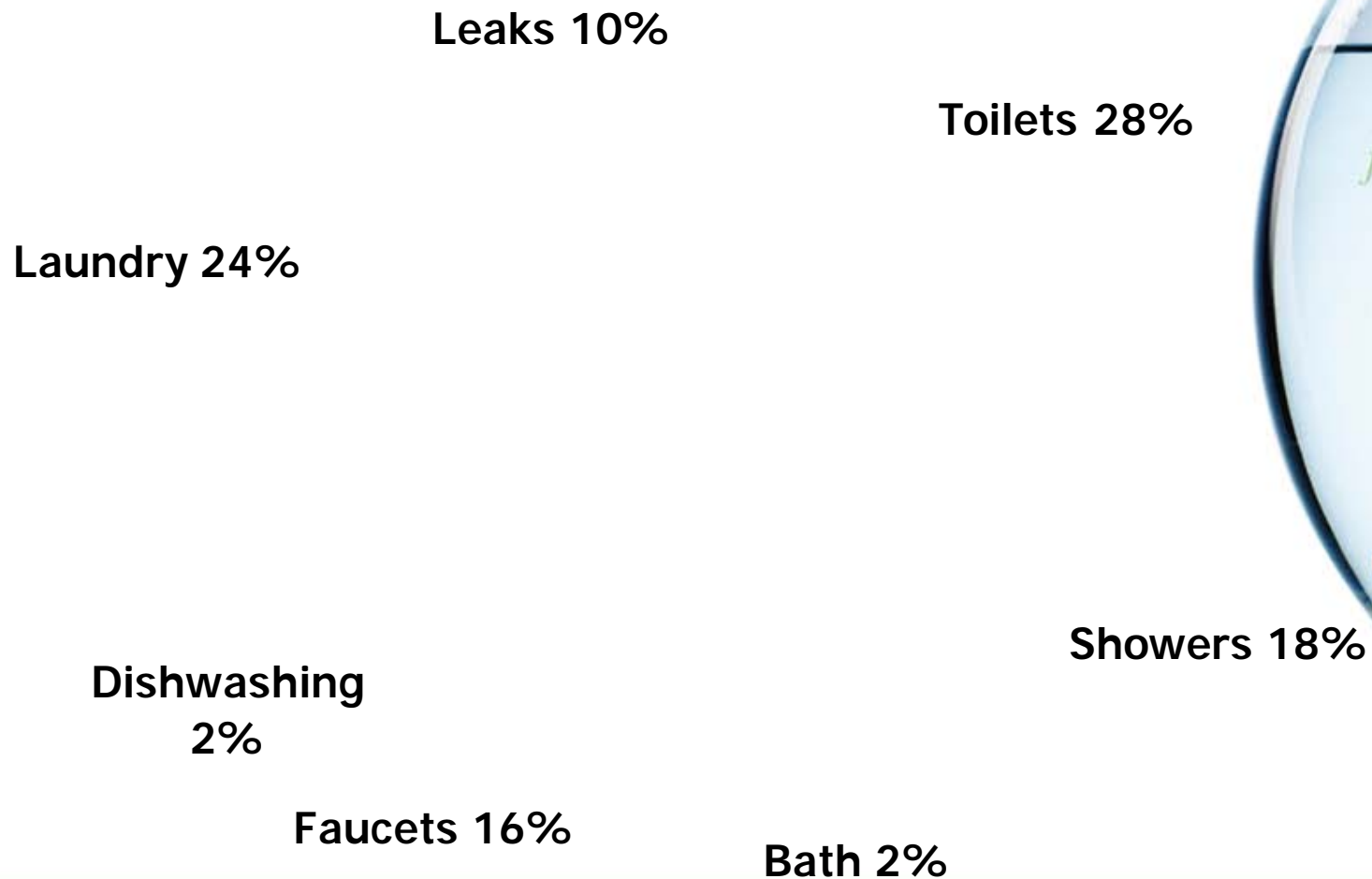
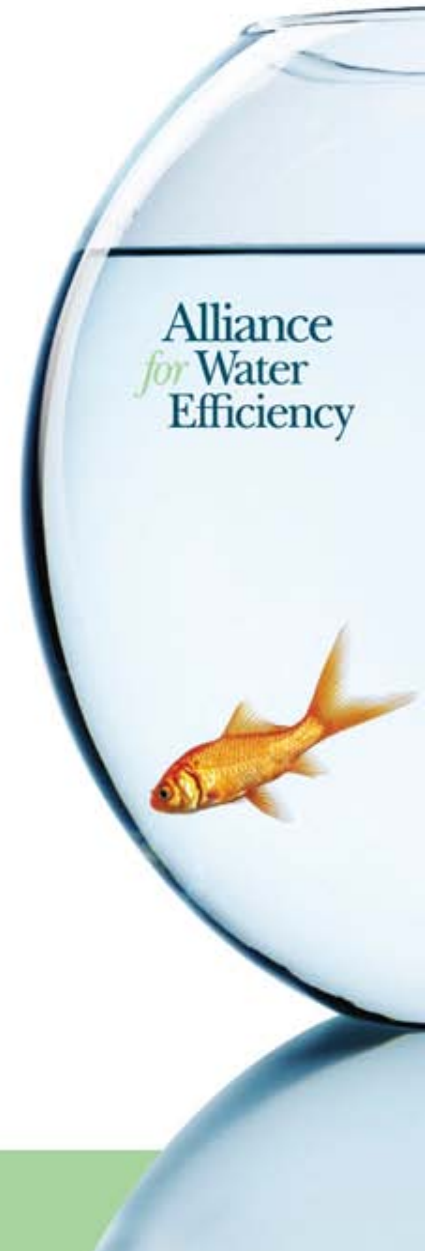


Figure 1. Indoor Water Use in a Typical Single Family Home



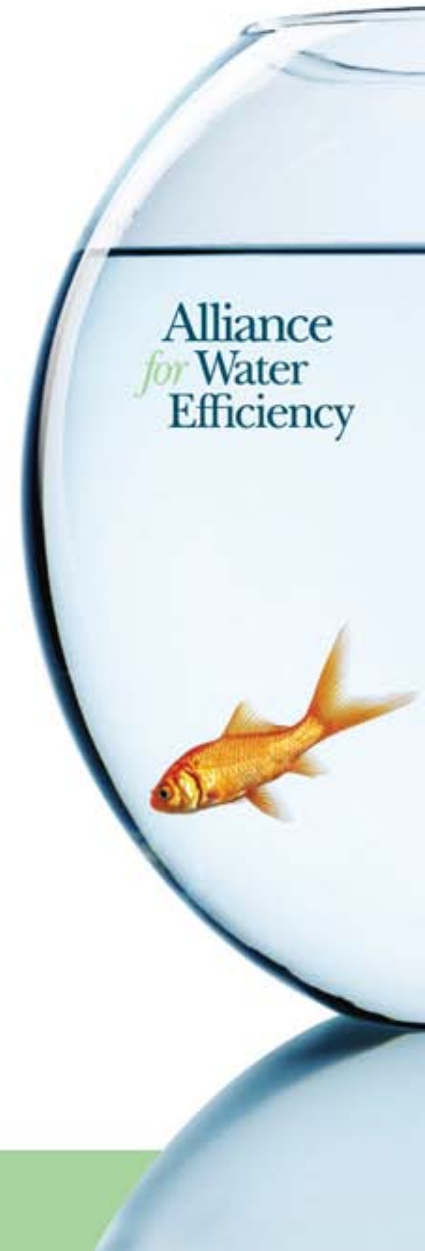
Hot Water Systems

- **Select a water- and energy-efficient water heater.** Specify a condensing water heater, whether tank or tankless, with an energy efficiency greater than 90 percent.
- **Cluster hot water outlets.** Consider where the hot water outlets are in relationship to one another in both the vertical and horizontal directions; cluster the hot water outlets accordingly in order to reduce the distance to the water heater.



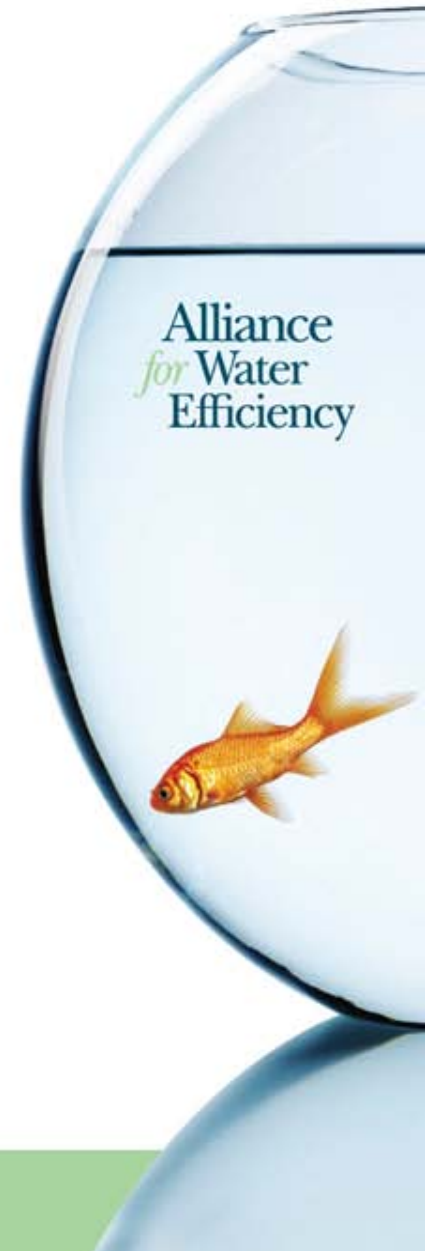
Hot Water Systems

- **Insulate hot water piping.** Install insulation on all hot water distribution system piping, regardless of design configuration.
- **Design for lower fixture flow rates in the future.** Consider that flow rates of faucets and showerheads and the volume of water used in dishwashers and clothes washer will be reduced as new technologies and products are introduced.



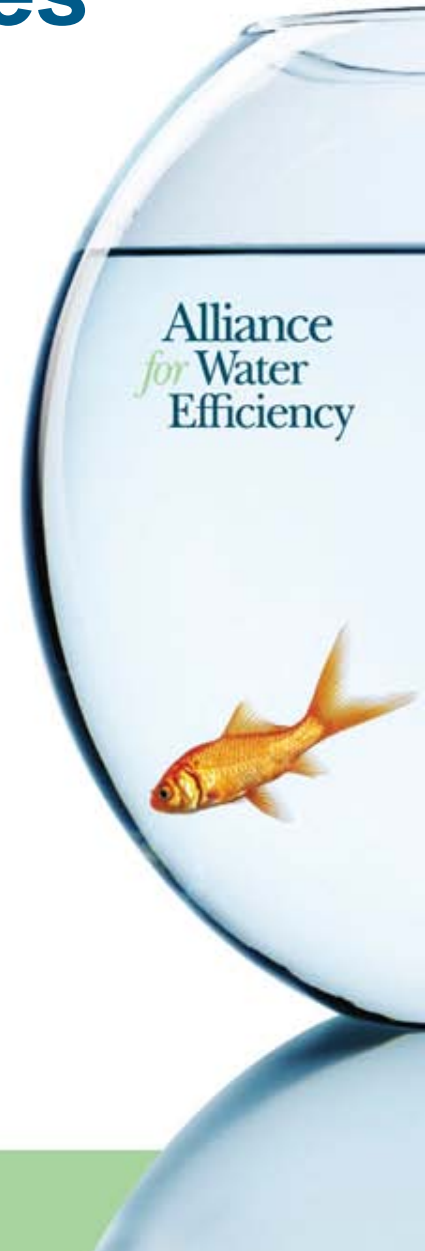
Hot Water Systems

- **Install a recirculation loop with a demand-controlled pump.** Limit the structural waste of water by using a demand controlled system. Avoid continuous recirculation systems.
- **If not physically possible or economically feasible** at the time of original construction, install plumbing in a trunk, branch and twig configuration to allow retrofit with such a system at a later date. Install an electrical outlet under the sink at the end of each plumbing direction.



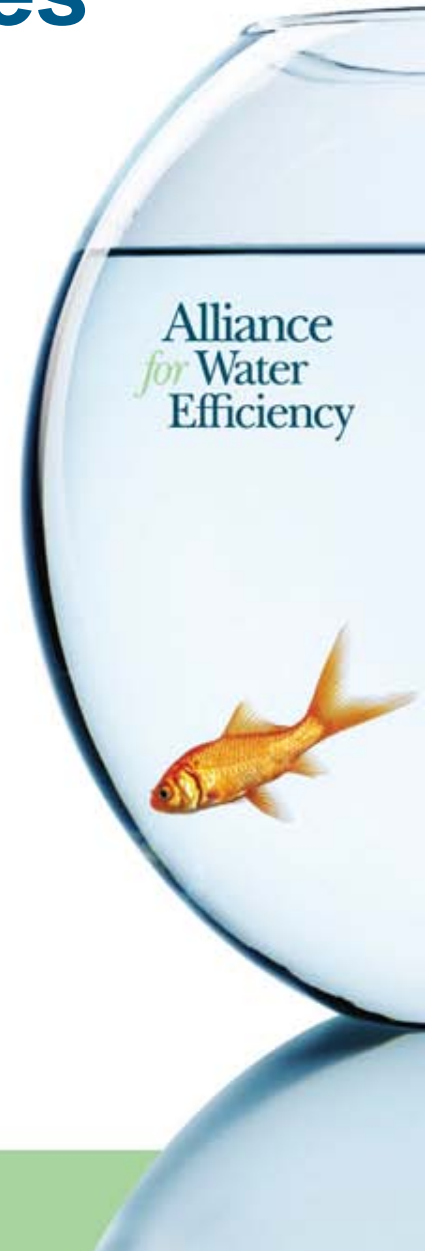
Plumbing Fixtures & Appliances

- **Select WaterSense Toilets.** WaterSense-certified single-flush toilets assure both a reduction in water consumption and excellent flush performance.
- **Select WaterSense Showerheads.** WaterSense-certified showerheads deliver efficiency at 2.0 gallons per minute but also meet a minimum level of showering performance as to force and coverage.



Plumbing Fixtures & Appliances

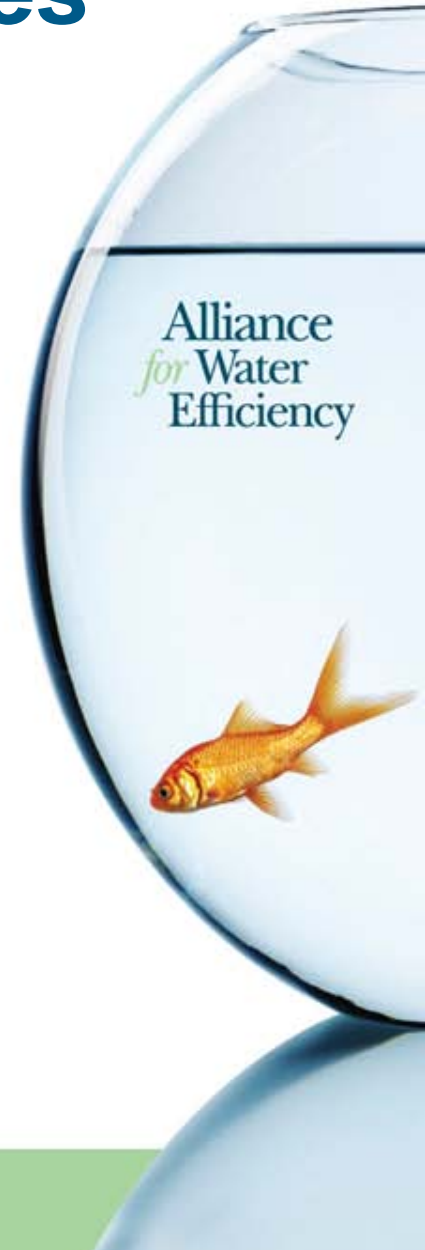
- **Select a WaterSense Bathroom Lavatory Faucet.** WaterSense® sets a maximum flow rate of 1.5 gpm and a minimum of 0.8 gpm.
- **Choose the standard kitchen faucet** with the EPA's maximum flow rate of 2.2 gpm. These faucets are used for washing, rinsing, pot filling and other related tasks. Green building codes for residential generally do not recommend a reduced flow rate for these applications.



Plumbing Fixtures & Appliances

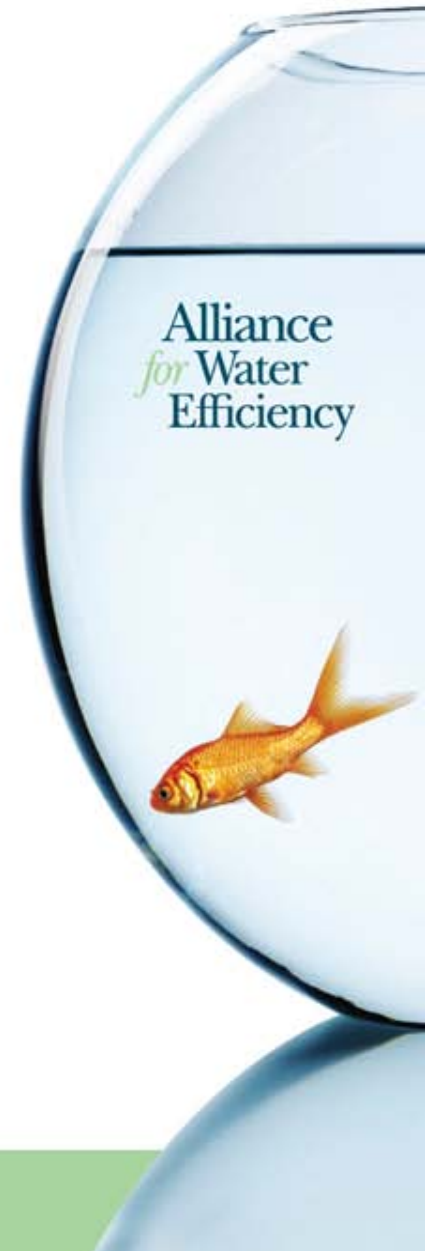
- **Select an Energy Star Dishwasher.** New Energy Star dishwashers are both water and energy savers -- 5.8 gallons per full cycle maximum water use.
- **Select an Energy Star Clothes Washer.** Where provided by the builder, an Energy Star qualified clothes washer with a Water Factor (WF)* of 6.0 gallons or less.

***Water Factor:** the quantity of water in gallons used to complete a full wash and rinse cycle per measured cubic foot capacity of the clothes container.



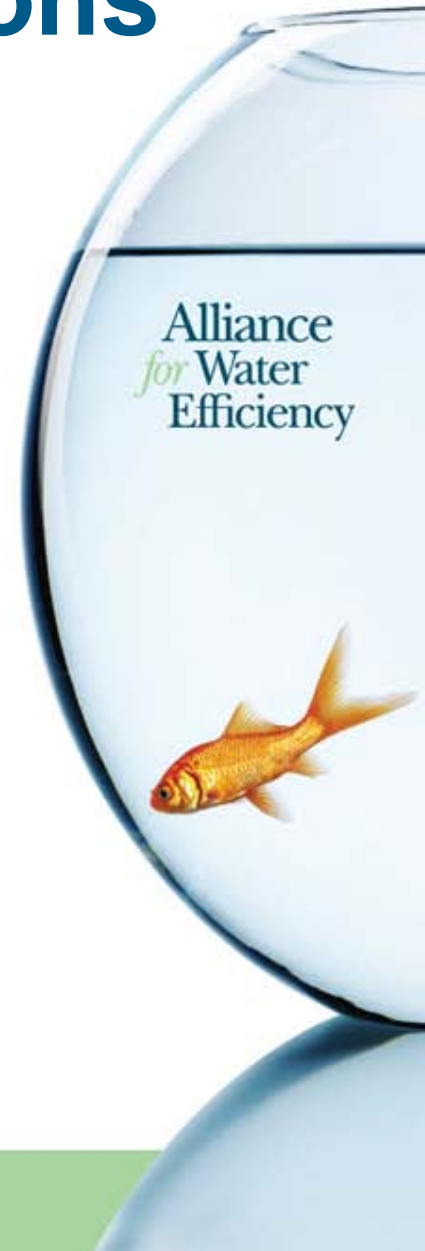
A Sustainable Landscape

- Uses up to 80% less water depending on the design style and site conditions.
- More resistant to pests and related health issues because plants are adapted to site conditions and attract beneficial insects.
- Reduces waste to landfills and use of fossil fuels.
- Protects water quality in creeks and waterways.
- Increases soil permeability and storm water capture capacity.



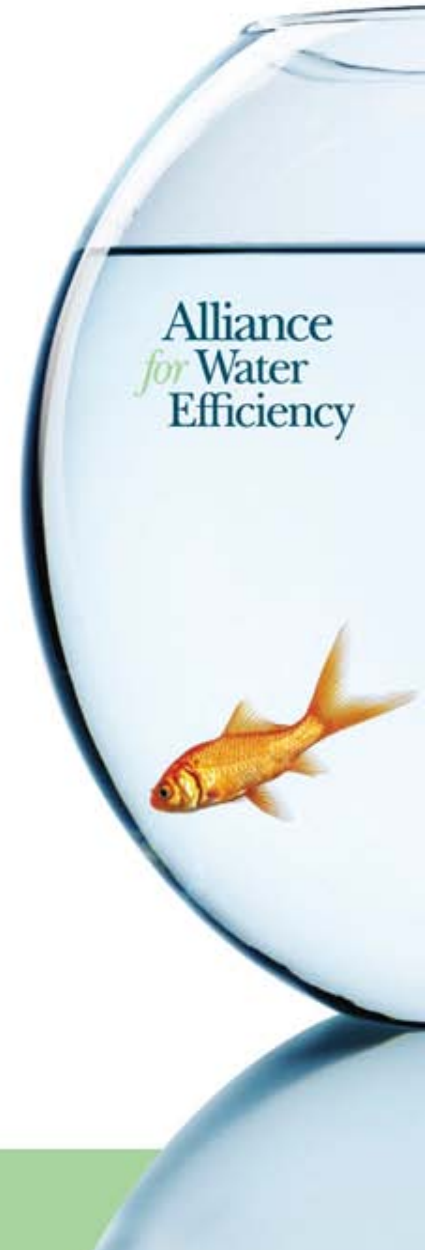
Landscape Recommendations

- **Choose** landscape plantings that are ideal for site conditions of soil and climate type.
- **Design** properly for size, location, grouping by zone and use, and no artificial turf.
- **Optimize** the need for inputs such as water and fertilizer. Choose smart irrigation options like drip irrigation. Mulch.
- **Minimize** the impermeable surface area.
- **Minimize** outputs like yard waste disposal and pollutants like fertilizers that can runoff.
- **Include** rainwater harvesting as appropriate.



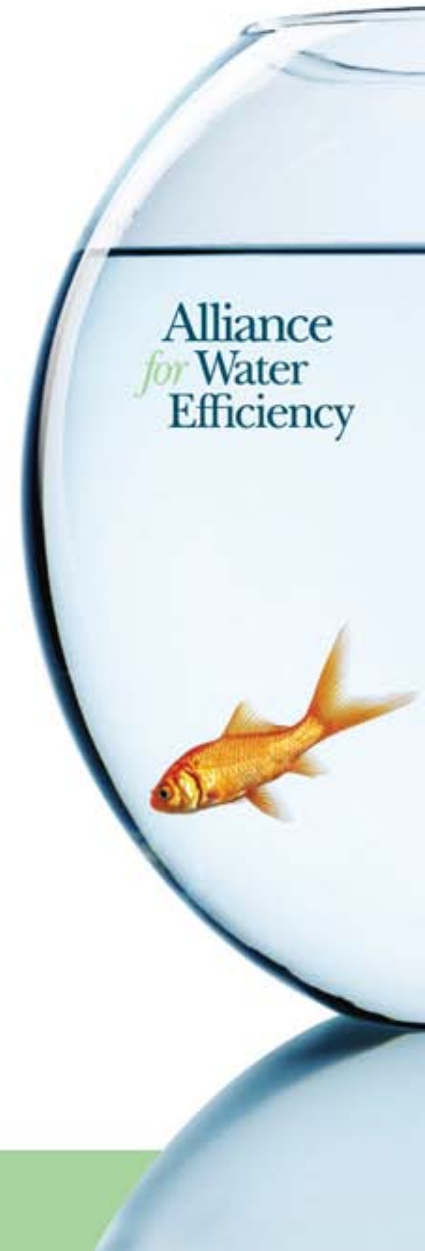
Gray Water: Potential

- Bathroom faucet: $2.2 \text{ gpm} \times .25 \text{ min} \times 30 \text{ uses per week} = 17 \text{ gal/person/week}$
- Showering and bathing: $2.5 \text{ gpm} \times 8 \text{ min} \times 6 \text{ showers per week} = 120 \text{ gal/person/week}$
- Clothes washer: $30 \text{ gallons (high efficiency unit)} \times 2.5 \text{ loads per week} = 75 \text{ gal/person/week}$
- Typical household = 212 gal/per/week
- **$5 \text{ persons} \times 212 \text{ gallons} = 1,060 \text{ gal/week}$**



Gray Water: Issues

- Generally prohibitive to retrofit if all the waste lines are located beneath a concrete slab, often leading to assumption that gray water is unaffordable
- In new construction, a simple gray water collection and reuse irrigation system can cost between \$200 and \$1,000.
- Correct maintenance is the key.
- Numerous recommendations in the report concerning installation, filtering, treatment, pumping and irrigation.



VENT THROUGH
ROOF

BATHTUB

TOILET

CLEANOUT

LAVATORY

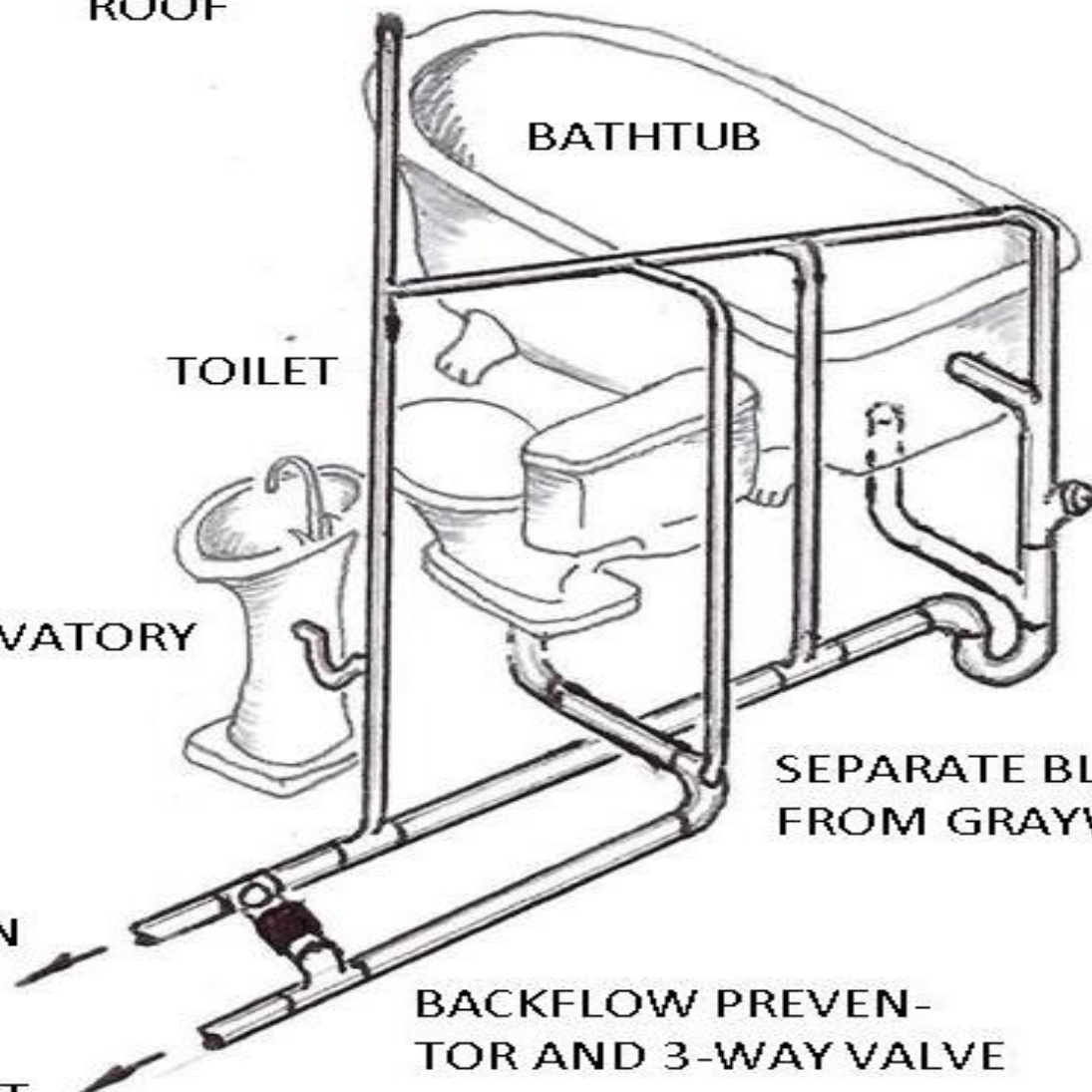
SEPARATE BLACKWATER
FROM GRAYWATER

OUT TO
IRRIGATION

BACKFLOW PREVEN-
TOR AND 3-WAY VALVE

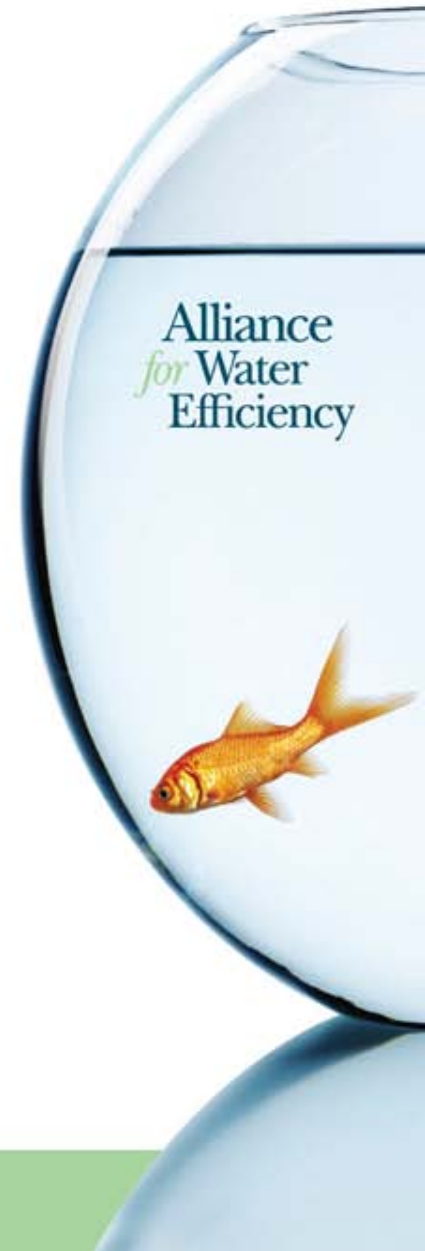
OUT
TO SEWER

TYPICAL WASTE LINE PLUMBING
(GRAYWATER BRANCH SYSTEM)



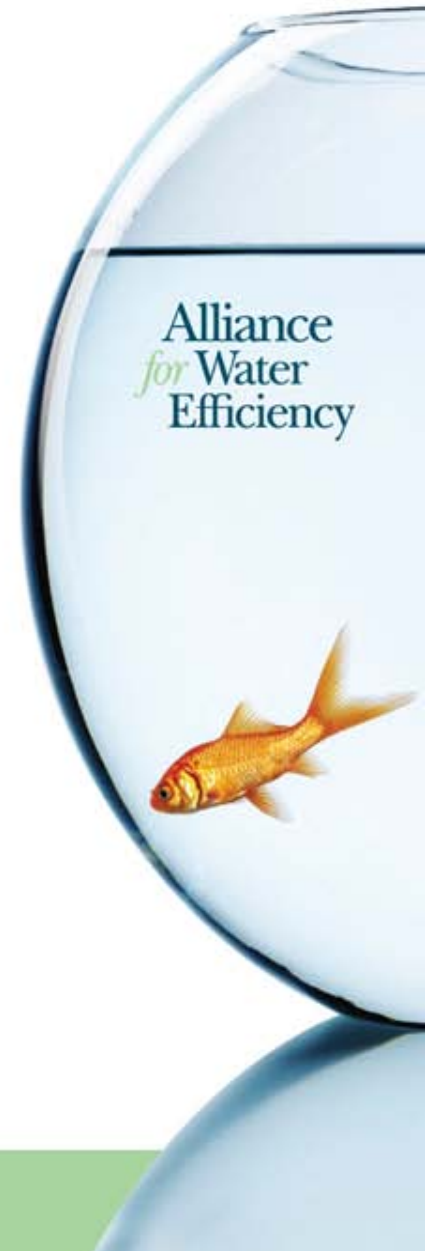
Hot Water Schematics

- Major new contribution of this project
- Hot water plumbing designs incorporated into existing Habitat for Humanity Affordable Housing Plans
- Report will have detailed structured plumbing solutions, with layouts for:
 - All trunk, branch and twig lines
 - A Home run manifold system
 - A recirculation system with demand controlled pump



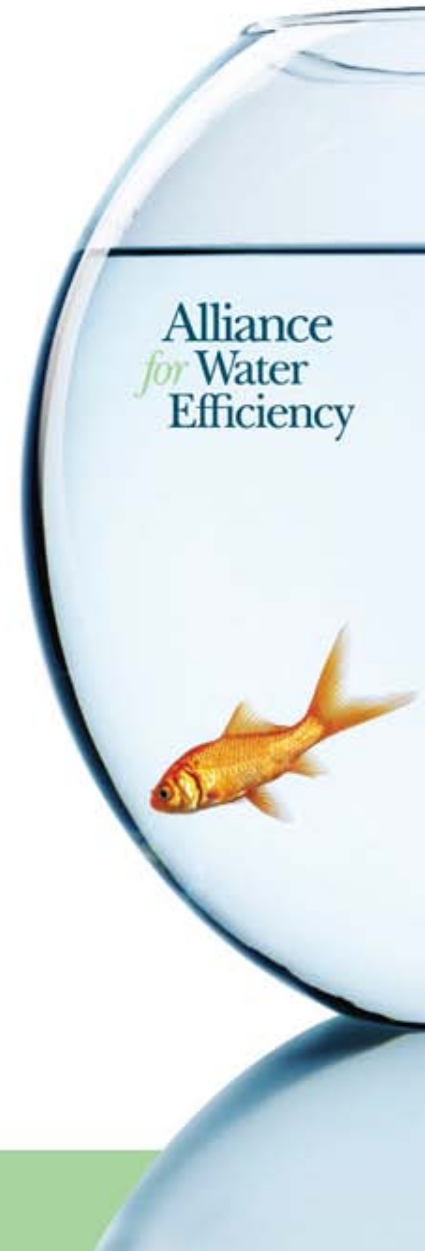
Definitions

- **Trunk, Branch and Twig:** traditional plumbing and base case. A twig serves one fixture either hot or cold water.
- **Home Run Manifold:** employs a manifold near the water heater from which twigs go to each fixture. A trunk line connects the water heater to the manifold.

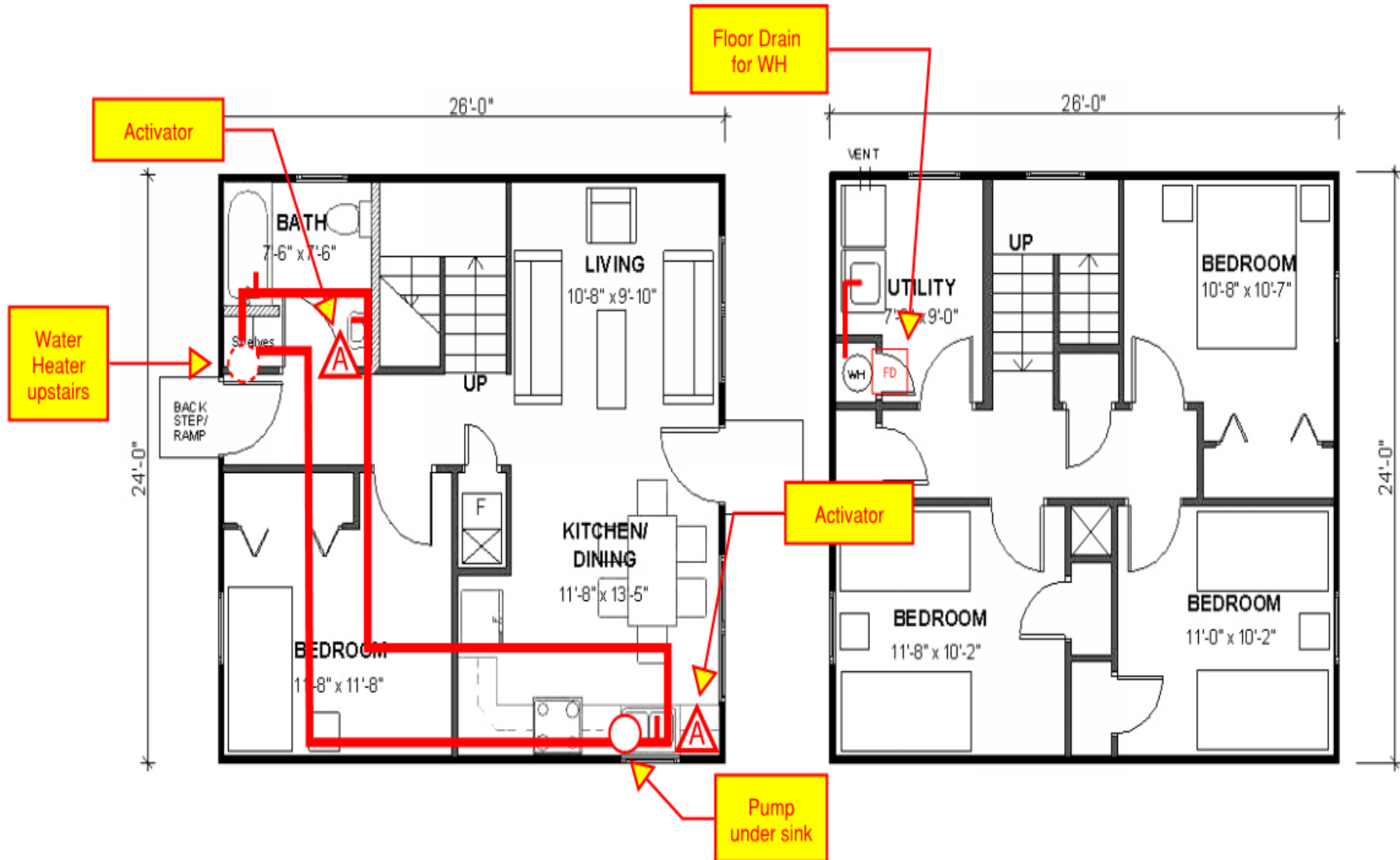


Definitions

- **Recirculation System with Demand Controlled Pump:** Uses a loop to bring hot water close to each hot water outlet. The demand system pump is controlled by the user, who activates it shortly before each intended use of hot water. Controls turn off the pump when the thermal sensor sees a rise in temperature of about 5°F above ambient water temperature in the pipe.
- All recirculation loops can save water, but this is the *only* system that is energy efficient.

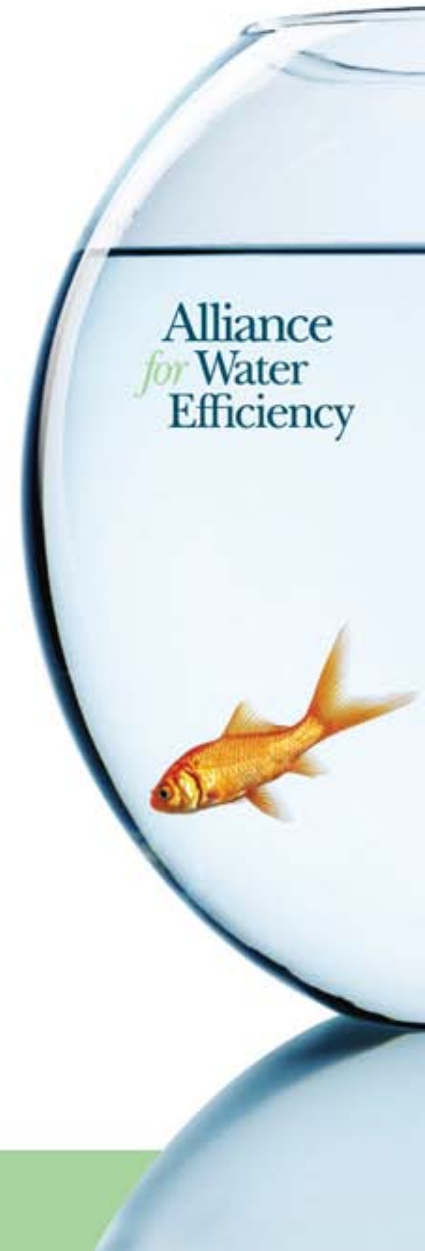


Example of Recirc System Layout



Hot Water Plans

1. Plan 39 - 884 Square Feet, 1-Story
2. Plan 41 - 900 Square Feet, 1-Story
3. Plan 50 - 1050 Square Feet, 2-Story
4. Plan 54 - 1056 Square Feet, 1-Story
5. Plan 66 - 1142 Square Feet, 2-Story
6. Plan 75 - 1148 Square Feet, 2-Story



What's Next?

- Builder schematics for landscape and gray water designs, similar to Hot water schematics
- Homeowner section on maintenance of water efficient design features
- Peer Review of report
- Graphic Design
- Online distribution by 1/1/2011





Alliance *for* Water Efficiency

A VOICE AND
A PLATFORM
PROMOTING THE
EFFICIENT AND
SUSTAINABLE
USE OF WATER

www.a4we.org

(773) 360-5100

CHICAGO

