



ILLINOIS

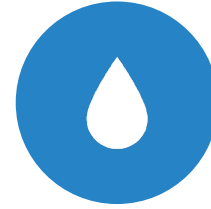
Illinois Sustainable Technology Center

PRAIRIE RESEARCH INSTITUTE

Water Conservation and Wastewater Minimization

- ❖ Making a Business Case
- ❖ Establishing a Baseline
- ❖ Identifying Opportunities

Making a Business Case



WATER IS A LIMITED RESOURCE AND SHOULD BE CONSERVED



REDUCTION CONSERVES BOTH WATER AND MONEY



OPERATING WITH LESS WASTE IS A COMPETITIVE ADVANTAGE



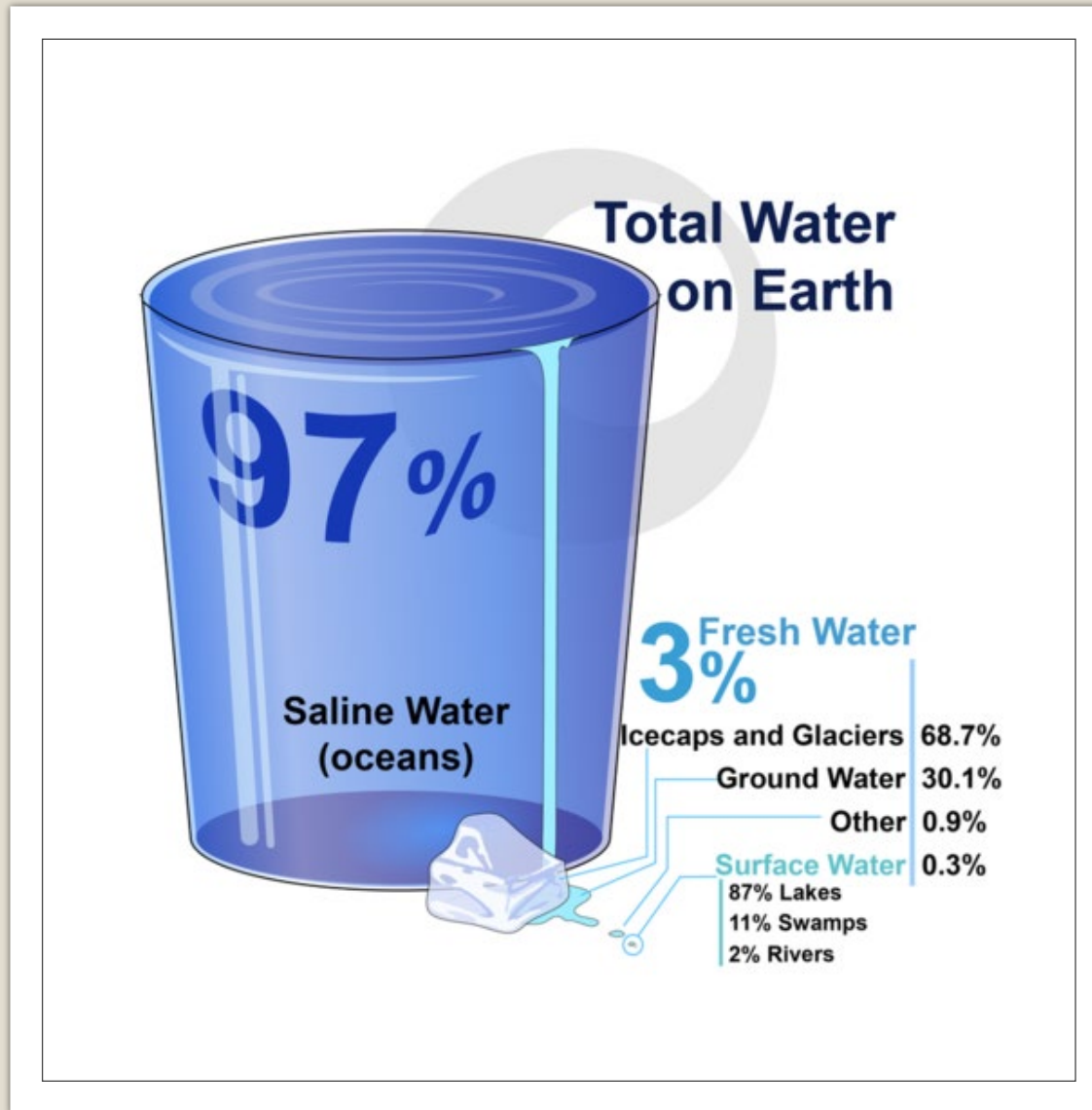
REDUCTION IN USE AND WASTE INCREASES BUSINESS RESILIENCE



DEMONSTRATES LEADERSHIP TO STAKEHOLDERS

Earth's Water

- Less than 1% of water on earth can be used as drinking water.
- If all the world's water were fit into a gallon jug, the freshwater available to us would equal only 1 Tbsp.
- A person can live 1 month without food, but 1 week without water.
- A precious resource.
- We must use it wisely!

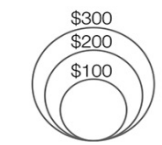
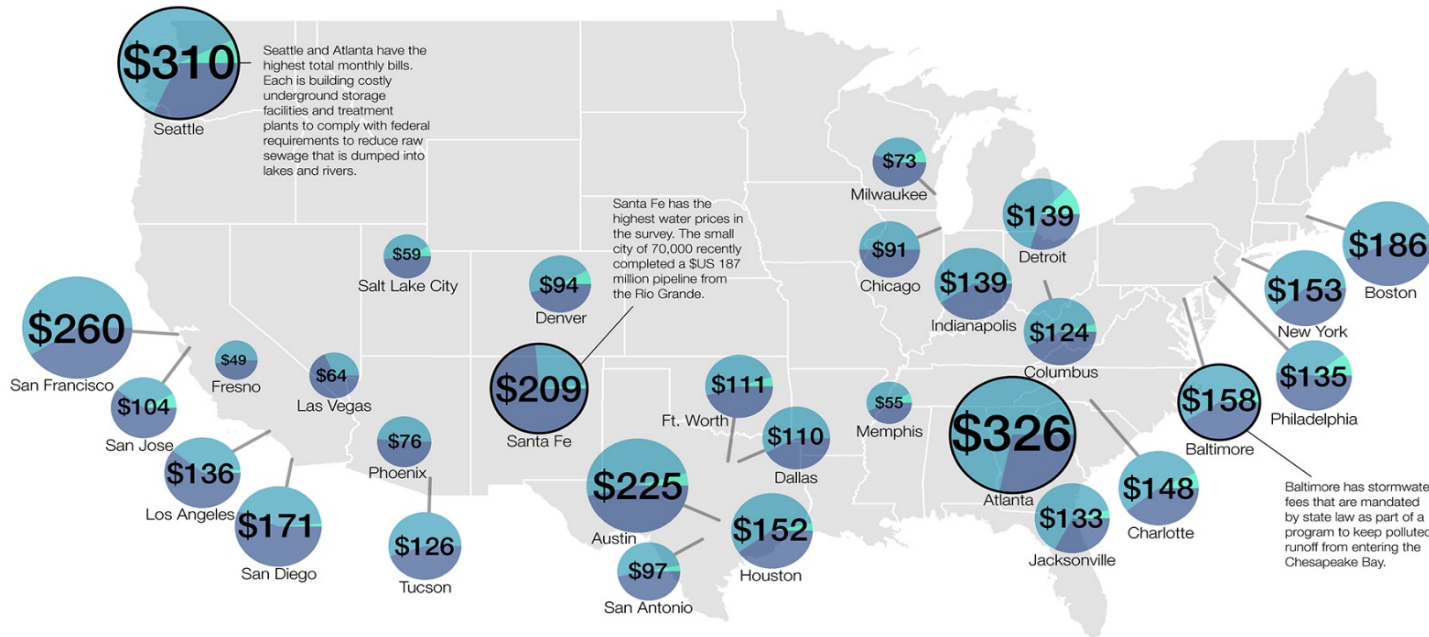


Why Water?

Price of Water Up 6 % in 30 Major U.S. Cities; 41 Percent Rise Since 2010

THE PRICE OF WATER: 2015

Combined water, sewer and stormwater prices for households in 30 major U.S. cities.



Water prices pay for treating, pumping, and delivering water, while sewer prices cover the cost of cleansing the water that goes down the drain.

Sewer prices are often higher than water prices because more energy and chemicals are required for treatment. Following the Clean Water Act, the federal government gave grants for new treatment plants during the 1970s and 1980s. Over the past three decades, however, new spending has been cut for local sewer infrastructure.

Stormwater fees are not included in every city's monthly bill. Some cities use general tax revenues to pay for projects to reduce polluted runoff from streets and parking lots. However, these projects must then compete for funds with other departments like police and schools.

Rates current as of April 1, 2015. Monthly bill calculated for a family of four using 100 gallons per person per day. Source: Circle of Blue research, based on utility water rates.



In Illinois:
H2O Generation 3,618 kWh/MG = \$450/MG

Wastewater Treatment 2521 kWh/MG = \$ 212/MG

Cost of Leaks from EPA Watersense

Malfunction	Leaking Flow Rate (gallons per minute)	Water Loss	Cost at Mike's House	Estimated Cost/ month in IL	Estimated Cost/Year in IL	Estimated Cost of Water Loss National Average
Leaking Toilet	0.5 gpm	21,600 gallons per month	\$ 243.30	\$ 72.42	\$ 869.10	\$2,100 per year
Drip Irrigation Malfunction	1.0 gpm	43,200 gallons per month	\$ 470.10	\$ 144.85	\$ 1,738.20	\$4,300 per year
Unattended Water Hose at Night	10.0 gpm	5,400 gallons per day	\$ 1,717.50	\$ 543.19	\$ 6,518.23	\$16,000 per year
Broken Distribution Line For:						Up to \$64,000 per year
One Night	15.0 gpm	8,100 gallons	\$ 120.45	\$ 27.16	\$ 325.91	
One Day	15.0 gpm	21,600 gallons	\$ 243.30	\$ 72.42	\$ 869.10	
One Week	15.0 gpm	151,200 gallons	\$ 1,604.10	\$ 506.97	\$ 6,083.68	
One Month	15.0 gpm	648,000 gallons	\$ 6,820.50	\$ 2,172.74	\$ 26,072.93	
Tempering Water Line on a Steam Sterilizer Stuck in the On Position	2.0 gpm	86,400 gallons per month	\$ 923.70	\$ 289.70	\$ 3,476.39	\$8,600 per year
Stuck Float Valve in a Cooling Tower	5.0 gpm	216,000 gallon per month	\$ 2,284.50	\$ 724.25	\$ 8,690.98	\$21,000 per year

USEPA Watersense

- <http://www3.epa.gov/watersense/index.html> for checklists, guides and products

Establish a Baseline

Know Where You Started to Measure Success

Use meters and submeters to know where and how much water is being used and wastewater generated

Establish a baseline BEFORE making any improvements

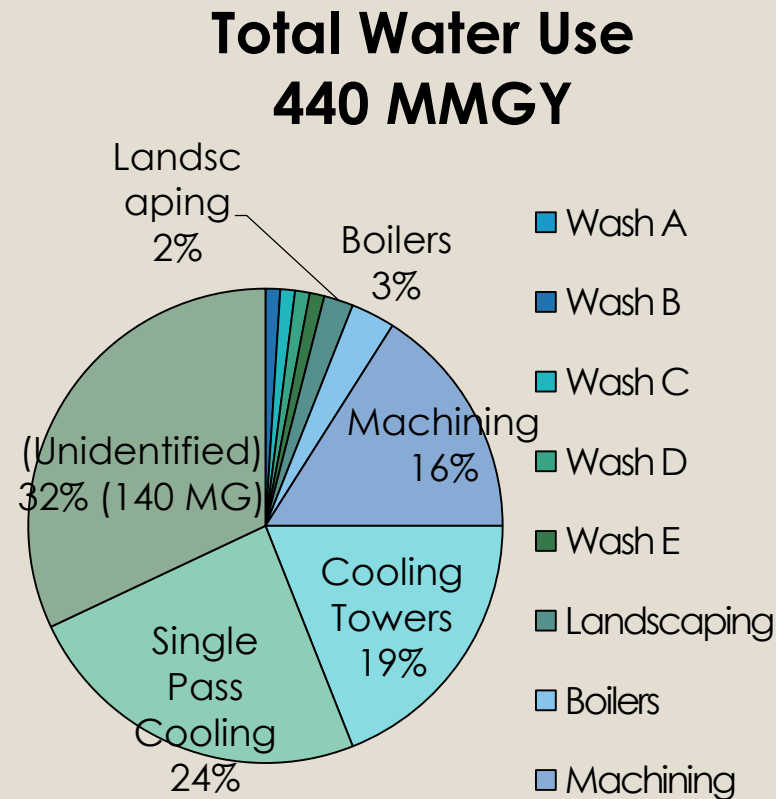
Conduct a Water Audit 1,2,3

- Level I
 - Building use
 - Single or multi-building
 - Demographics
 - Rough estimate of savings
- Level II
 - Detailed consumption by end use (equipment)
 - More robust flow measures
 - More rigorous estimate of savings
- Level III
 - Detailed analysis of subsystems
 - Detailed analysis of all water use equipment
 - Evaluation of capital investment and projected savings

Sample Water Audit Findings: Large Manufacturing Facility

Facility Total Water Use:

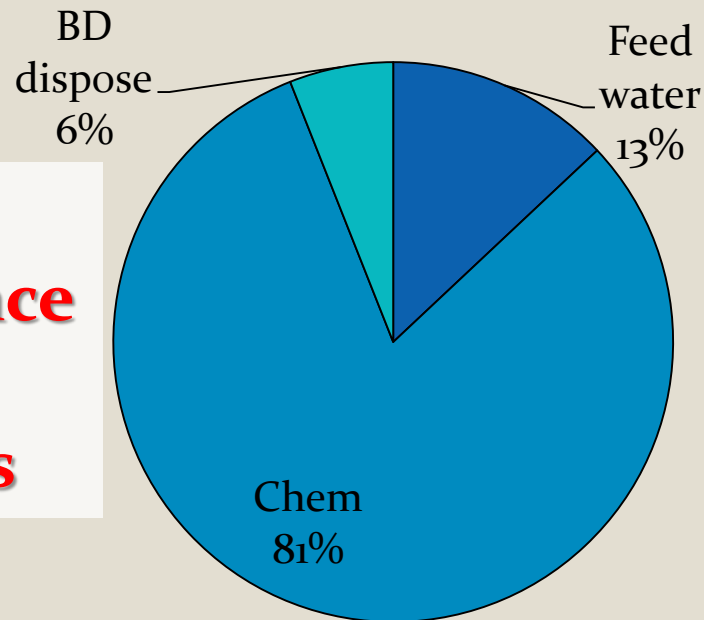
- *Perceived* cost of water = \$1.71 per 1,000 gallons; \$0.5 million per year
- *True* cost of water = \$10.21 per 1,000 gallons; \$3 million per year



Sample Water Audit Findings: Large Manufacturing Facility

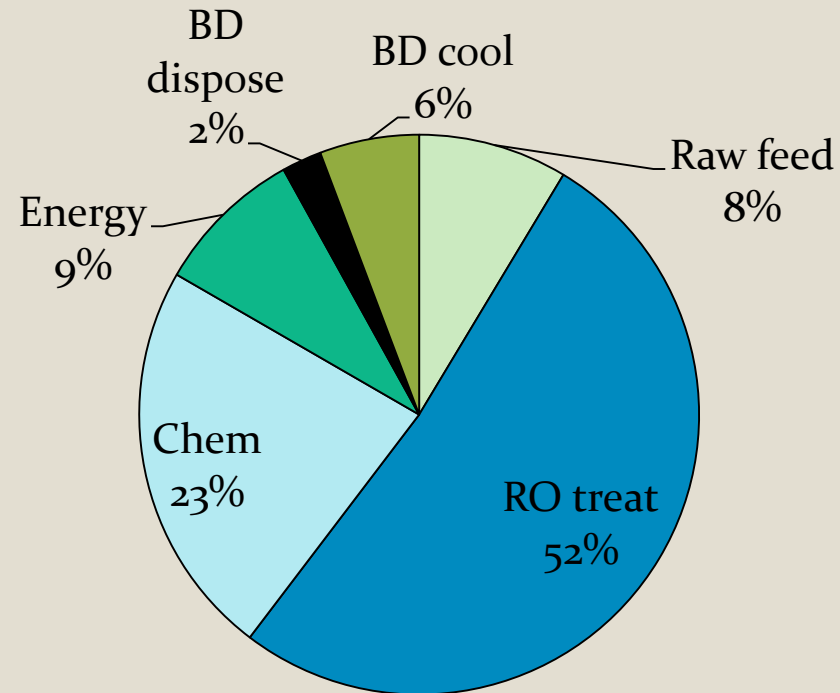
Cost to Use Cooling Tower Water

Perceived cost = \$1.71/kgal
Actual Cost = \$4.46/kgal



Cost to Use Boiler Water

Perceived cost = \$1.71/kgal
Actual Cost = \$9.78/kgal



•Also include :
-Maintenance costs
-Labor costs

Opportunities

Turn Off and Fix Leaks



Reduce Flow



Green Pre-Rinse Nozzle



Waterless



Dual Valve Flush



Rotary spray heads



Low Flow Head



Aerator



A New Take on a Brick



Sensor

Reduce Flow

Throttling-back all existing sink faucet shutoff valves



Rinsing: Eliminate Guesswork

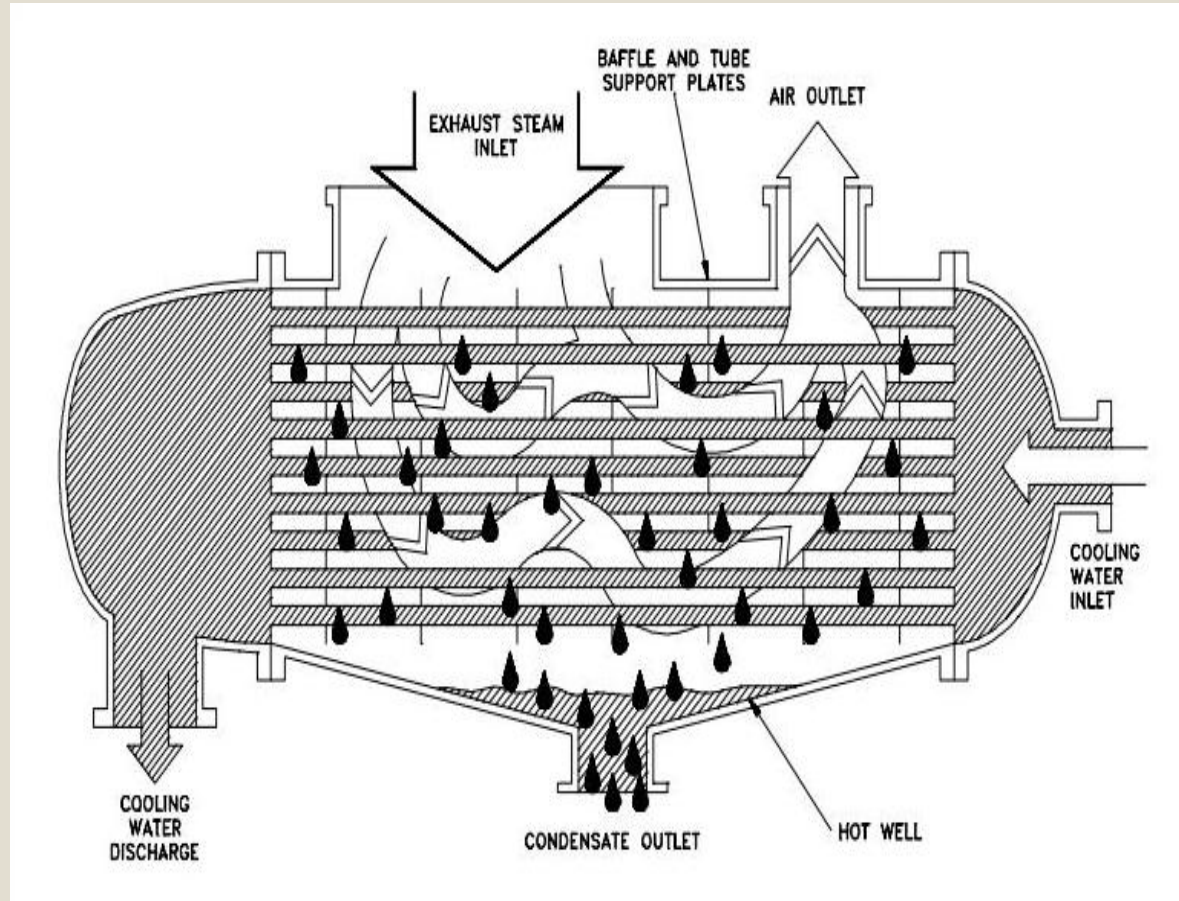
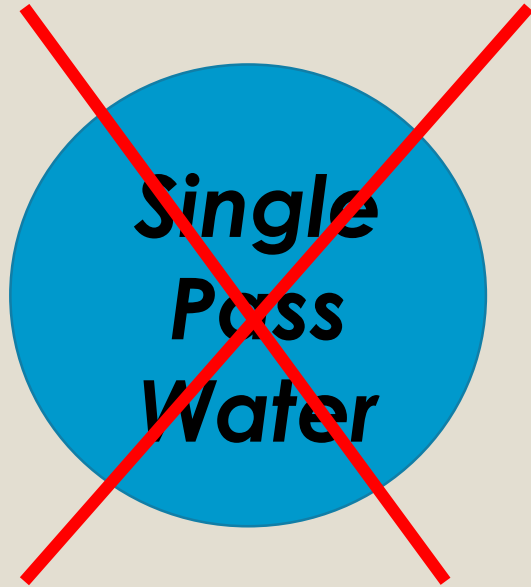
Maintain Water Quality Standard
Conductivity Control



50-90% Savings

Identify Single-Pass Water Use

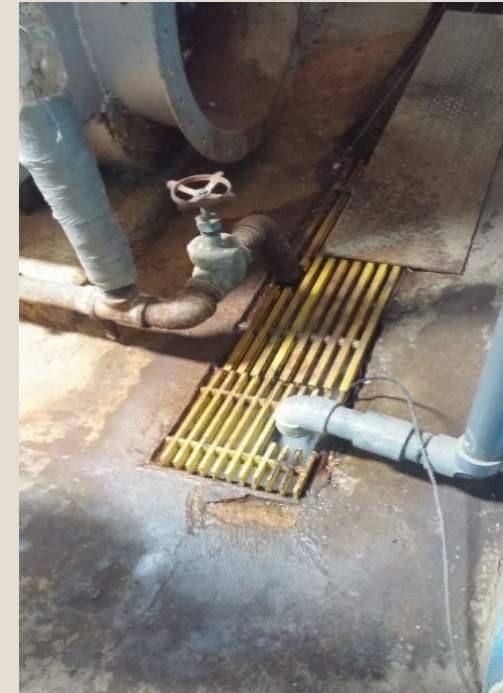
Then modify or eliminate



Single-Pass
Condenser

Reuse RO Reject

- Replace old filters
 - Save water and \$
- Reuse RO Reject
 - Floor Scrubber
 - Irrigation
 - Roof Cooling
 - Non-contact Process Water



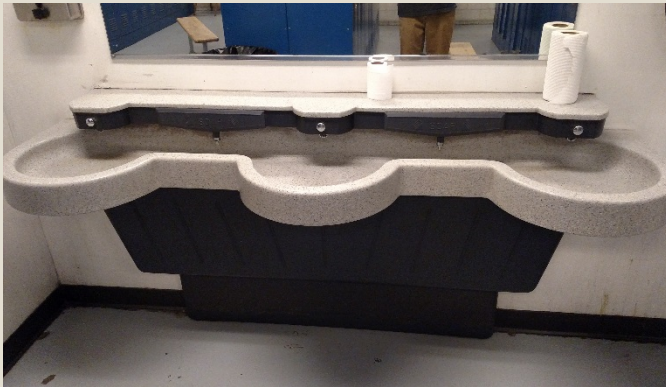
**Great VFD
Opportunity**

**Utility
Incentive**

Opportunities

Reduce flow and conserve water in wash fountains.

- 3-station wash basin.
- Push button metering air valves.
- Mfg. Rating at 0.5 gallons per minute (gpm).
- Adjusting all metering air valve setting times to 8 - 10 second cycles to conserve water.



Ameren Incentives

- Faucet Survey (Measure flow and Use): \$2 Per Faucet
- Faucet Aerator: \$3 per Faucet
- Laminar Flow Devices: \$8 per Device
- High-efficiency Shower Heads: \$12 per Head
- Custom Incentive: \$0.30 per 1,000 Gallons Saved

Use and Frequency Data

- Female building occupants use the toilet three times per day on average, while male building occupants use the toilet once per day on average.
- Male Building occupants use the urinals two time per day on average.

Vickers, Amy. 2001. *Handbook of Water Use and Conservation*. WaterPlow Press.

- Average private-use lavatory faucet use is approximately 8.1 minutes per person per day. Public-use faucets can be used between 15 seconds and one minute per use, and used three or four times per occupant per day.
- The average shower duration is approximately eight minutes.

Mayer, Peter W., and DeOreo, William B. American Water Works Association (AWWA) and AWWA Research Foundation. 1998. *Residential End Uses of Water*. Page 95.

Equations

- **Water Use of Toilet (gallons per year) = Toilet Flush Volume x Number of Flushes x Days of Facility Operation**
- **Water Use of Urinal (gallons per year) = Urinal Flush Volume x Number of Flushes x Days of Facility Operation**
- **Water Use of Faucet (gallons per year) = Faucet Flow Rate x Daily Use Time x Number of Building Occupants x Days of Facility Operation**
- **Water Use of Showerhead (gallons per year) = Showerhead Flow Rate x Duration of Use x Use Rate x Number of Building Occupants x Days of Facility Operation**

Current Water Use - Fixtures

- **Urinals** installed prior to 1994 have flush volumes that typically range between 1.5 and 3.5 gpf. Urinals installed after 1994 have flush volumes of 1.0 gpf.

Vickers, Amy. 2001. *Handbook of Water Use and Conservation*. WaterFlow Press.

- **Lavatory faucets** installed after 1996 have flow rates of 2.2 gpm or less. Some public-use lavatory faucets installed in more recent years may flow at 0.5 gpm.
- **Showerheads** installed after 1994 will have a flow rate of 2.5 gpm or less. Older showerheads may flow as high as 3.0 to 5.0 gpm. (look for rating)

https://www3.epa.gov/watersense/docs/ws-at-work_bmpcommercialandinstitutional_508.pdf

Opportunities

Retrofit toilets with dual flush technology to conserve water.

- Flushometer valves.
- Tank toilets
- Dual-flush valves and tanks allow for full flushes dispensing 1.6 gpf (solid waste), while reduced or quick-flush operation dispenses 0.8 to 1 gpf. (Liquid waste).



Opportunities

Install High Efficiency, Low-flow Wash-down Urinals.

- Waterless urinals.
- High efficiency; Pint/0.125 gal.



Opportunities

Throttle valves in sinks or provide aerators as a means to control flow and conserve water.

- Throttling-back all existing sink faucet shutoff valves
- Install faucet aerators or Laminar Flow Devices



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