



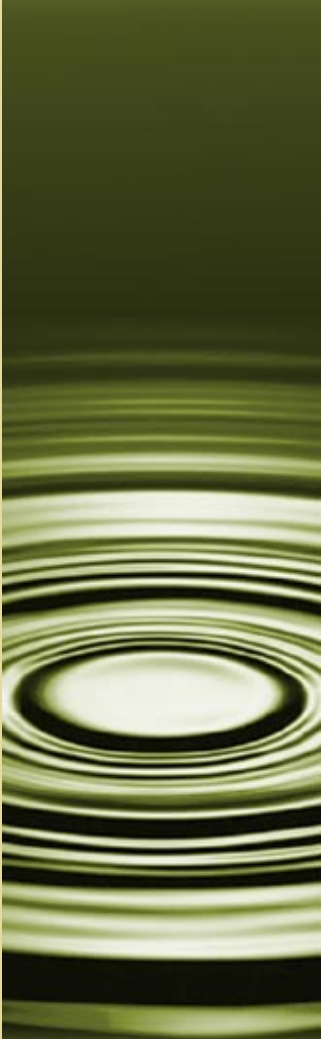
Indoor Water Audits

Presented by:
PJ Newcomb

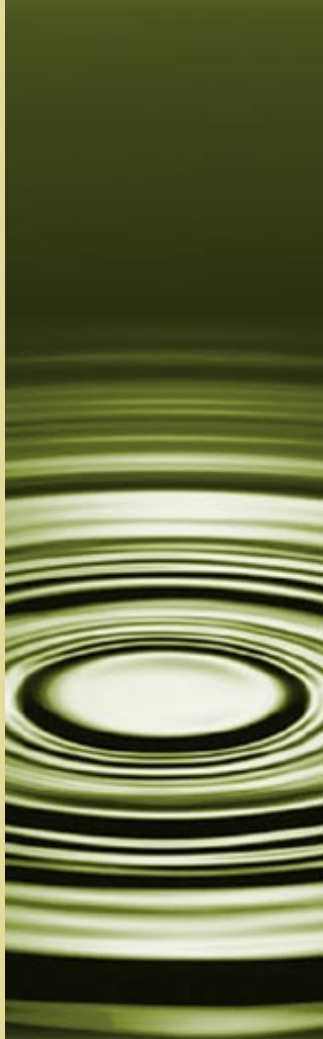
**Higher Education Water Workshop
February 6, 2008**

In This Presentation

- Understanding and Managing Water Use
- Pre-Audit Information
- Base-lining and Benchmarking
- Conducting an Indoor Water Audit at the building level



Managing Water – Getting Started



What's our
usage/costs?

Review Bills

Are they
reasonable?

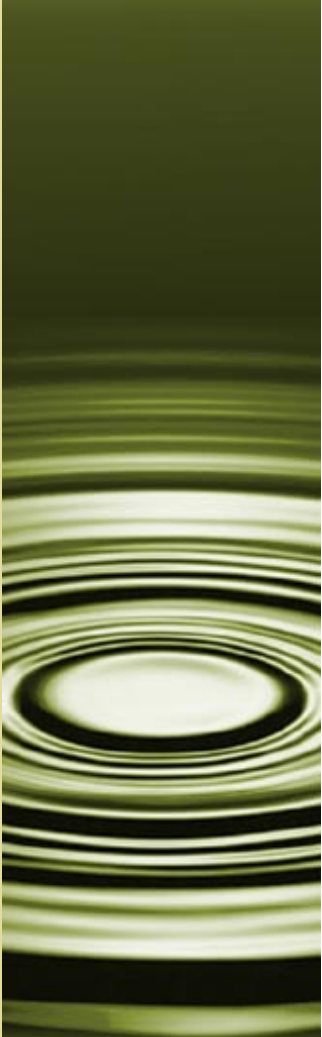
Benchmarking

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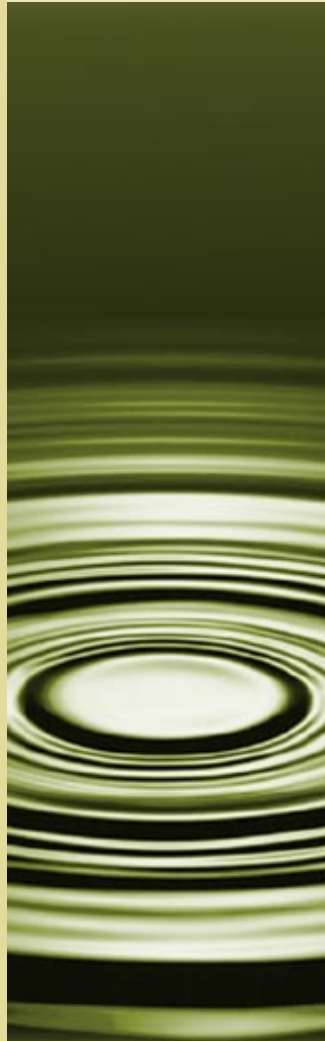
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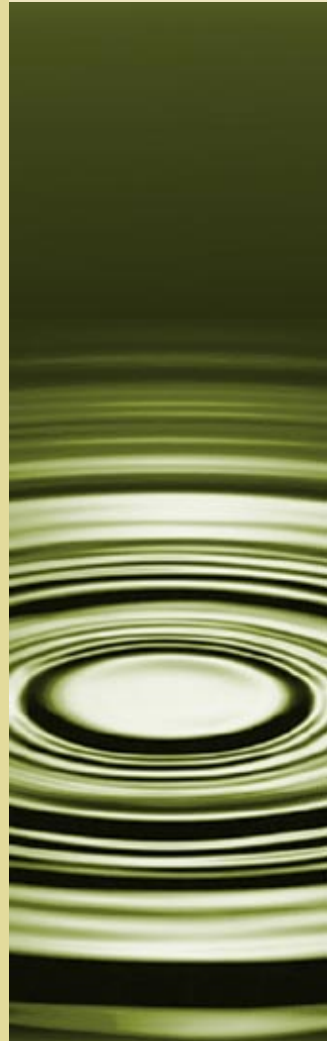
**Benchmark
k**



Where to Focus?



How to Choose Options



*Analyze
Cost/Benefit*

**What are
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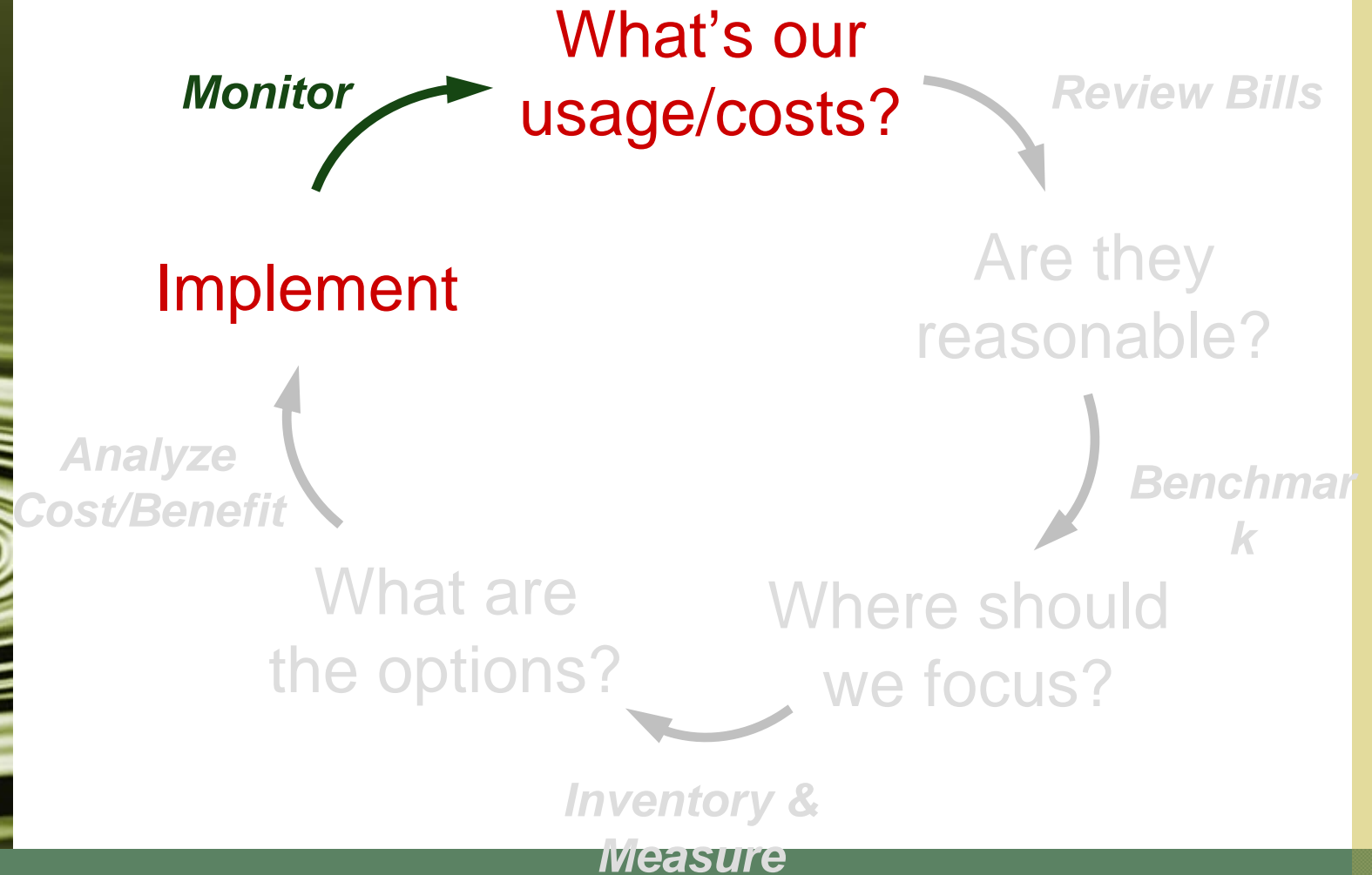
Benchmark

Where should
we focus?

*Inventory &
Measure*



Implement & Check Progress

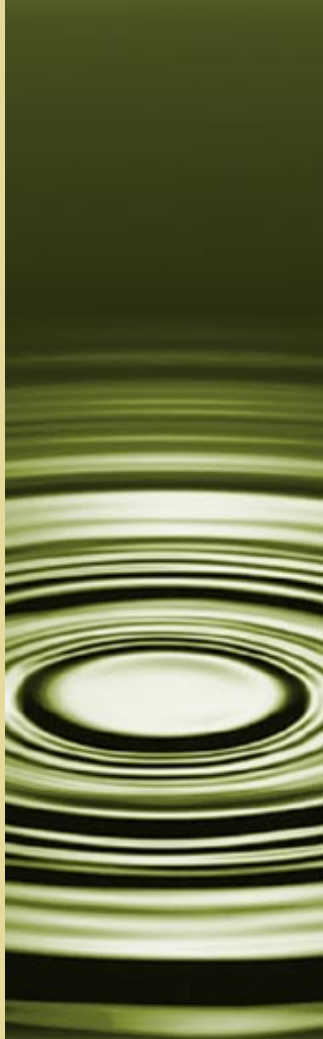


Pre Audit Information

- Water and Sewer Bills
 - 1 year (Min)
- Rate structure for billing
- Sources of water (ground, surface, municipal, rainwater...)
- Age of building/retrofits/renovations
- Number of occupants
- Hours of operation
- Square footage

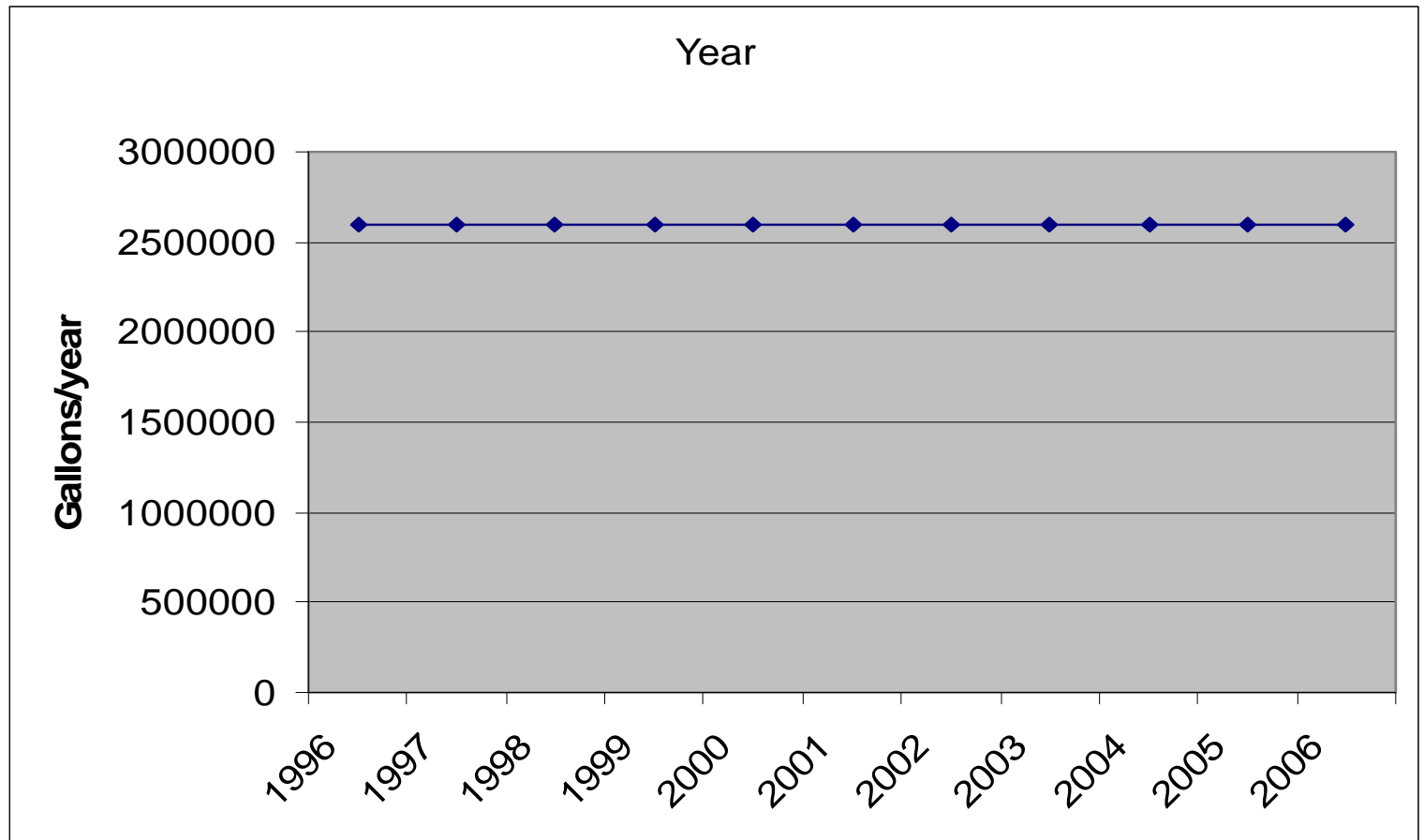
What to look for in your data

- Compare water use to:
 - Other buildings with similar use. (Gal/ft² or gal/person)
 - Manufacturers recommendations (boilers/cooling towers/dish washers/ice makers).
 - Estimates from worksheets (P²AD website & others).
- Look for anomalies in the data:
 - Water use in the winter vs summer.
 - Water use in months with more weekends or holidays.
 - Water use on weekends.
 - Does meter spin when all water uses are off-line?



Water Bill Vs. Metered Flow Example

What is wrong with this picture?



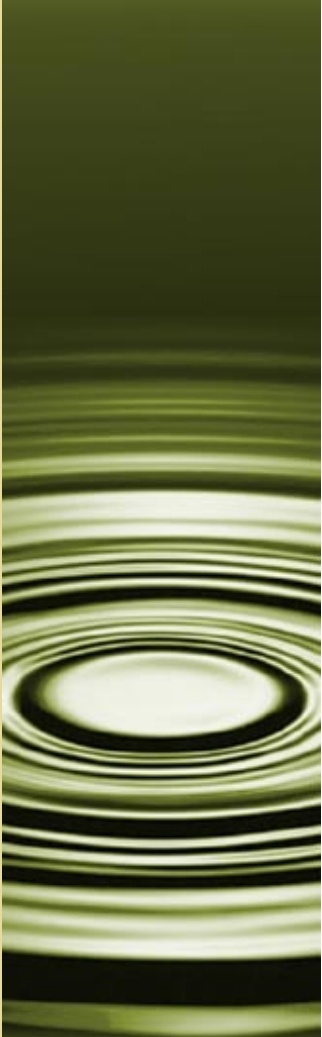
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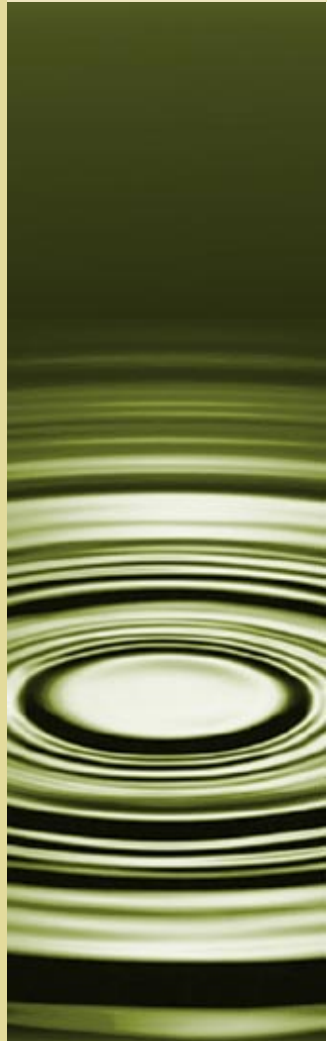
**Benchmark
k**



Benchmarking

- What drives water use on campus?
 - # Students & employees, activities, gross square footage
- Examples
 - UNC: **25 gal/GSF** (2006-07)
 - Colorado State: **31 gal/GSF** (2006)
 - UC Berkeley: **44 gal/GSF** (2002)
- Must understand YOUR water use
- Compare use among buildings; will lead to questions

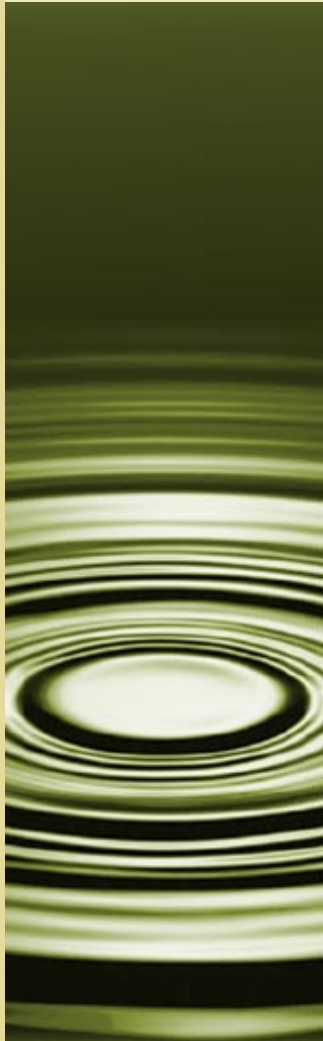
Where to Focus?



Inventory & Measurement

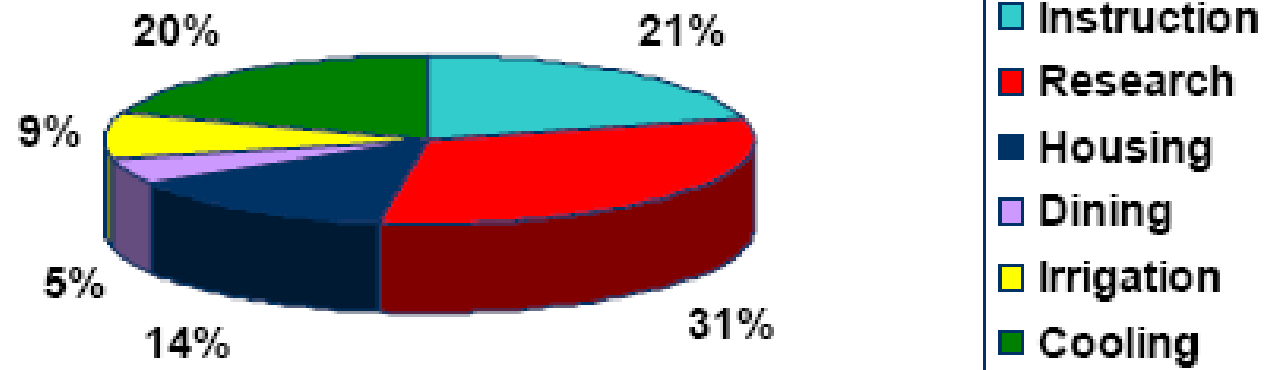
HOW do you use water?

- Domestic (toilets, sinks, showers)
- Cooling & Heating (towers, boilers)
- Landscaping
- Kitchens & Laundry
- Research Needs
- Athletic
- Leaks!



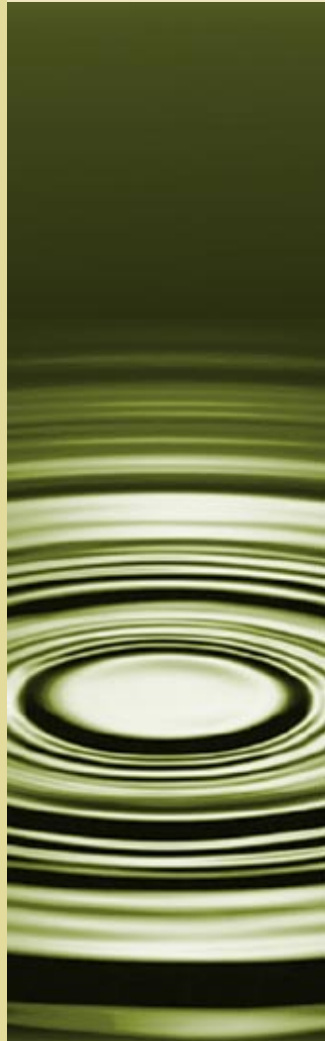
UGA

Figure 1. Water Consumption by Category



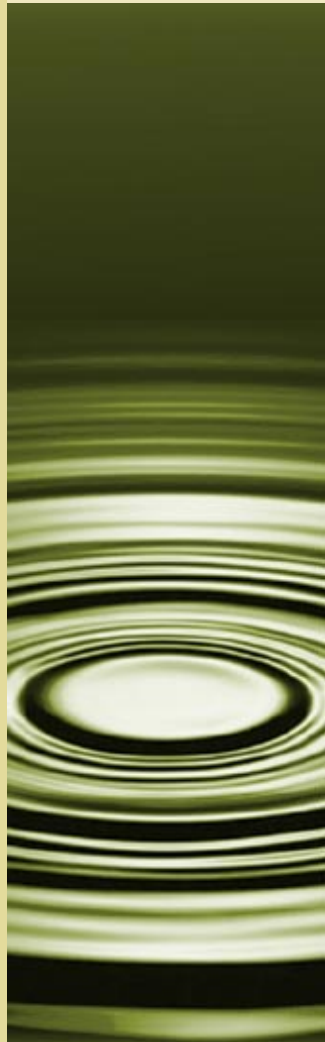
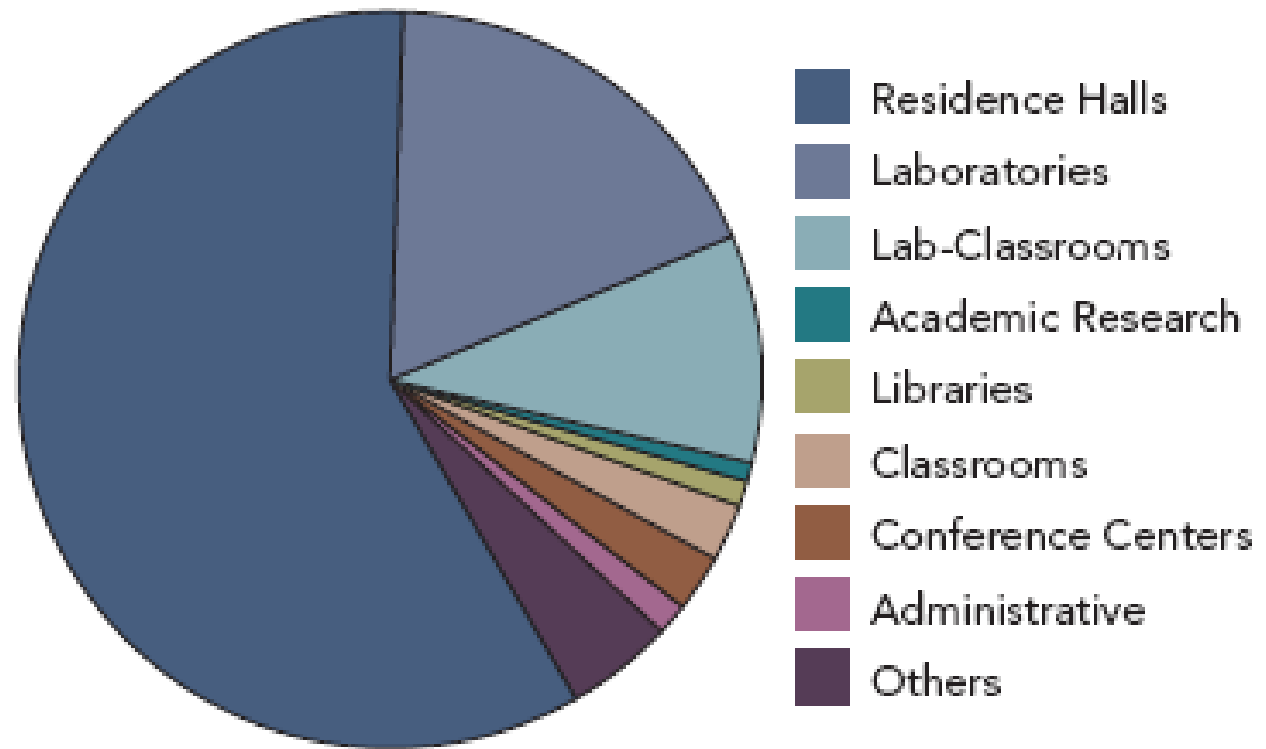
564 Million Gallons Annually

Source: UGA Physical Plant



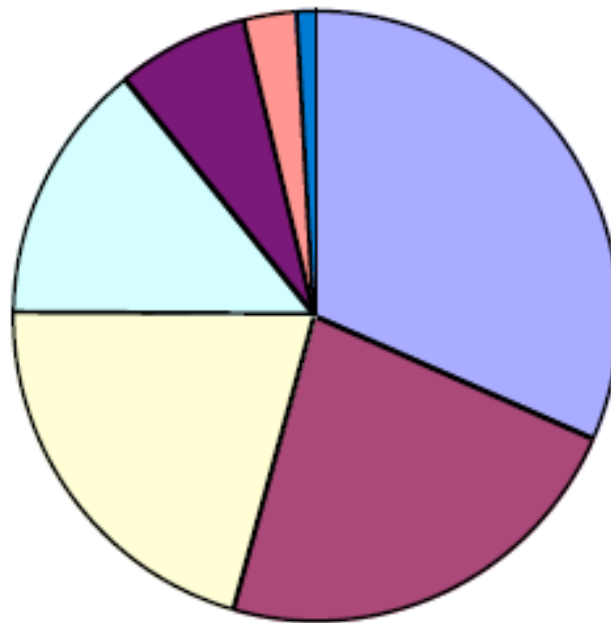
University of North Carolina

Water Consumption by Building Type
(Thousands of Gallons)

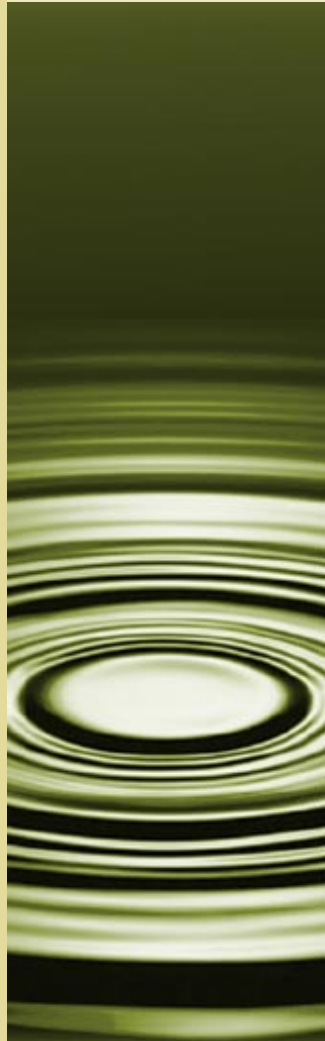


Colorado University

CU Potable Water Use

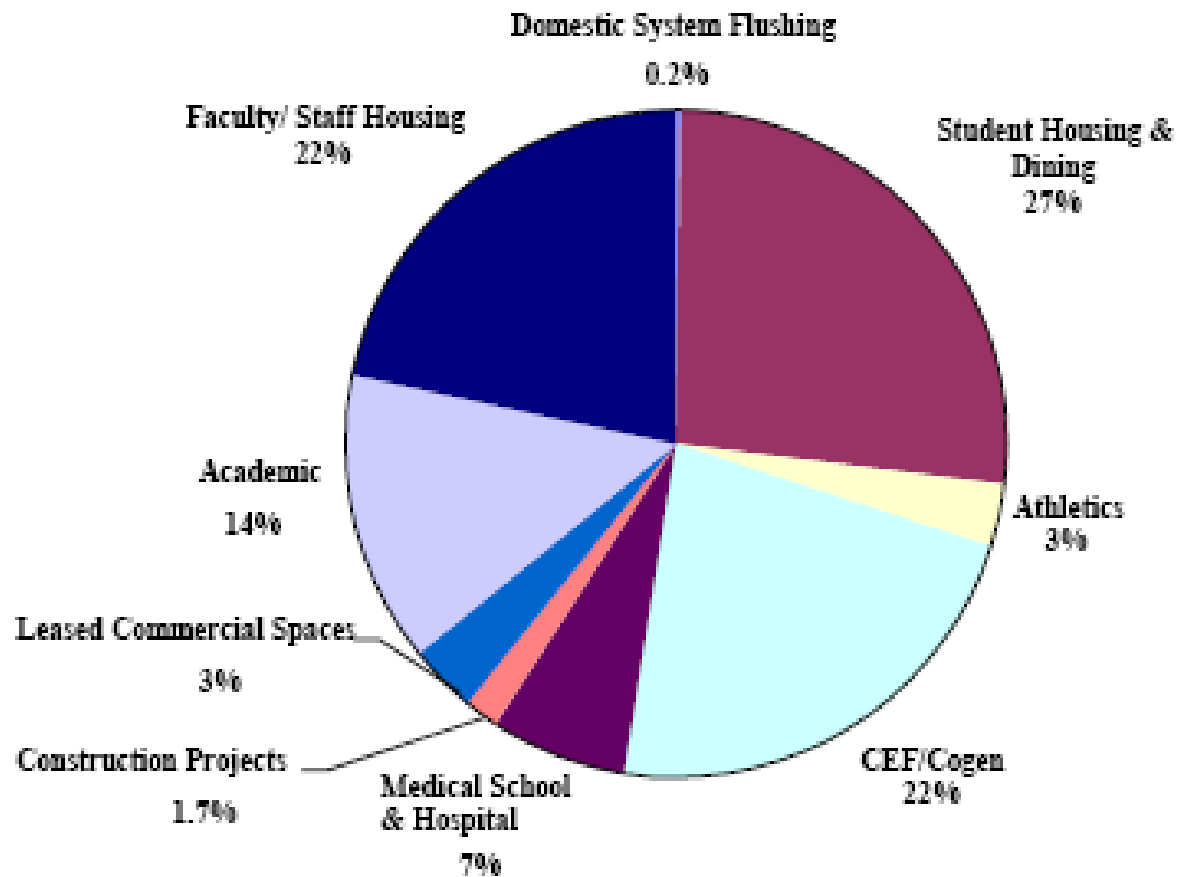


- Housing
- Academic
- Power House
- Research
- Auxiliaries
- Athletics
- Administrative



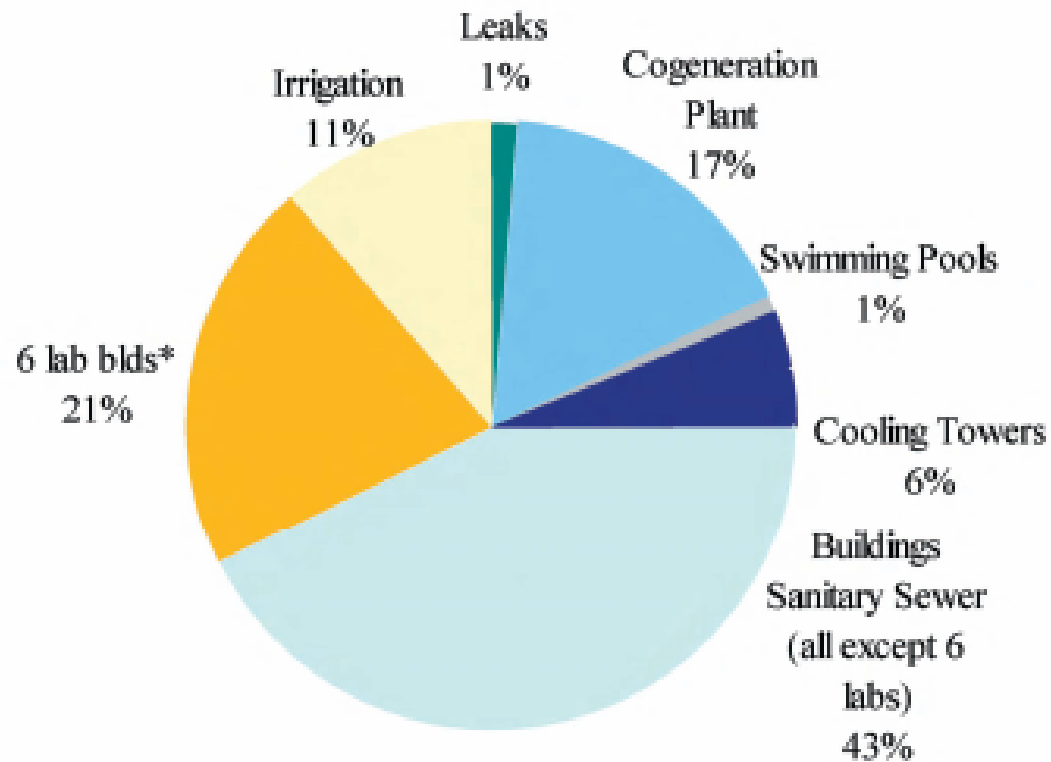
Stanford U.

Figure 4-1. Average Annual Demand By Category for Domestic Water System



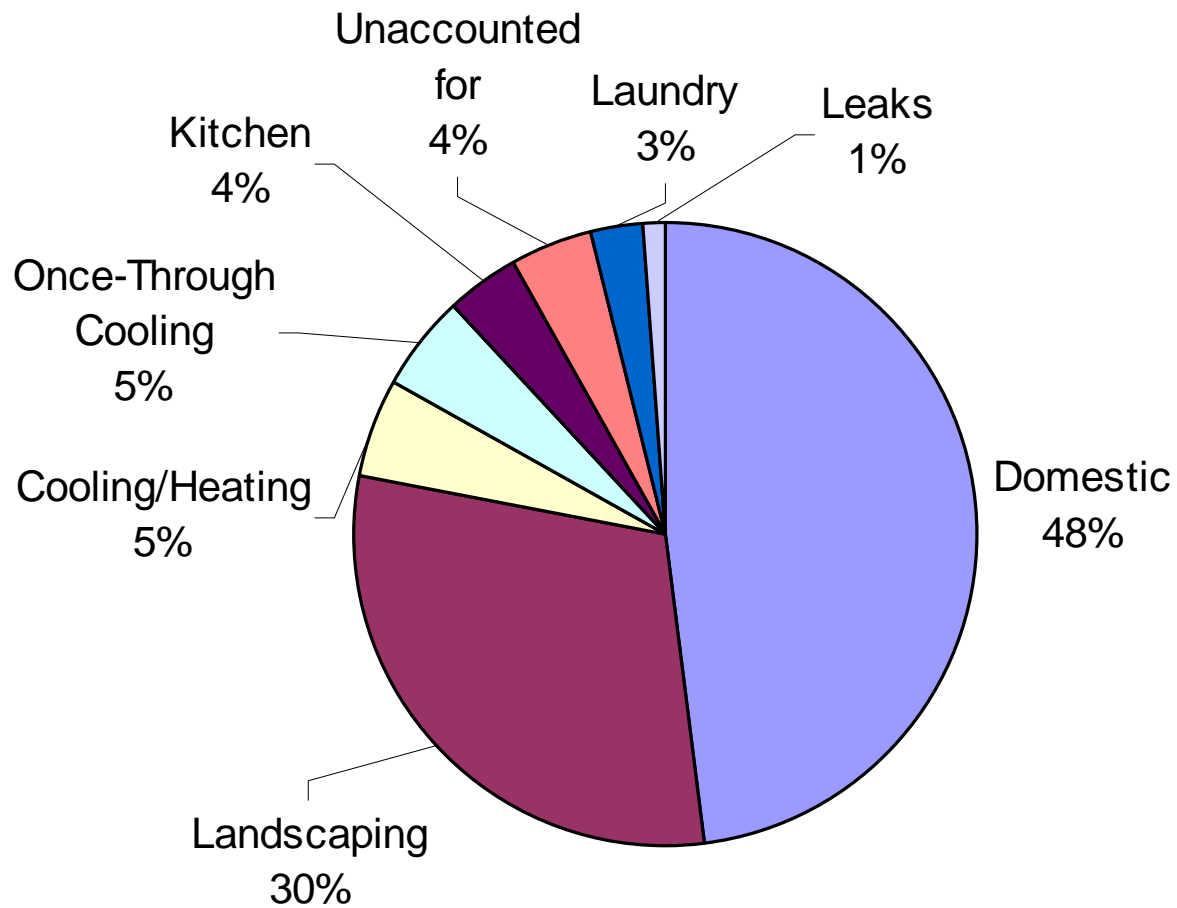
UC Berkeley

UC Berkeley Water Distribution 2003

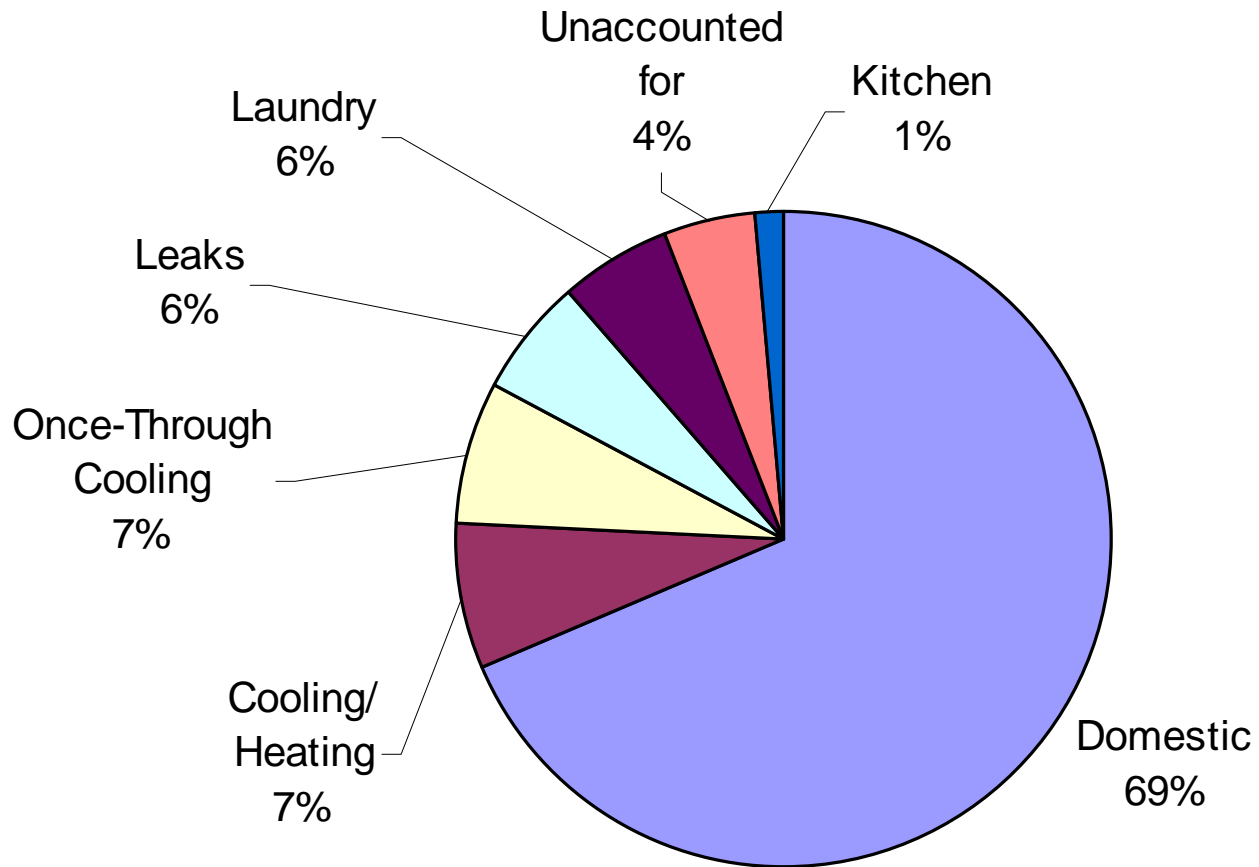


*Cory, Koshland, Latimer, LSA , McCone, VLSB

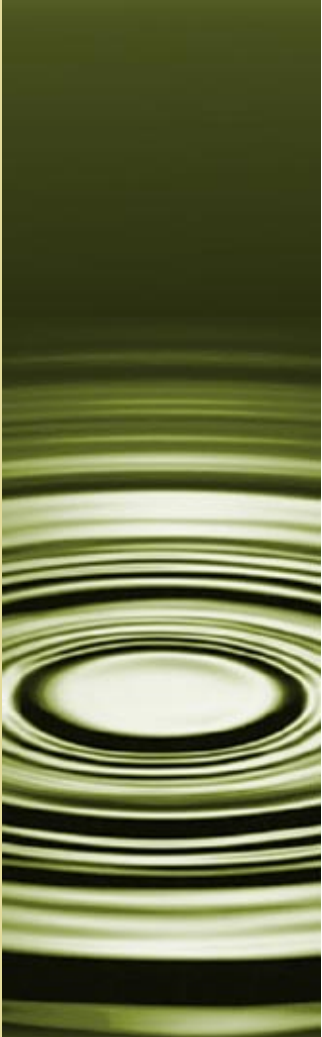
Water Use in Schools & Universities



Indoor Water Use ONLY

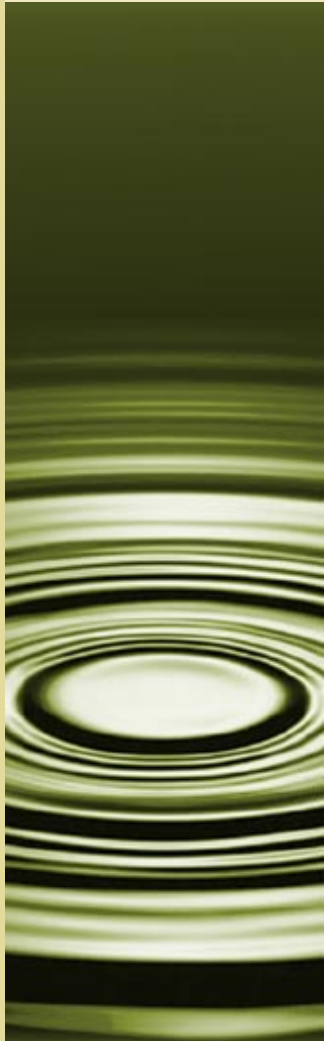


Conducting a Water Audit




What Is a Water Audit?

A water audit is an on-site survey and assessment of water-using hardware, fixtures, equipment, landscaping, and management practices to determine the efficiency of water use and to develop recommendations for improving water-use efficiency.



How Do I Perform a Water Audit ?

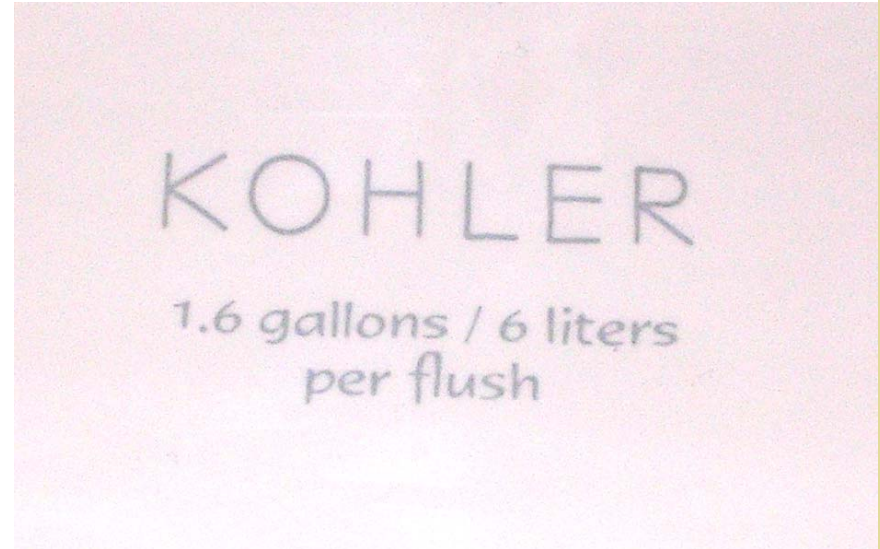
- 
- Collect meter readings and water bills including any historical information.
 - Identify areas of greatest water use by metering or measuring (ID at least 80% of water use).
 - Inventory water use of all equipment, porcelain fixtures, and leaks.
 - Quantify water flow and quality needs.
 - Summarize data and check against bills and industry benchmarks for consistency.

Domestic Audit Info

- Number and type of water-using appliances
- Average number of uses per day
- Amount of time items are used
- Leak history information
- Age of water lines

Toilets

- Energy Policy Act of 1992 (EPAct) - federal law that established maximum allowable water-use requirements for toilets, urinals, showerheads, and faucets manufactured, sold, or installed in the US

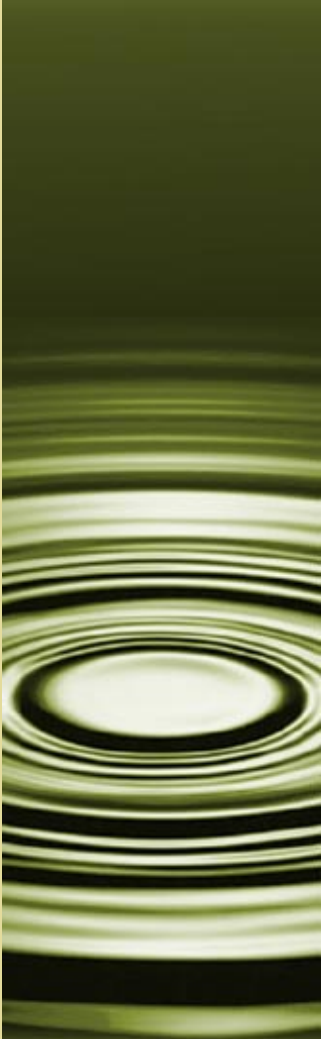


- All post 1992 toilets **MUST** be stamped with flush rates
- Stamp is located behind seat
- Office: 3 flushes/day for women and 1 flush/day for men;
Residential = 5.1 flushes/day/person

Tank Toilet Flush Volume

Multiply the inside dimensions (width and length) times the difference between the water line when tank is full and water line at the close of the flapper

- Divide this result by 1728 and then multiply by 7.48 gallons
- To this result add 0.3 gallons for approximate flush volume

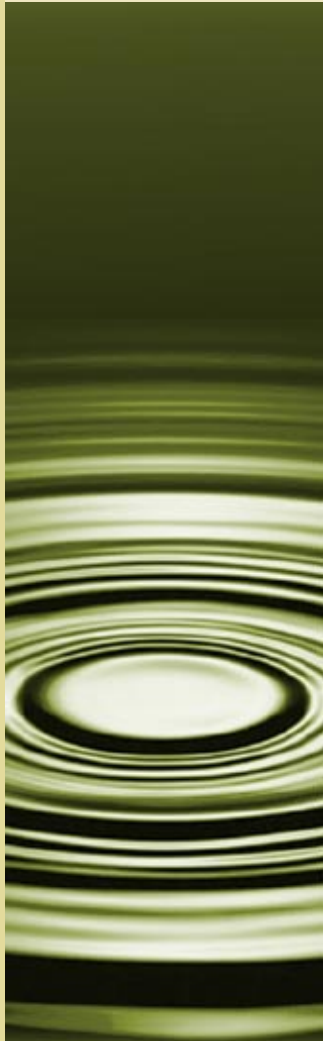


Urinals

Flush valves should be stamped with gpf on newer models (since 1994)

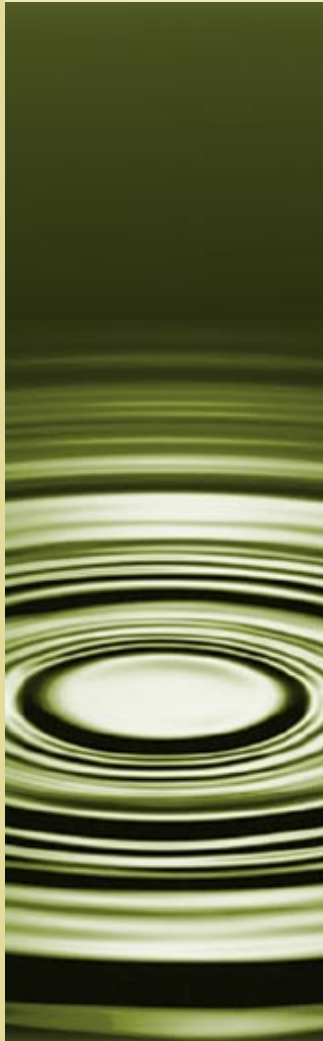
Range from 5 gpf (pre-1980s) to 1 gpf (today)

Actual flow hard to deduce by looking b/c diaphragm/piston retrofit may have occurred



Measuring with Bucket and Stopwatch

- Verify how operators / users adjust equipment for water use. How many different users?
- Bring many different containers for measuring in/under sinks, sumps, showers, troughs, etc...
- Measure at least two times and average (Three times preferred).
- Measure at least 10% of similar devices scattered randomly throughout facility (20 % preferred). Toilets, sinks, showers, etc...
- Don't forget rain jacket, hat & boots!



Faucets

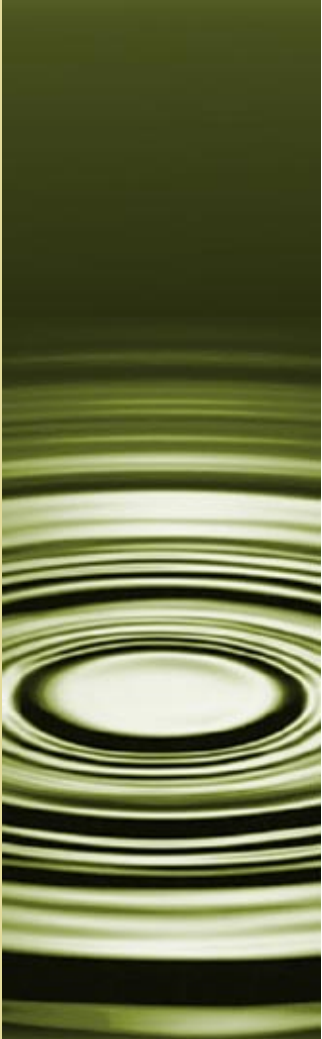
- All post 1992 aerators should be stamped with flow rate.
- Always best to measure exact flow as pressure may affect actual flow rate.
- Measure time of cycle for infrared faucets.
- Check pressure on water system – 60 to 75 psi is normal.



- Assume 8.1 min/person/day *residential* use or 35 sec/person/day *office* use

Showerheads

- All post 1992 showerheads should be stamped
- Always best to measure exact flow
- Assume 5.3 min/person/day



Equipment Audit Information

- Flow rates and number of all water using fixtures/equipment.
- Hours/Day and Days/Week use of equipment. Verify with operator!
- Obtain Model number of water using equipment where flow rates cannot be calculated or measured and locate manufacturer's data for equipment.

Residential Dishwashers & Laundry Machines

- Record Model Number
- Dishwasher: 0.10 loads/person/day
- Laundry machine: 0.37 loads/person/day

GENERAL ELECTRIC COMPANY

MOD. PDW7880J03SS
SER. ZG832994B

THERMALLY PROTECTED

LISTED
UL

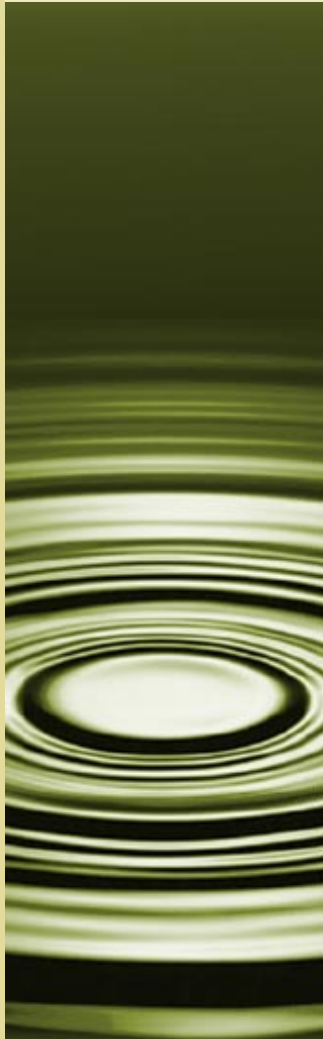
490L

APPLIANCE PARK 40225
120 VOLTS 60 HZ
MOTOR 1.8 AMPS
OTHER 8.1 AMPS
TOTAL CURRENT 9.9 AMPS

165D6292P012

Cooling Towers

- Transfer heat from inside building to outside air using water loop.
- Frequently the largest single water user of all equipment in Institutional / Commercial Buildings
- Water lost by:
 - Bleed-off
 - Blowdown
 - Evaporation
 - Drift

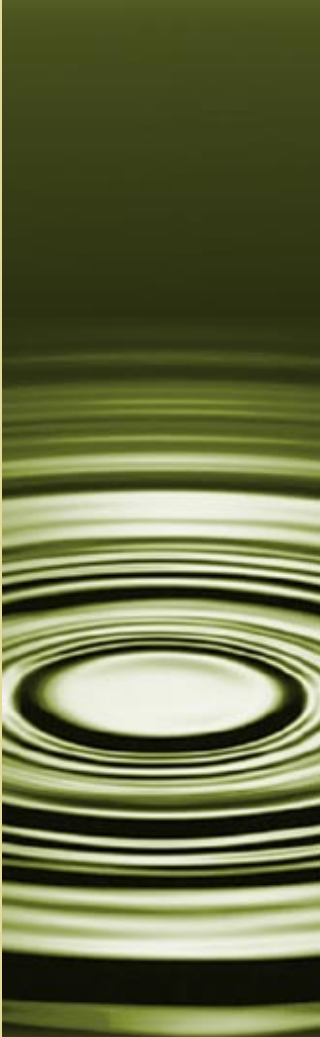


Cooling Tower Audit Info

- Meter readings (if available)
- Number of cooling towers
- Minimum requirements for cooling
- Model numbers of all cooling towers
- Method of bleeding water (Timer Vs. Conductivity)
- **Cycles of concentration for each**
- Health and safety requirements at site

Boilers and Steam Generators

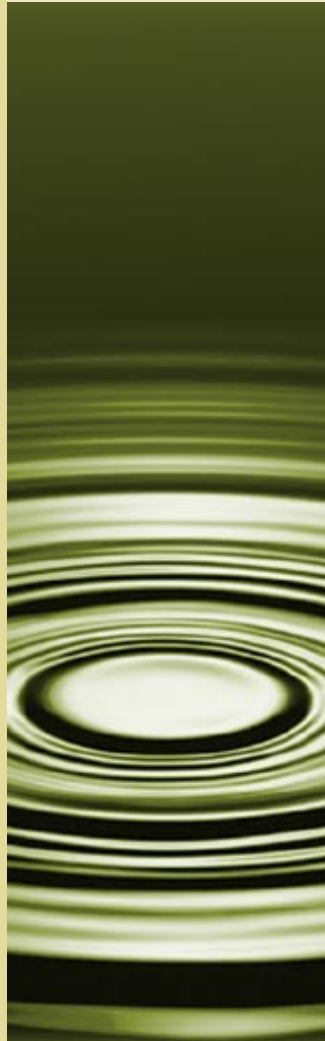
- Circulate hot water or steam through coils for heating large buildings
- Use several types of heating sources
- Water Lost by:
 - Leaks
 - Bleed-off
 - Blowdown
 - Condensate



Boiler and Steam Audit Info

- Meter info (if available)
- Number of type of boilers
- Blowdown frequency
- Make-up/bleed-off rates
- Frequency of system inspections
- Steam pressure
- Boiler capacity (BTUs/hr) and efficiency

What are the Options?



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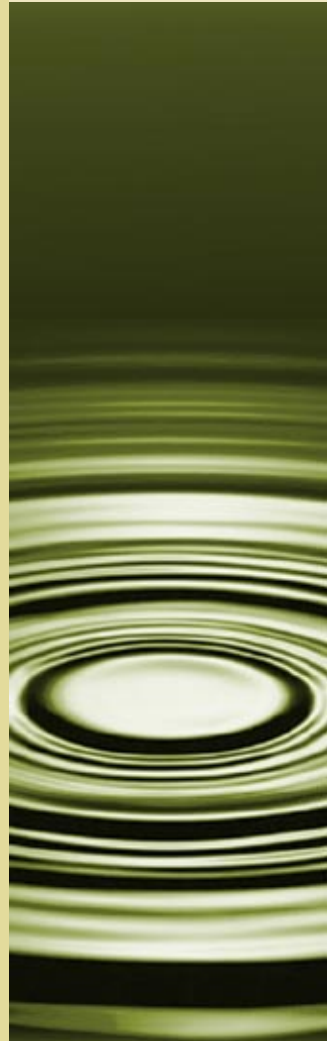
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Implement & Check Progress



Questions?

*For more information,
please visit:*

www.p2ad.org

404-651-5120

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POLLUTION PREVENTION ASSISTANCE DIVISION
GEORGIA DEPARTMENT OF NATURAL RESOURCES