

# Welcome

Craig Selover

Director – Plumbing Products Technology

Masco Corporation

[cselover@masco-rd.com](mailto:cselover@masco-rd.com)

313 792-4457

# Water Conservation – Impact of Residential Plumbing System Design

# What is the Environments For Living® – Certified Green Program?

The *Environments For Living -Certified Green* program is designed to have homes built in accordance with the program achieve an energy-efficiency level equal to a reduction of carbon dioxide (CO<sub>2</sub>) emissions and a reduction in internal water usage of 20%, and a home must achieve a Home Energy Rating System Index of 80 or less (20% more energy efficient than the 2006 International Energy Conservation Code).

- Durability
- Energy Efficiency - Guaranteed Performance\*
- Indoor Environmental Quality
- Water Efficiency

\* Written Guarantees are issued to homeowners on the amount of energy used for heating, cooling and comfort. See actual guarantee for details and imitations [www.environmentsforliving.com](http://www.environmentsforliving.com)

# EFL Water Efficiency Specifications

## Current

- Kitchen - 2.2 gpm
- Lavatory - 1.5 gpm
- Showerhead - 2.0 gpm
- Toilets - HET @ 1.28 gpf
- Energy Star Appliances –
  - Horizontal Axis Washing Machine - WF = 6
  - Water Heater Efficiency Standards
- Engineered Plumbing (minimize water wasted waiting for Hot Water) – Recommended Practice

# Green Building Standards - The Water Efficient Home

Application	1999	Environments For Living® Certified Green	% Savings
Toilet Flush	18.5	6.5	64.8
Clothes Washer	15	6.8	54.6
Shower	11.6	9.2	20.6
Faucets	10.9	9	17.4
Other	3.8	3.9	0
Total	59.8	35.4	41%

Units – Gallons/Capita/day

1999 – Residential End Uses of Water Study – (excludes leakage  
Annual usage (350 occupancy days )= 58,604 gallons/year.

Environments for Living – Kitchen Faucet – 2.2 gpm, Lav Faucet 1.5 gpm,  
Showerhead 2.0 gpm, Toilet – 1.28 gpf, Clothes Washer – Water Factor 6.0  
Annual usage = 34,700 gallons/year

# WaterSense for Homes

## Indoor Water

- Kitchen Faucets – 2.2 gpm
- Lavatory Faucets – 1.5 gpm
- Showers – 2.0 gpm per 2160 in<sup>2</sup> (36 x 60 tub)
- Toilets – HET @ 1.28 gpf
- Engineered Plumbing – 0.5 gallons WH to Outlet (max)
- Optional:
  - Appliances – Energy Star (Clothes Washer WF ≤ 6.0)
  - Specifications for Evaporative Cooling, Water Softeners and Water Filtration/Purification Equipment

# WaterSense for Homes Outdoor Water

- Option 1 – Turfgrass Allowance < 40% of landscapable area
  - Option 2 – Professional Landscaper & irrigation specialist design landscape using EPA Water Budget tool
    - Sets requirements for irrigation system where used
    - Requires system audit testing

# Next Steps

- Change Environments For Living Water Efficiency Specifications to WaterSense for Homes requirements
- Consider setting EFL pipe volume limits lower than WaterSense to further reduce water wasted waiting for hot water.
- Develop a Plumbing Plan Design tool to assist builders/plumbers in evaluating system design alternatives
- Begin to educate Builders, Architects and Plumbers about how to consider home layouts that result in shorter HW pipe runs
- Conduct Home Water Use Study to gather data on actual use patterns, generating insights that relate to improved system design approaches.

## Typical Plumbing



Pipe Length = 152 feet  
 Water wasted waiting for Hot  
**25 g/d, 8750 gallons/year**

Approximate Hot Water Wait Times

Kitchen	1 minute
Master Bath Lav	1.5 minutes
Master Bath Shower	1.25 minutes
Bath 2 Lav	1 minute
Bath 2 Shower	45 Seconds

# Home Water Use Study

- 4 Homes
  - 2 Adults, 2 Children who shower
  - December 10-February 10 Baseline Study
- Data
  - Hot and Cold Water Flow Rate and Temperature all Faucets
  - Shower Arm Flow Rate and Temperature
  - Reported Change of State on Flow (0.1 gpm) and Temperature (10° F)

# Observations

- Wide variation in uses among the 4 families
  - » Shower – Gallons per use

Group	Average	Std Deviation	3 Sigma
Adults	13	7	21
Children	16.7	7.5	22.5
All	14.8	7.5	22.5

- » Shower – Duration (minutes)

Group	Average	Std Deviation	3 Sigma
Adults	6:48	3:27	10:20
Children	8:28	3:43	11:08
All	7:38	3:40	11:00

# Observations

- Large variations from family to family

## Averages

Total Faucet Use	Gallons	Minutes	# Uses
High	32	24.6	61
Low	13.5	8.9	28

Total Shower Use	Gallons	Minutes
High	58.1	34:54
Low	49.2	22:47

# Water Wasted Waiting for Hot

	House 1	House 2	House 3	House 4
Average (GPD)	8.6	3.8	3.8	4.4
3 - Sigma	11.7	7.6	8.9	11.6

Primarily Showers

- Faucet Usage Observations
  - Zero & One Second Uses (On-Off)
    - Varies 12 to 46% of the total uses
  - Uses All Hot Draw (Water < 80° F)
    - Varies 10-19% of uses – usually of short duration

# Simultaneous Use

House 1	Kitchen Sink	Master Bath Sink 1	Master Bath Sink 2	Kids Bath Sink 1	Kids Bath Sink 2	Main Floor Bath Sink	Master Shower	Kids Shower	
Kitchen Sink	-		6	0	6	1	4	2	18
Master Bath Sink 1	6-			7	0	5	0	0	14
Master Bath Sink 2	0	7-			3	1	0	11	12
Kids Bath Sink 1	6	0	3-			10	0	3	3
Kids Bath Sink 2	1	5	1	10-			0	1	9
Main Floor Bath Sink	4	0	0	0	0-			0	2
Master Shower	2	0	11	3	1	0-			11
Kids Shower	18	14	12	3	9	2	11-		

House 3	Kitchen Sink	Master Bath Sink 1	Master Bath Sink 2	Kids Bath Sink	Main Floor Bath Sink	Master Shower	Kids Shower
Kitchen Sink	-	0	0	0	1	2	1
Master Bath Sink 1	0	-	2	3	0	5	18
Master Bath Sink 2	0	2	-	0	0	4	2
Kids Bath Sink	0	3	0	-	0	2	1
Main Floor Bath Sink	1	0	0	0	-	2	2
Master Shower	2	5	4	2	2	-	6
Kids Shower	1	18	2	1	2	6	-

# Peak Flow Rates - Cold

Location	House 1	House 2	House 3
Master Sink	1.2	1.4	1.5
Master Shower	0.72	1.0	1.0
Bath 2 Sink	1.2	1.1	1.6
Bath 2 Shower	0.54	0.7	1.0
Kitchen	1.3	1.9	1.5
Powder	1.2	1.2	1.3

# Peak Flow Rates - Hot

Location	House 1	House 2	House 3
Master Sink	1.2	1.4	1.5
Master Shower	1.16	1.1	1.49
Bath 2 Sink	1.2	1.5	1.7
Bath 2 Shower	1.18	01.5	1.10
Kitchen	1.3	1.2	1.5
Powder	1.2	1.2	1.3