Water Efficiency Assessments (Audits)

Helping with management on the other side of the meter

AWWA N.W. Section
May, 2013

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Welcome

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C.I.C. C.I.D. CGLIA, CLIA

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Water Efficiency Assessments (Audits)

- Please turn off cell phones
- Refreshments
- Restrooms
- Questions /comments

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Take Aways

- Broader understanding of the need to conserve as it may pertain to your municipality/district
- Recognizing the benefits of adding assessments(audits)
- Interest in adding assessments (audits) to current conservation program
- Skills to begin performing general assessments (audits) of water use efficiency for residential customers

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A Reality Check

At some point the sun will burn itself out

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A Reality Check

We will all die

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A Reality Check

No new water will ever be made

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A Reality Check

We will continue to have shortages and droughts

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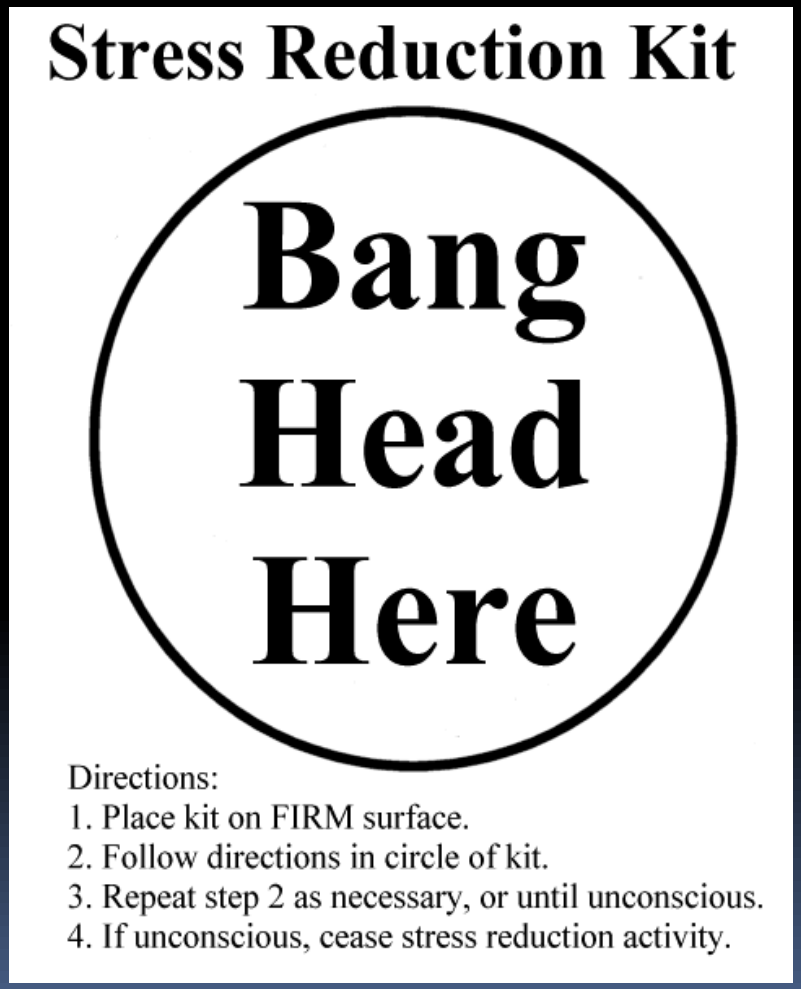
A Reality Check

Water rates will continue to rise



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A Reality Check

Water Conservation will become sexier and sexier

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Assessments V.S. Audits

- **What is an Audit?**

  The general definition of an **audit** is an evaluation of a person, organization, system, process, enterprise, project or product.

- **What is an assessment?**

  The evaluation or estimation of the nature, quality, or ability of someone or something. (organization, system, process, enterprise, project or product)

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What an Assessment (Audit) is

- **Time consuming:** Residential assessments can average 1-2 hours ea. Commercial can be days/weeks
- **Reasonably accurate:** Specific to the needs of the property being assessed. Can locate general area of leaks. Can locate sources of inefficient water use. Can provide important data.
- **A Picture**: Snapshot of the water usage on that property at that time and what can be done (according to current practices) to improve efficiency.
- **Education Opportunity:** One on one time with customers. Illustrates "informally" new methodologies and tips.
- **Messaging vehicle:** for information/programs/incentives.
- **Customer Service**

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Who can we assess?

All retail water customers

- Residential: Single family, duplexes and condominiums (meter per dwelling)

- Commercial: Multi-family /multi residential: condominium complexes, apartment complexes, duplexes, hotels & motels, assisted living facilities and hospitals, offices, office buildings, restaurants, industry, manufacturing, warehouses etc.

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What are we looking at?

	Commercial	Residential
Leaks	✓	✓
Indoor appliances (equipment)	✓	✓
Indoor appliances (maintenance)	✓	✓
Indoor appliances (habits/management)	✓	✓
Irrigation System (equipment)	✓	✓
Irrigation System (maintenance)	✓	✓
Irrigation System (management)	✓	✓

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What are we hoping to accomplish?

- Reduce peak period demands
- Reduce Non-point source pollution
- Reduce impacts on infrastructure
- Extend life of infrastructure
- Mitigate population growth impacts
- Educate end users
- Reduce costs

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American Water Issues from thirty thousand feet

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Aging & Failing infrastructures

Drinking Water: D- (ASCE 2009) & (2013) D

America's drinking water systems face an annual shortfall of at least $11 billion to replace aging facilities that are near the end of their useful life and to comply with existing and future federal water regulations. This does not account for growth in the demand for drinking water over the next 20 years.

Estimated cost to fix the USA aging water supply system over the next few decades according to the EPA - $325 billion

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Treatment Costs

Inorganic Compounds

Beryllium (ppb)
Cyanide (ppb)
Nickel (ppb)
Thallium (ppb)
Arsenic (ppb)
Antimony (ppb)
Asbestos (MFL)
Barium (ppm)
Cadmium (ppb)
Chromium (total) (ppb)
Mercury (inorganic) (ppb)
Nitrite (ppm)
Nitrate (ppm)
Selenium (ppb)
Fluoride (ppm)
Chlorine (CL^2)
Haloacetic Acids (HAA5)
Total Trihalomethanes

Copper
Lead
Turbidity (NTU)

Volatile Organic Compounds

Benzene (ppb)
Carbon tetrachloride (ppb)
p-Dichlorobenzene (ppb)
1,2-Dichloroethane (ppb)
1,1-Dichloroethylene (ppb)
Trichloroethylene (ppb)
1,1,1-Trichloroethane (ppb)
Vinyl chloride (ppb)
Dichloromethane (ppb)
Chlorobenzene (ppb)
o-Dichlorobenzene (ppb)
Cis-1,2-Dichloroethylene (ppb)
Trans-1,2-Dichloroethylene (ppb)
1,2-Dichloropropane (ppb)
Ethylbenzene (ppb)
Styrene (ppb)
Tetrachloroethylene (ppb)
Toluene (ppb)
Xylenes (total) (ppm)
1,2,4-Trichlorobenzene (ppb)
1,1,2-Trichloroethane (ppb)

Microbiological

Fecal Coliform/E. Coli
Total Coliform)
Cryptosporidium

Synthetic Organic Compounds

Ethylene dibromide (ppt)
Heptachlor (ppt)
Heptachlor epoxide (ppt)
Lindane (ppt)
Methoxychlor (ppb)
Pentachlorophenol (ppb)
PCBs (ppt)
Toxaphene (ppb)
2,4,5-TP (ppb)
2,4-D (ppb)
Picloram (ppb)
Simazine (ppb)
Diquat (ppb)
Endothall (ppb)
Endrin (ppb)
Glyphosate (ppb)
Hexachlorobenzene (ppb)
Hexachlorocyclopentadiene (ppb)
Oxamyl (vydate) (ppb)
PAHs [benzo(a)pyrene] (ppt)
Phathalate[di(2-ethylhexyl)] (ppb)
Adipate[di(2-ethylhexyl)] (ppb)
Dalapon (ppb)
Dinoseb (ppb)
Carbofuran (ppb)
Chlordane (ppb)
Dibromochloropropane (ppt)
Alacholor (ppb)
Atrazine (ppb)

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Consequences of our actions/inactions

:**US: # 1 contributor to non-point source pollution in rivers, lakes and streams (Landscape irrigation)**

24D, Glyphosate, Atrazine

The effect of 1 Tbsp of fertilizer on lake water

Nutrients are absorbed by native vegetation around/in lakes – help to keep our shorelines natural and eliminate excess nutrients from entering the water

Both jars are filled with lake water and left in a sunlight place for one week. The jar on the left has had 1 Tbsp of fertilizer added to it.

Nitrogen/ Phosphorus

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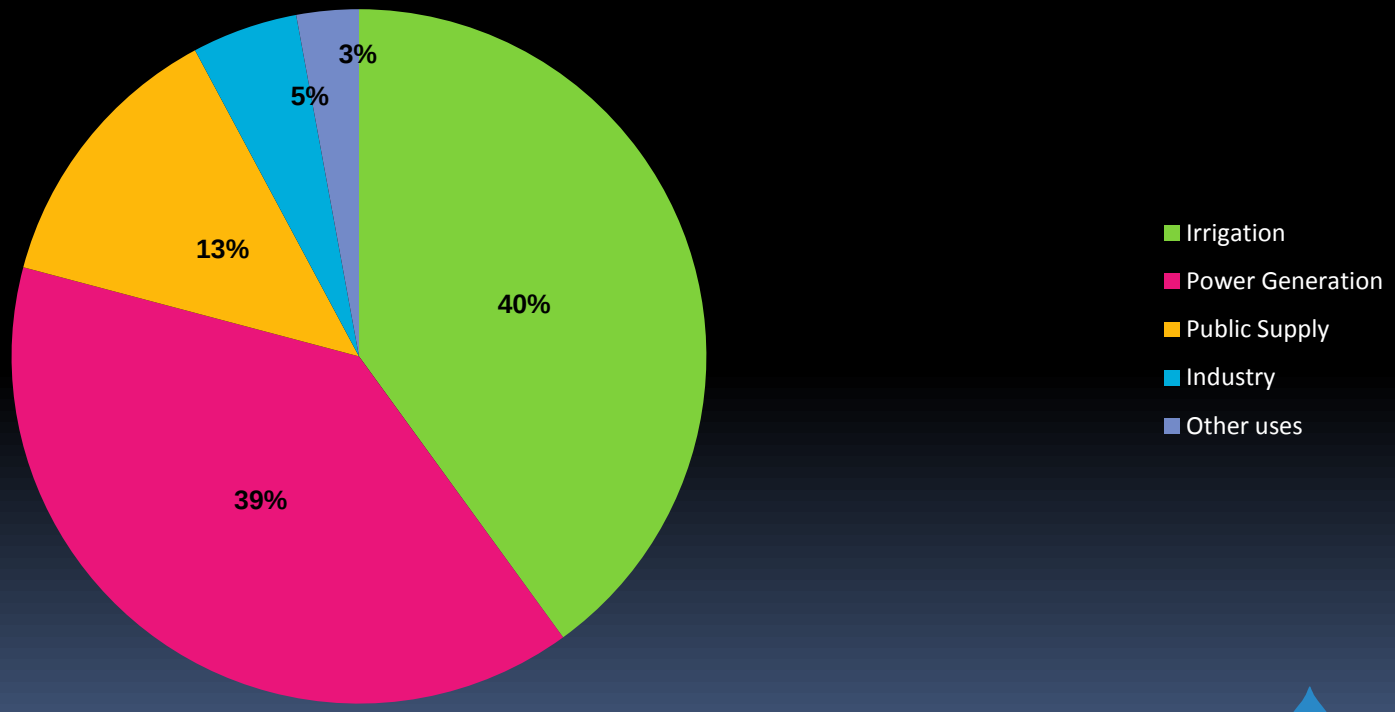
The Energy connection

Fresh Water Withdrawals in the U.S. (2000)
346 Billion Gallons per Day



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Population, Propagation and Power

Population of Oregon (1850): 12,093
Population of Oregon (1900): 413,536
Population of Oregon (1950): 1,521,241
Population of Oregon (2000): 3,421,299
Population of Oregon (2010): 3,831, 074

New Water Resources: None

Columbia River Basin irrigated acreage
(1900) 500,000 acres
(2000) 8,000,000 acres

New Water Resources: None

Flow reduction on Columbia River: 14.4 million acre ft (1 Crater Lake annually)
Reduction in Hydroelectricity production: (2006) 625 megawatts at a cost of $274 million in displaced power. (170,000 homes for 1 year)

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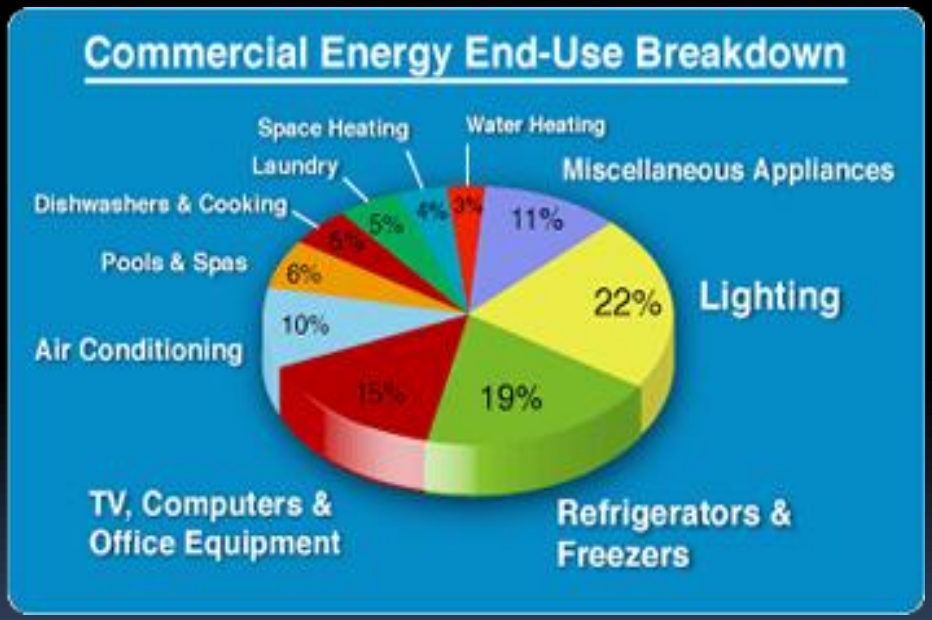
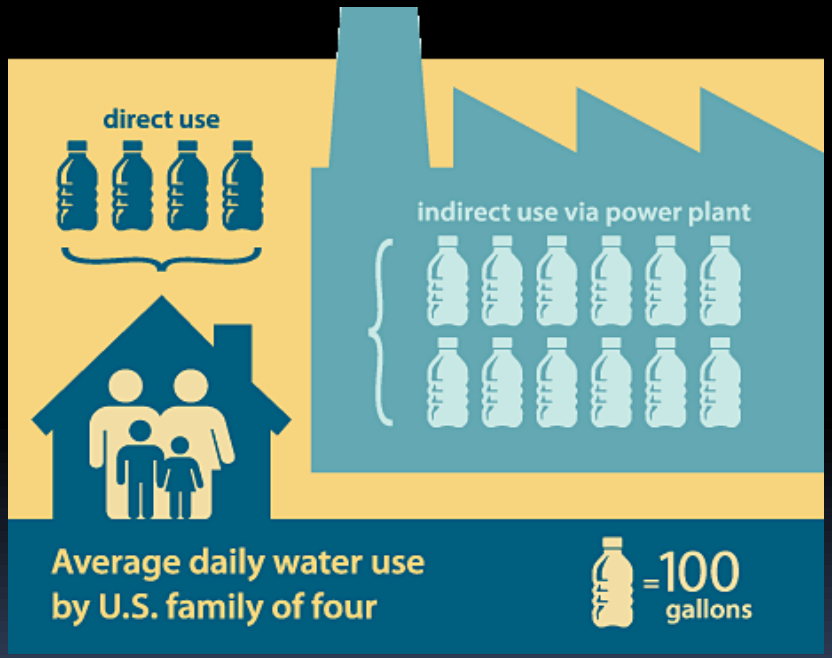
The Energy connection

Running hot water for 5 minutes through a faucet uses about the same amount of energy as burning a 60-watt bulb for 14 hours.

-EPA





13% of the total electricity produced in the U.S. (520 Billion KW Hours), is used to treat, transport and heat water

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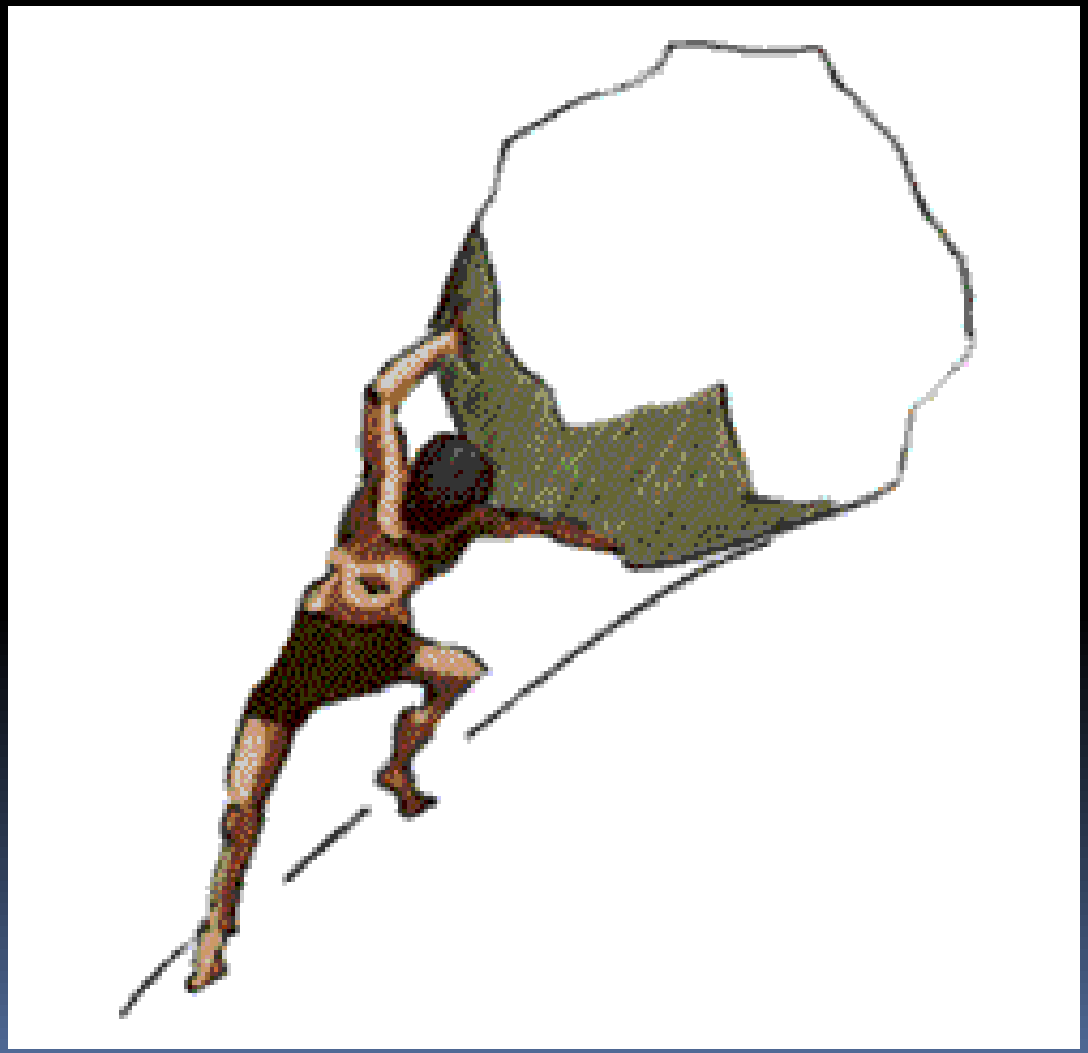
What are we are up against?



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Typical Residential Usage

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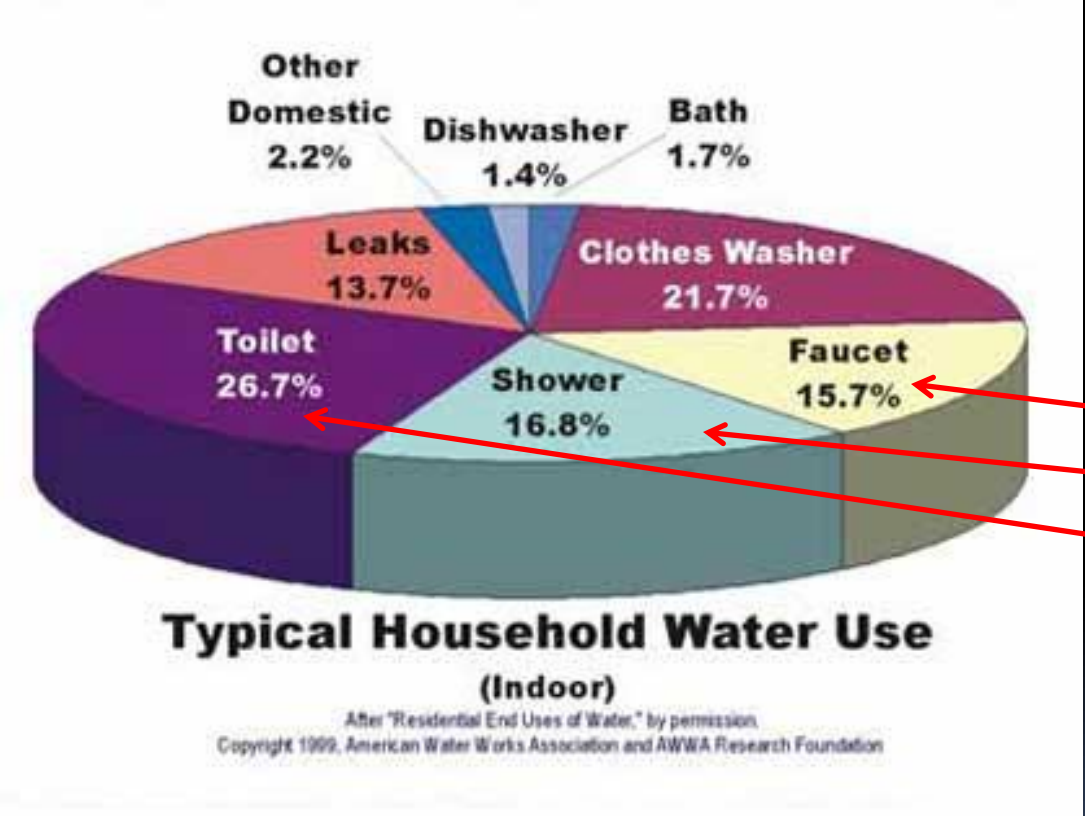
Goals of assessments: Identify what will offer the highest return for the least investment



Toilets account for 26.7 % of indoor usage

Faucets and Showers account for 32.5% of indoor usage

Aerators ≤ 1 gpm: 8%
Shower Heads ≤ 2 gpm: 6%
Toilets ≤ 1.6 Gal per flush: 13%

27% reduction over all

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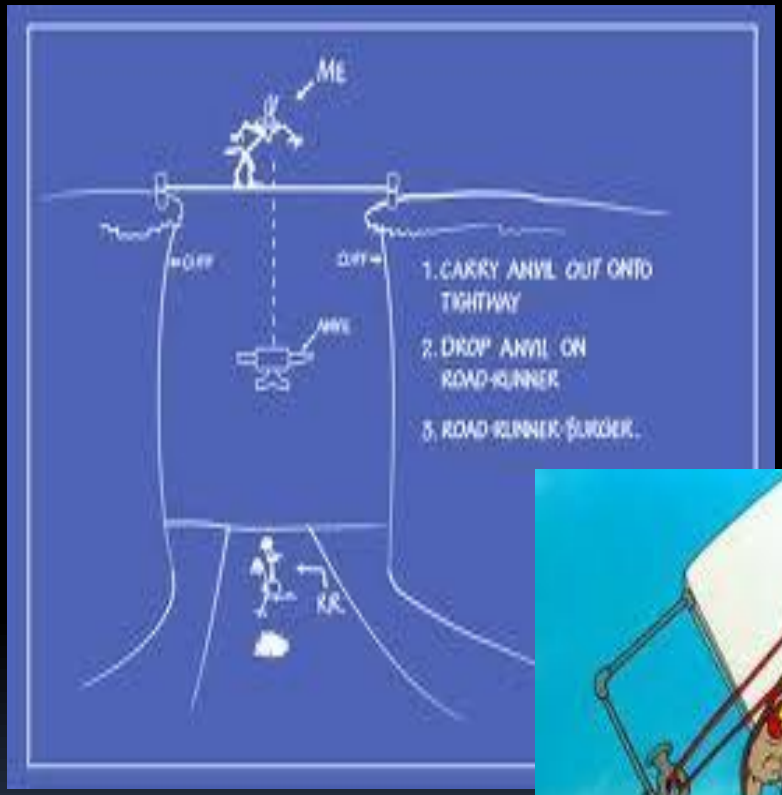
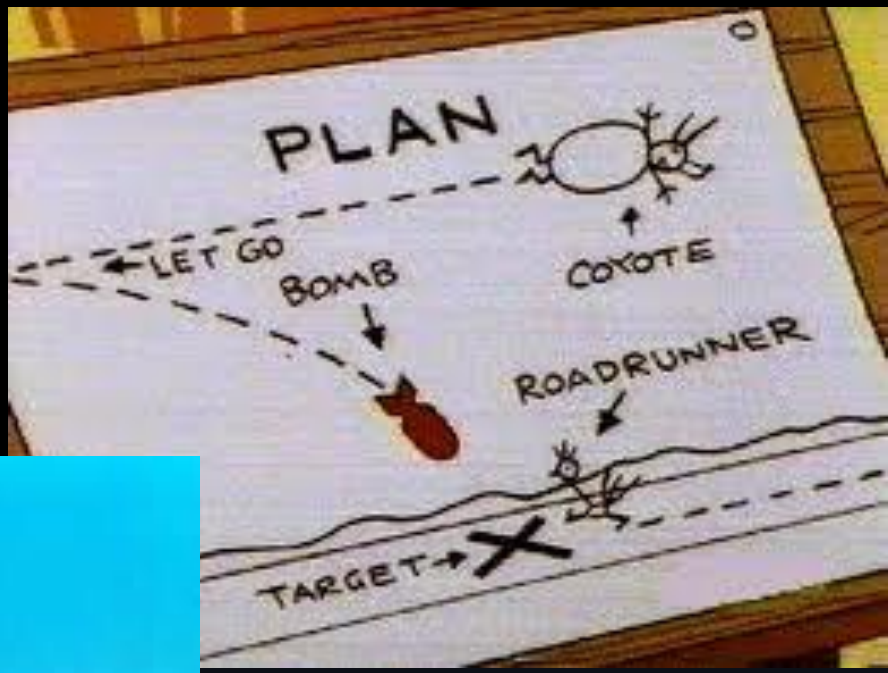
Do Assessments Work?





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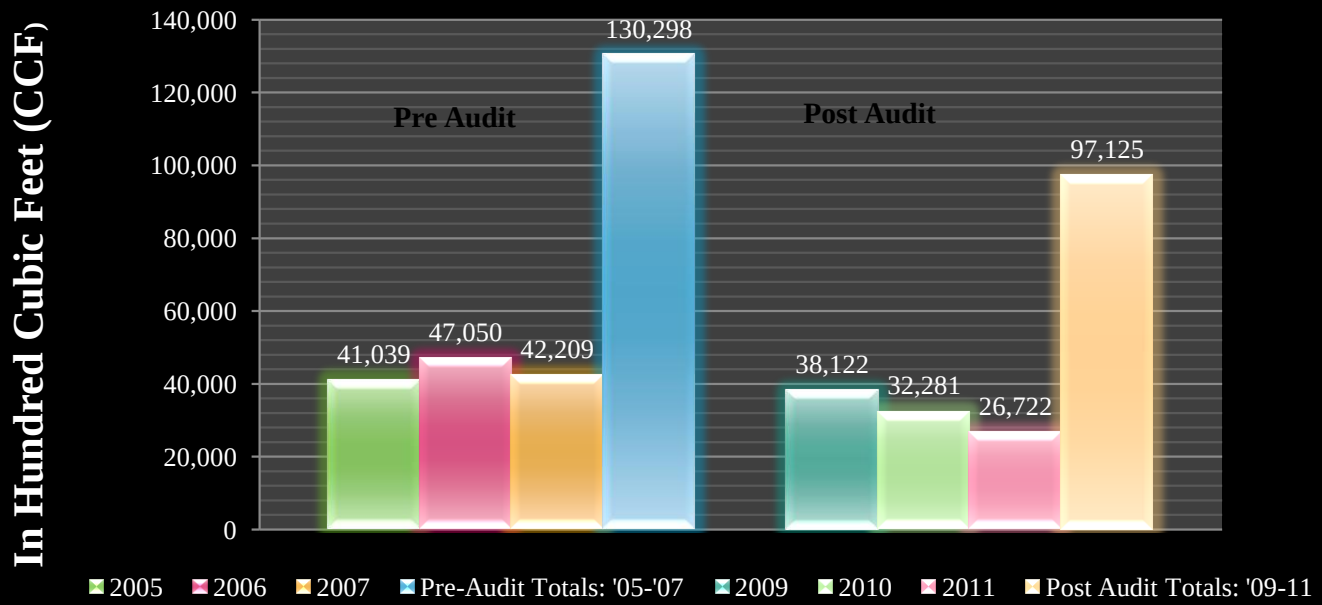
A Tale of Two Cities

Lake Oswego, OR (26% savings)



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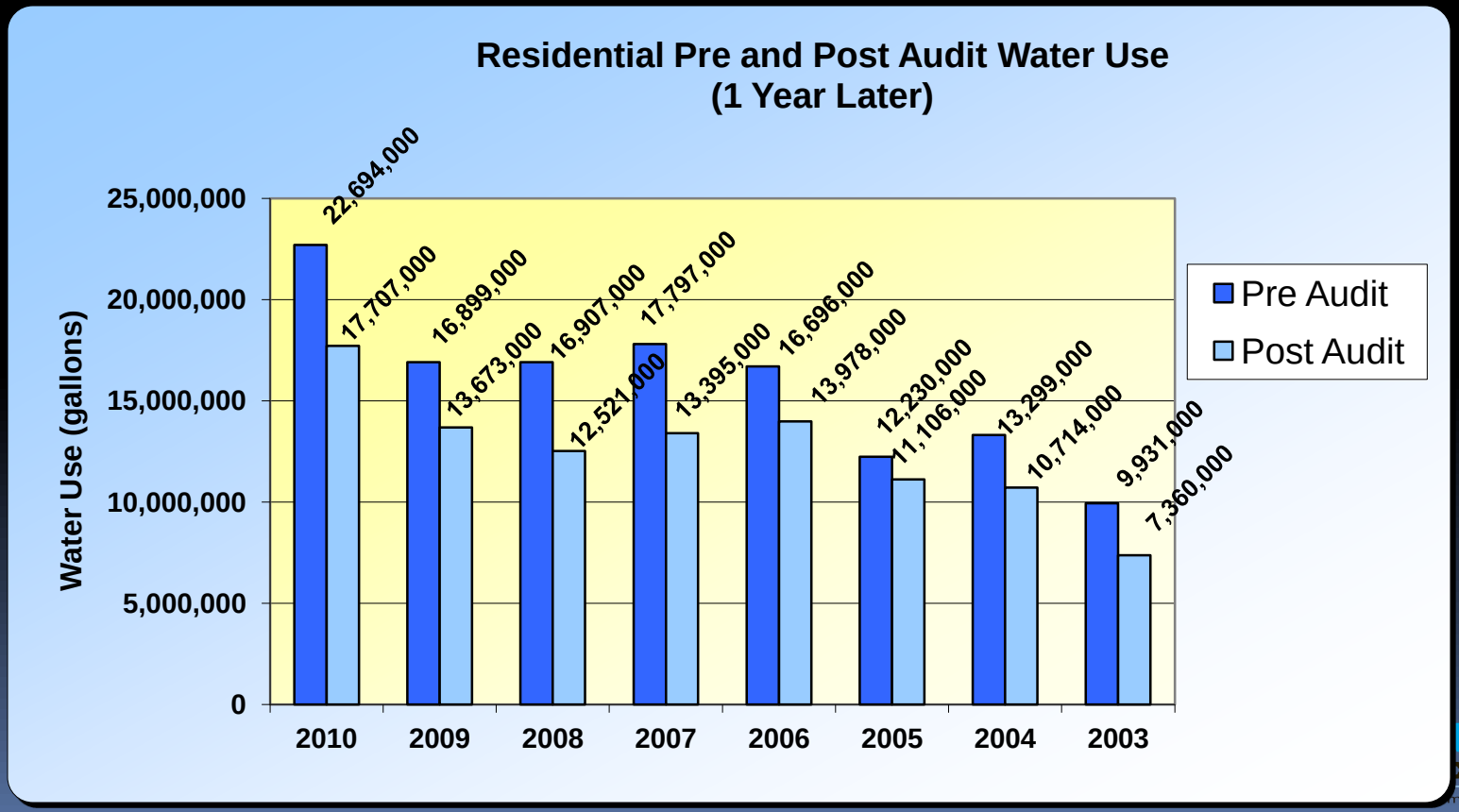
A Tale of Two Cities

Oro Valley AZ (19% savings)



Some Tools of the Trade

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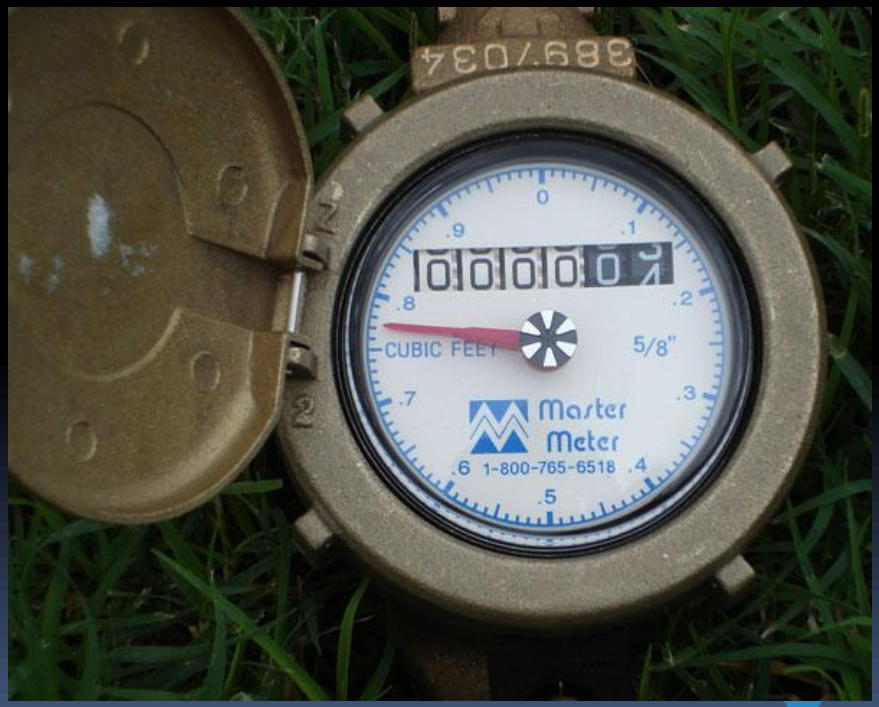
Water Meter



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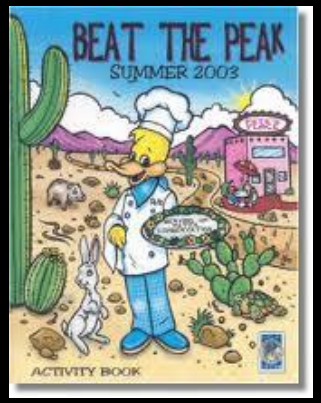
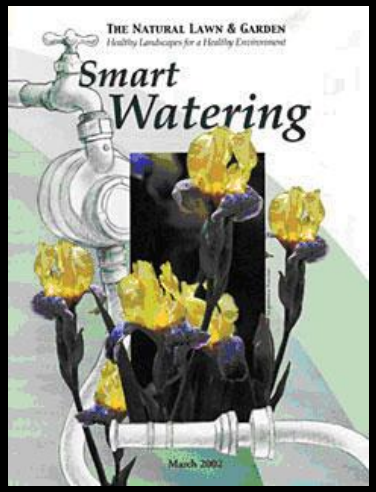
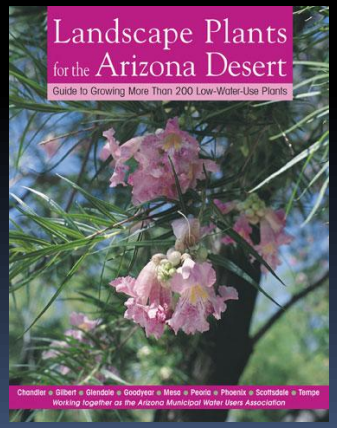
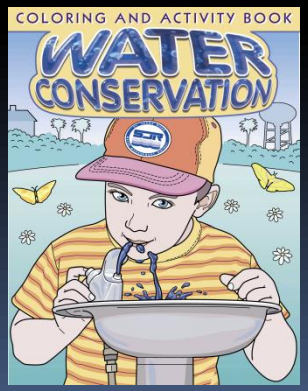
Literature

- Works for all age levels
- Regionally specific
- Multiple sources









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Aerators

- Flow rates 0.5 to 2.5 gpm
- Saves Energy (hot water) and water
- Easily installed by most customers
- Reasonably inexpensive to provide
- Immediately effective with out changing behavior

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Shower Heads

- Saves energy (hot water) & water.
- Flows from 1.0 to 2.5 gpm.
- Easily installed by most customers
- Reasonably inexpensive to provide
- Immediately effective with out changing behavior

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Toilets

Ultra low flow toilets (ULFT) 1.6 GPF

- Immediately effective with out changing behavior
- Will pay for itself in reduced water and sewage fees
- Effective if offered with rebates

High Efficiency Toilets (HET) 1.28 GPF

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Assessments (Audits)

- May help change dynamic between the rate payer and the utility
- Strong customer educational tool
- Long term effectiveness
- Useful data

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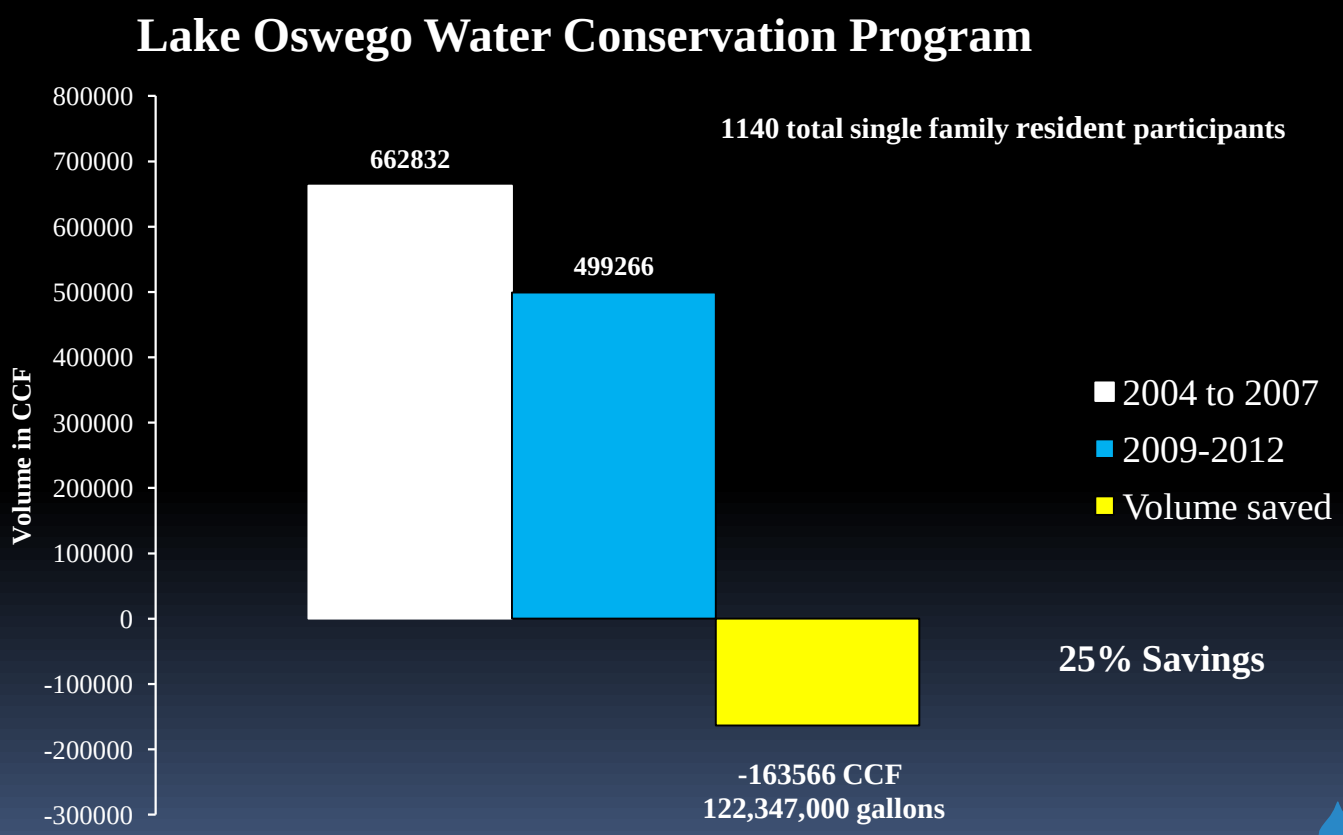
All Tools Working



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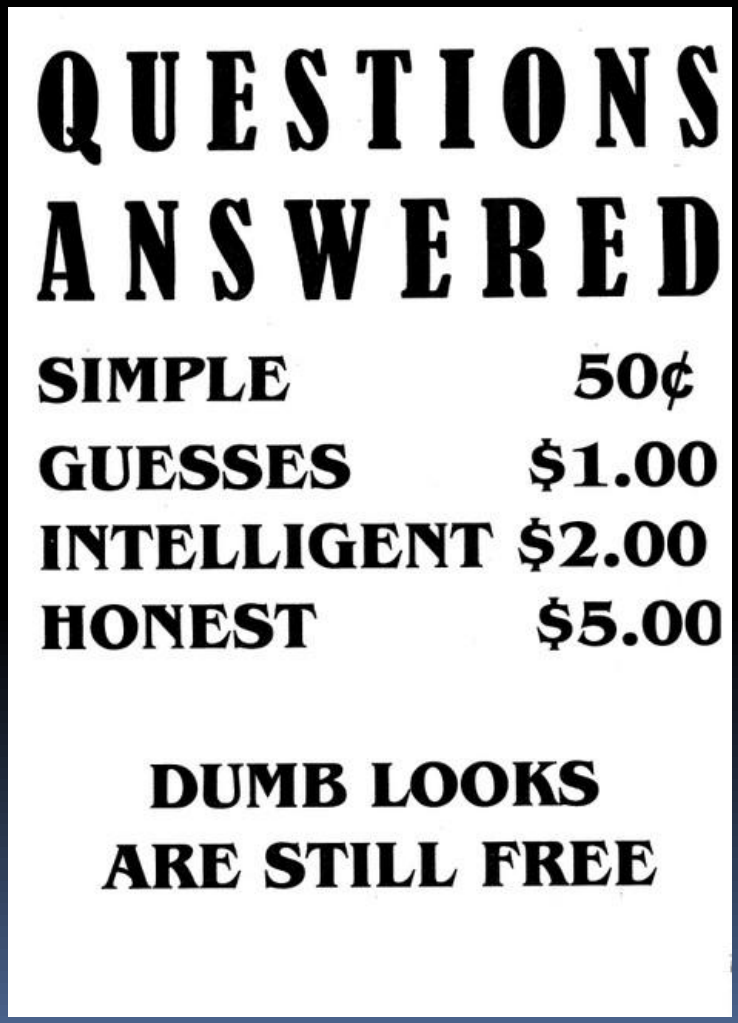
Questions So Far?



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The Basics: Starting the Assessment

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Some things to do prior to the assessment

Check Customer's account for:

- **spikes, irregularities.**
- **Water use that goes up and doesn't come down.**
- **High volumes in winter season.**
- **Normal usage tendencies month to month.**

Go back at least three years if you can.

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Single Family residence

Consumption In CCF

08/18/2009	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	192.98	85
06/23/2009	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	120.24	106
04/20/2009	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	245.2	248
02/23/2009	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	219.68	219
12/16/2008	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	274.24	281
10/20/2008	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	167.76	160
08/19/2008	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	150.16	140
06/20/2008	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	99.28	86
04/21/2008	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	102.68	90
02/19/2008	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	90.78	76
12/17/2007	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	100.98	88
10/18/2007	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	142.63	137
08/17/2007	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	78.03	61
06/19/2007	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	47	26
04/18/2007	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	39.53	17
02/22/2007	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	37.04	14
12/19/2006	Regular	SINGLE FAMILY RESIDENT	WATER - RESIDENTIAL	41.19	19

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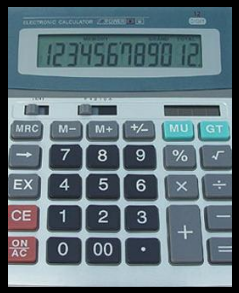
Assessment Kit

Interior

Small graduated pitcher (1 Pt)



Calculator

Stop watch

Large graduated pitcher (2qt)

1 gallon Bucket (optional)

Wax Pencil

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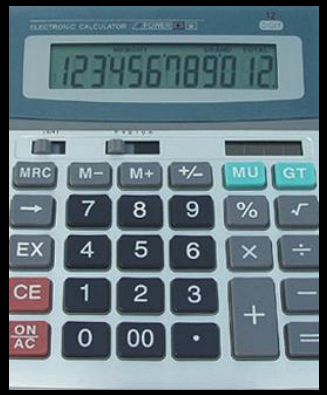
Assessment Kit

Exterior

100’ tape: ?

Calculator



Measuring wheel: ?

Pace:?

Stop watch

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Audit Sheet (Residential)

City of Lake Oswego
Water Conservation
380 A Avenue
Post Office Box 369
Lake Oswego, Oregon 97034
Tel: 503.635.0270 Fax: 503.635.0269

Residential Irrigation Audit

Customer: ____________________ Reference/WO#: ____________
Address: ____________________ Date: ____________
____
PH#: ____________

Make/Model
1) Controller: ____________ #of Stations________ # of Sta. operating: ____________
2) Controller: ____________ #of Stations________ # of Sta. operating: ____________

	Zones	*#1*	*#2*	*#3*	*#4*	*#5*	*#6*
Scheduling: Run Times:		______min	_____ min	______min	______ min	______ min	______min
Scheduling: Run Times:		______min	_____ min	______min	______ min	______ min	______min
Scheduling: Run Times:		______min	_____ min	______min	______ min	______ min	______min

Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____
Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____
Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____
Landscaping: ____

Equipment:
BFP: ___ Size: ____ Type: Vacuum BRKR PVB DoubleCHK RPP Comments: ____________

Valves: Model/Manf: ________ Size: __ Comments:____________________

Turf: Y/N Total # of Zones: ____ Type of Heads: ____________Comments:____________

Total GPM: (By Zone) #1 _____ #2_____ #3_____ #4_____ #5______ #6_____ Comments:_______

Recommendations:
Equipment: ____

Scheduling: ____

City of Lake Oswego
Water Conservation
380 A Avenue
Post Office Box 369
Lake Oswego, Oregon 97034
Tel: 503.635.0270 Fax: 503.635.0269

Residential Interior Water Audit

Customer: ____________________ Reference/WO#: ____________
Address: ____________________ Date: ____________
____
PH#: ____________

No of Residents in household:___ Leaks (meter): Y N **GPM:___ Visible:** Y N **Location:** __________
Comments: ____

Kitchen:
Dishwasher ___ Brand: ____________________ Water per load (Est):____________
Sink Faucet ___ GPM (gallons per minute):__________ Comments: ____________________

Bathroom (s):
Faucets: __ GPM: __ GPM __GPM __Water Closet: __ Type: HE LF ST **GPF (gal. per flush):____**
Showers: ___ GPM: ___ Tub: __ Type: ______________ Capacity: ______ in gallons
Faucets: __ GPM: __ GPM __GPM __Water Closet: __ Type: HE LF ST **GPF (gal. per flush): ____**
Showers: ___ GPM: ___ Tub: __ Type: ______________ Capacity: ______ in gallons
Faucets: __ GPM: __ GPM __GPM __Water Closet: __ Type: HE LF ST **GPF (gal. per flush): ____**
Showers: ___ GPM: ___ Tub: __ Type: ______________ Capacity: ______ in gallons
Faucets: __ GPM: __ GPM __GPM __Water Closet: __ Type: HE LF ST **GPF (gal. per flush): ____**
Showers: ___ GPM: ___ Tub: __ Type: ______________ Capacity: ______ in gallons
Comments:____

Laundry:
Washing Machine:___ Type:______ Water per load (Est): ____________
Utility Faucet:___ GPM ___ Misc. Equipment: ____________________GPM: ____

Usage Habits:
Showers / Baths per day ____ (per person) **Length_____** (min) **Laundry Loads per (**day) (week) _____
Dishwasher Loads per (day) (week) ____ **Misc. usage ;**____________________

Recommendations: ____

The approach

1) Be on time. Schedule time between calls for travel. Call if previous assessment runs long.
2) Identify your self at the door and give customer your card.
3) Ask if there are any “particular “ issues that they are having trouble with at present.
4) Explain what you intend to do and what you’ll need from them. Not using water, accessing valves etc.
5) Encourage them to follow you as you do the assessment. They not only get to hear what can be improved, they get to see it as well.
6) Wherever you can: demonstrate what you are doing and why

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Questions?

Quick Break?

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Step # 1: Detecting and diagnosing leaks

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The Importance of identifying Leaks?

- Commonly overlooked
- Frequent offender (1 in 4 homes have a leak in Lake Oswego)
- 50% of leaks never reach the surface
- Raises customers costs
- If you are able , calculate the volume of lost water for account holders. (Gallons per minute, hour, day , year etc)

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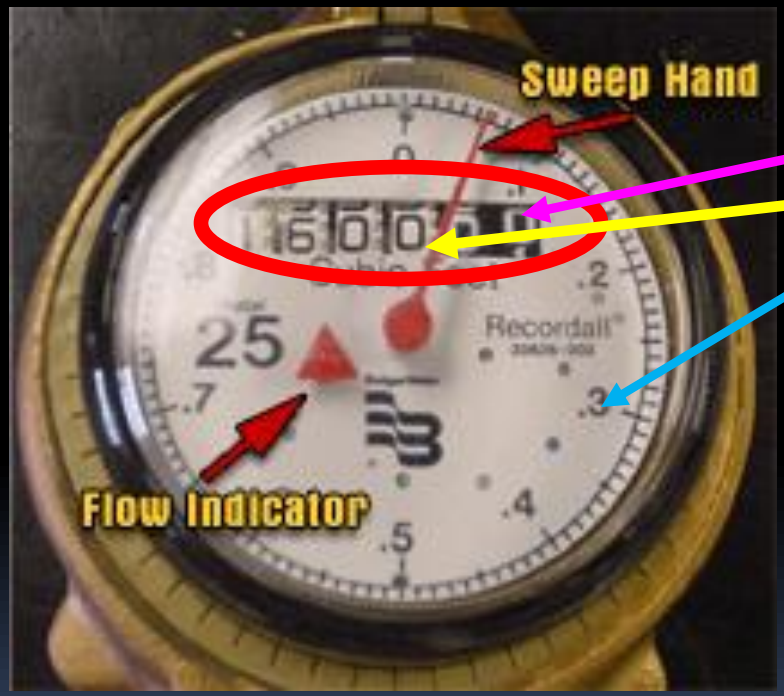
Water Meter Basics: CCF
The Read



1 cubic foot = 7.48 gallons

100 cubic feet = 748 gallons

1/10th of a Cubic Foot = .748 gallons

Use 7.5

Water Meter Basics: 1000 gallons
The Read

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Isolating Leaks: A process of elimination

The Initial check

- Insure that no one uses any water
- Observe meter for 5 minutes
- Look for movement in the flow indicator
- If no movement , system is tight.

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What to look for at the meter

- **Intermittent/irregular movement**: Typically a toilet. Can be a flapper leak, or worn out float valve. Customer often complains of hearing sound of water at night. Can also be a float valve for a pool or pond. Can also be a failing diaphragm on an irrigation valve.

- **Steady movement**: Leaky flapper on toilet, worn out float valves, pipe leak. much more significant due to potential damage and difficulty controlling.

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Isolating The Leak

If movement on the Meter

- Verify no water was being used at the time
- Turn off main valves to pools/spas/ water features (if any)
- Turn off irrigation at the main valve
- Recheck meter

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management for a sustainable future

If no movement

The leak is likely in one of the systems you just shut down. Open those valves one at a time. Recheck the meter each time until you identify which component(s) are leaking. (There can be more than one)

Frequent offenders:

Auto fill valves on pools and water features

Open test ports on backflow preventers or manual drain valves.

If movement continues after shutting off all main valves, then the leak is likely in the house or the service line.

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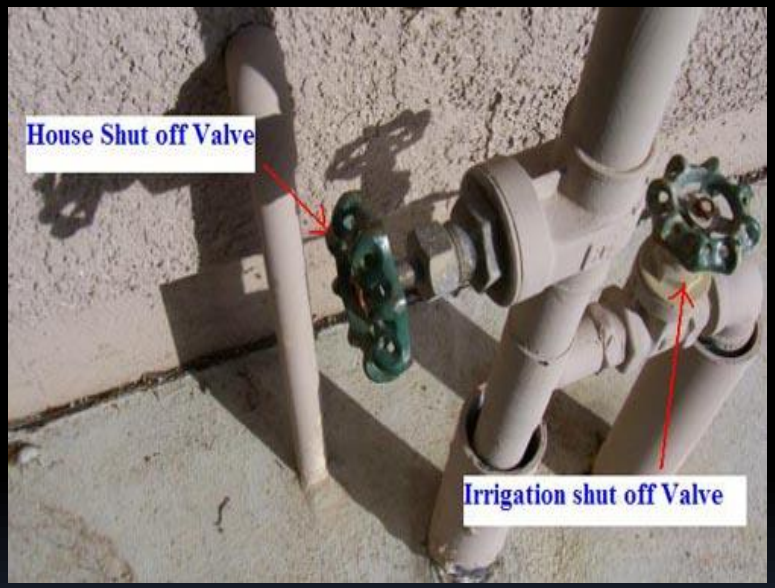
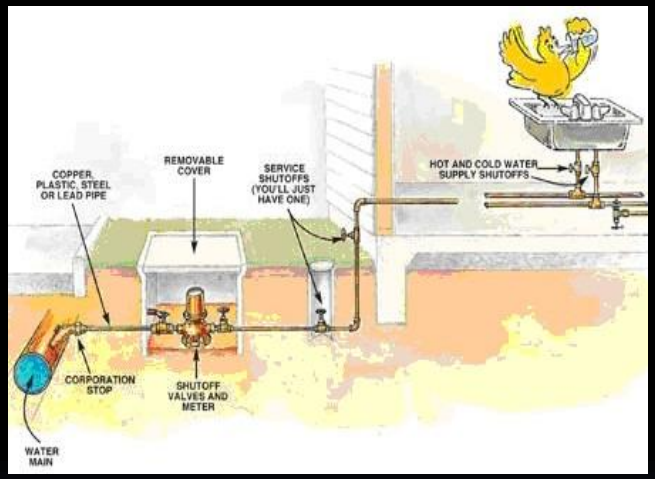
Isolating The Leak

Locate the main valve to house: Shut it off and check meter again for movement.





If movement stops: Leak is in the house
If movement continues: Leak is between the valve and the meter

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Isolating The Leak

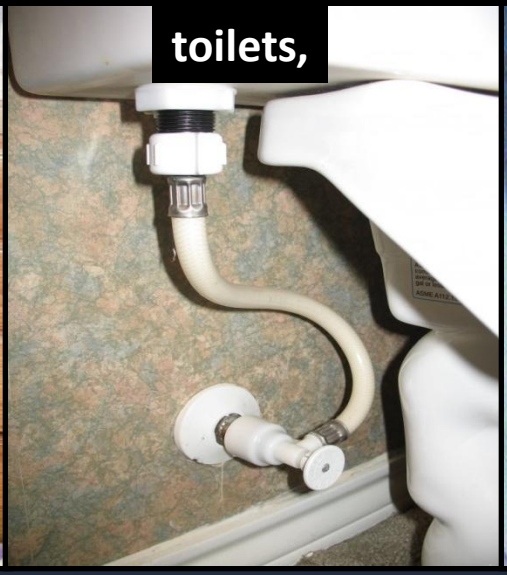
If No Main Valve

Turn off individual water stops at all fixtures and check meter for movement.

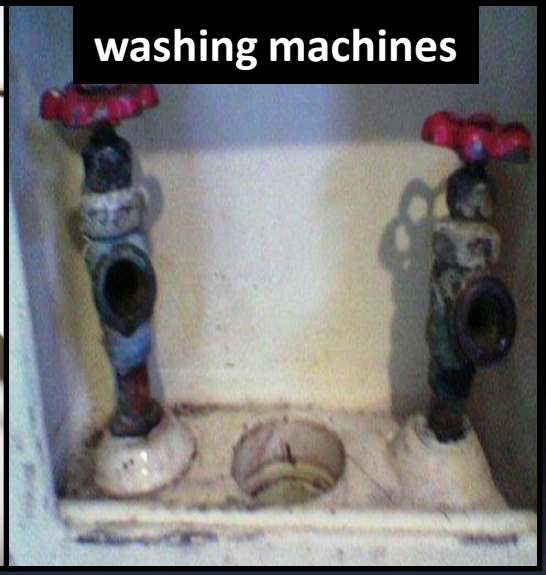
If none, leak was in one of the fixtures that were turned off.

sinks,

toilets,



washing machines



If the flow continues, then the leak is probably in the service line

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Calculating Leaks

Observe the meter: Minimum 5 minutes

Use a wax pencil to mark position of sweep hand. If hand travels more than two "ticks" between number in 5 minutes, then leak may need to be repaired before continuing with assessment

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Step II: Inside the home

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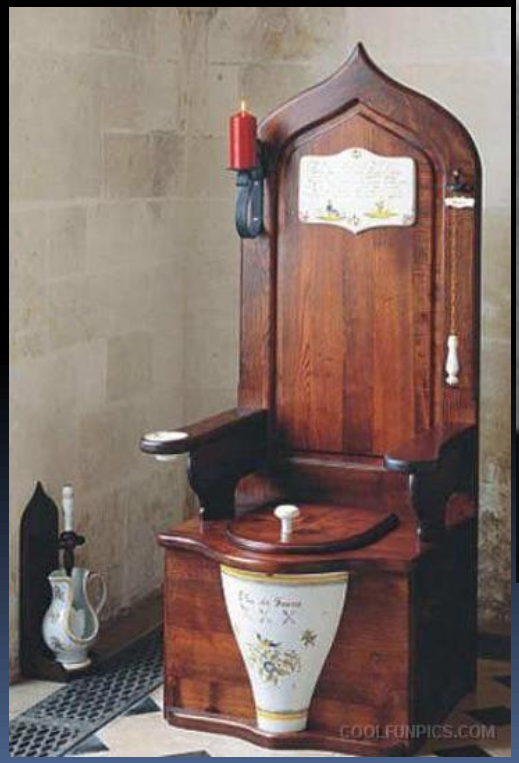
Toilets

(Tank Type)



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Physical Assessment

Assess overall appearance; any signs of leakage? Cracks?

Flush and check for function.
Leaks? Valve shuts off tight?

After fill - drop in dye tabs
Check later for flapper leaks

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Determining Gallons Per Flush (GPF) (Tank Type)

Stamp on tank

Stamp on rim of bowl where the seat connects. All 1.6 gpf (6.1 liters) or less toilets should be marked at this location.

If no markings, check the underside of the tank lid or the tank's back inside wall for a date stamped in the porcelain.

Year the house was built or year of the last remodel

Toilets produced before 1985 are 5–7 gpf, a date between 1985 to 1991 would be 3.5 gpf. All toilets made after 1991 are 1.6 gpf or less.

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Determining Gallons Per Flush (GPF) Tank Type

Tank Measurement

All Measurements are in inches

1) Measure the length of the tank .
2) Measure the width of the tank.
3) Measure the full water level in the toilet tank (depth **A**).
4) Flush the toilet and measure the drop at the lowest level (depth **B**).
5) Subtract depth **B** from depth **A**. This will give you the **"drop** "measurement.
6) Multiply the **L** X **W** X **"drop"** to determine cubic inches of water used per flush.
7) Divide the volume by 231 to get the number of gallons per flush.

EX: Length: 19" Width: 7" High water level: 10" Low level: 4" = 798 cubic inches

3.45 gallons

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Determining Gallons Per Flush (GPF)

Use the meter

CCF: 1.6 GPF

3.5 GPF

Gallons: 1.6 GPF

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Faucets: Kitchen/Bath/utility

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Assesment

Turn faucet on to full stream and then off. Water stream should shut off crisply. No drips

Calculating the cost of a drip:

30 Drops/Minute = 96 Gallons/Month

Leaks: Look at base of stem and seam along the bottom of the unit for water.

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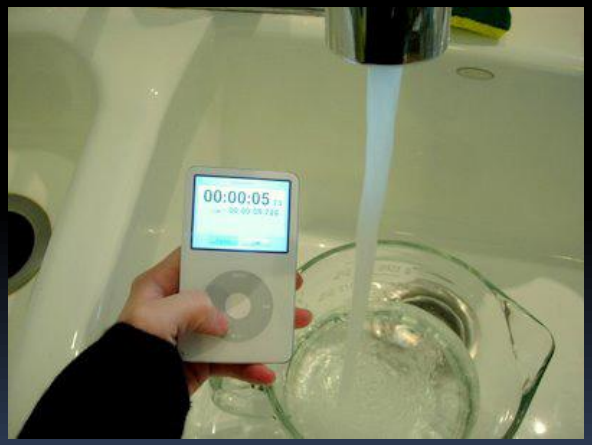
Determining flow

Lavatory faucets: Small pitcher should not fill faster than 5 seconds (1.5 gallons per minute)

Kitchen Faucets: Large pitcher should not fill faster than between 14 and 15 seconds (2.25 GPM)

Utility Faucets: Same as kitchen faucets



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Showers /Baths

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Assesment

Turn shower on to full stream and then off. Water stream should shut off crisply. No Drips

Calculating the cost of drips:

30 Drops/Minute = 96 Gallons/Month

Leaks: Look at base of handles for any water leaking.

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Determining Flow

Showers: Large pitcher should not fill faster than between 14 and 15 seconds (2.25 GPM)

Less is better: 1.5 is possible

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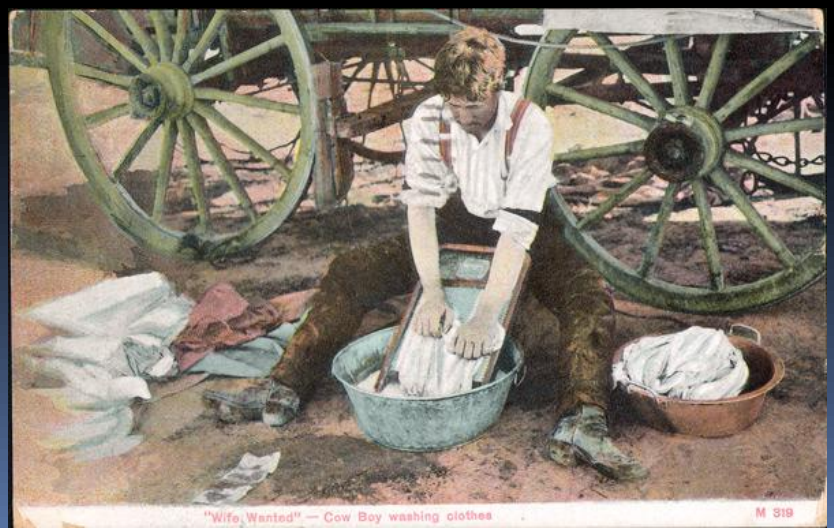
The Laundry



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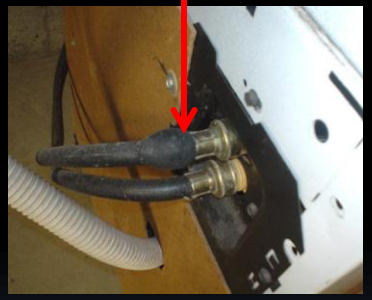
Assessment

Leaks: Standing water on the floor or stains from standing water. Look for repairs, damage to hoses etc.

Alert owner to potential for damage



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Calculating the Volume per Load

The Old VS the New

Older Washers

An old school washer will use approximately 35 to 45 gallons of water per load regardless of cycle selection. A family of four using a standard clothes washer will generate more than 300 loads per year, consuming 12,000 gallons of water annually.

High Efficiency Washers

New, High-Efficiency Washers (HEW) (front loading or top loading machines are available) can use 14 to 25 gallons of water per load. Replacing an old and inefficient clothes washer can reduce this water use by more than 6,000 gallons per year), save energy, clean the clothes better, and reduce fabric wear.

- Manufacturers specifications
- Age

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Other potential water wasters in the home

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Putting it all together

Residential Interior Water Audit

Customer: ______________________________ **Reference/WO#:** ______________

Address: _______________________________ **Date:** ___________________

____

PH#: __________________

No of Residents in household: _3__ **Leaks** (meter): Y N **GPM:**___ **Visible:** Y N **Location:** ___________

Comments: ____

____

Kitchen:

Dishwasher _✖_ **Brand:** _______________________________ **Water per load (Est):**_________________

Sink Faucet _✖_ **GPM (gallons per minute):**____________ **Comments:** ___________________________

____

Bathroom (s):

Faucets: _✖ **GPM:** __ **GPM** __**GPM** __**Water Closet:** _✖_ **Type:** HE LF ST **GPF (gal. per flush):**____

Showers: _✖_ **GPM:** ___ **Tub:** _✖_ **Type:** _________________ **Capacity:** ______ **in gallons**

Faucets: __ **GPM:** __ **GPM** __**GPM** __**Water Closet:** __ **Type:** HE LF ST **GPF (gal. per flush):** ____

Showers: ___ **GPM:** ___ **Tub:** __ **Type:** _________________ **Capacity:** ______ **in gallons**

Faucets: __ **GPM:** __ **GPM** __**GPM** __**Water Closet:** __ **Type:** HE LF ST **GPF (gal. per flush):** ____

Showers: ___ **GPM:** ___ **Tub:** __ **Type:** _________________ **Capacity:** ______ **in gallons**

Faucets: __ **GPM:** __ **GPM** __**GPM** __**Water Closet:** __ **Type:** HE LF ST **GPF (gal. per flush):** ____

Showers: ___ **GPM:** ___ **Tub:** __ **Type:** _________________ **Capacity:** ______ **in gallons**

Comments:____

____

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management for a sustainable future

Putting it all together

Laundry:

Washing Machine:___ **Type:**_____ **Water per load (Est):** _____

Utility Faucet:___ **GPM** ___ **Misc. Equipment:** _____**GPM:** ____

Usage Habits:

Showers / Baths per day ____ **(**per person) **Length**_____ (min) **Laundry Loads per (**day) (week) _____

Dishwasher Loads per (day) (week) ____ **Misc. usage**_____

Recommendations:

_____

_____

_____

_____

_____

_____

_____

_____

Lake Oswego water conservation

management for a sustainable future

Lets do a Couple Together

A) House was built in 1996. 2 residents in their 60's. No leaks were observed. House has two Bathrooms: Master remodeled in 2003 with all high efficiency equipment. Both bathrooms have one lav., one toilet and one shower with a tub. Has a Kenmore Energy star dishwasher, but rarely used maybe once a month. Dishes are typically done by hand. Washing Machine is a top loader and was purchased new when they bought the house. Does laundry once per week. Rarely if ever do baths. Shower at least every other day. Both enjoy a good long hot shower; at least 15 minutes. Lav faucet test: Both filled pitcher in under 5 seconds (Master: 4/Other 2.5) Kitchen faucet filled pitcher in 12 seconds. Shower filled pitcher in 15 seconds(Master) and 8 seconds in the other. Has a water softener.

Recommendations?

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Lets do a Couple Together

(Groups)

B) Built in 1973. Never remodeled. 5 residents 2 adults (Early 30's) 3 children (8, 6, and 2) Small leak observed (intermittent) 2½ baths all original appliances. Has a newer Maytag dishwasher. Hand washes only the pots. Usually does a load of dishes at night, whether it is full or not. Older top loading washing machine 4-7 loads a week, but uses mostly the medium water cycle. Toilet tanks are all 21" X 7" water drops from 12 " to 4" each flush. Wife bathes frequently. Fills tub up and soaks. Husband short shower am and occasionally one at night. 8 year old showers daily, others bathe daily. Lav. Faucets fill sm pitcher in under 3 seconds. Kitchen faucet fills large pitcher in 8 seconds. Showers fill large pitcher in under 10 seconds.

Reccommendations?

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Review: Indoor Assessment

Step I: Leak detection

a) Water off/observe meter How long: 5 minutes. What to look for?
b) Isolate and locate

Step II: Indoor assessment (residential)

a) Toilets
b) Faucets: kitchen/ bath/utility
c) Sowers/baths
d) Laundry
e) Other
f) Write down what you find
g) Make recommendations

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Break

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Moving to the outside

Questions?

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High return/minimal investment?

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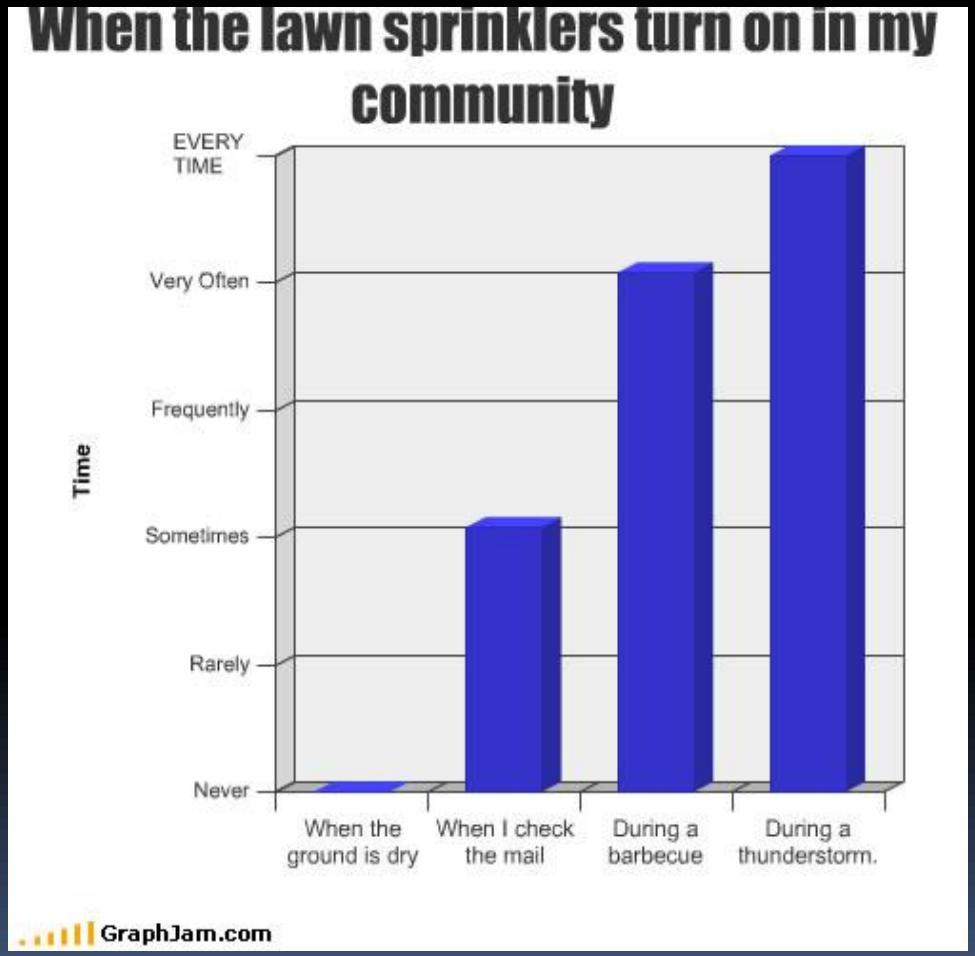
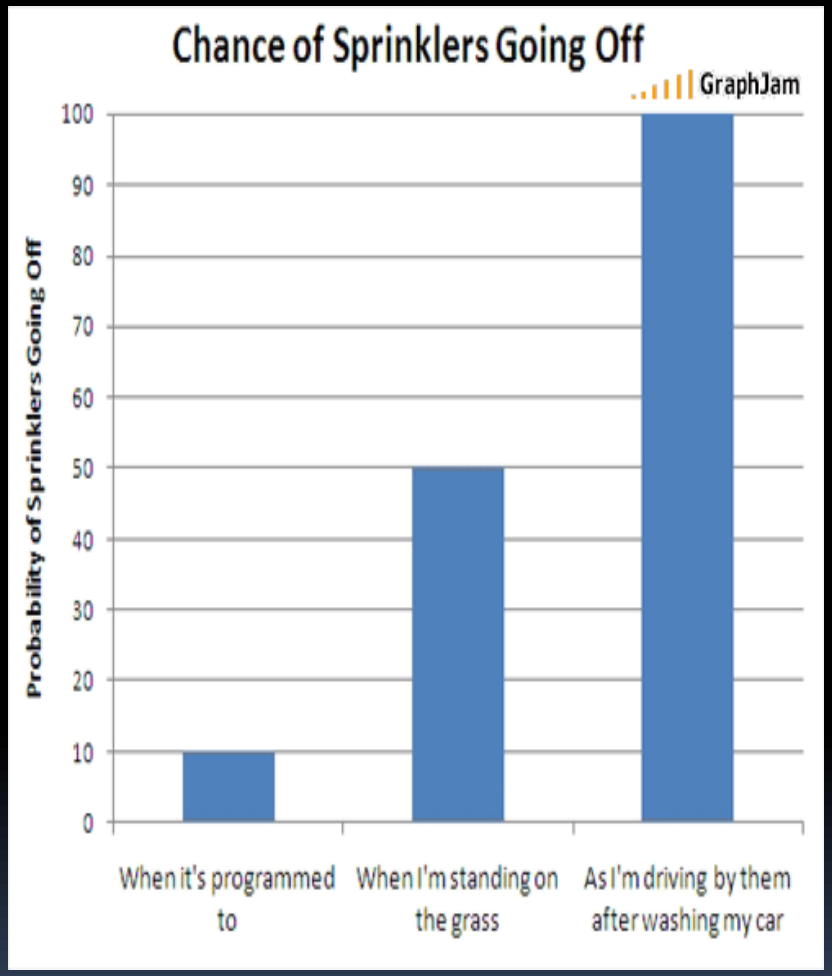
Some Truths About Irrigation





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….More truths

- Nearly half of all treated water used in the U.S. during the summer is applied to residential and commercial landscapes.
- More than 50 percent of residential and commercial irrigation water is lost to evaporation, runoff, overwatering, or poor design/maintenance
- Americans typically apply on the average 30% to 60% more water on their landscapes than necessary for the plants to thrive.
- Largest contributor to non-point source pollution
- Drip systems can use more water than conventional systems
- There is no such thing as an Automatic Irrigation System

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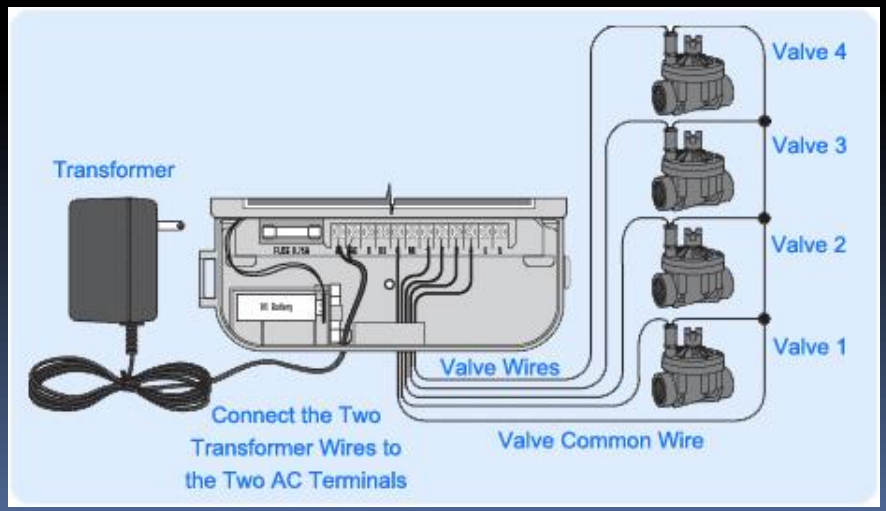
management for a sustainable future

Step III: Assessing the irrigation system

(A)
Examine the controller

- Make sure power is on
- Check all wiring
- Check that all buttons and displays are working properly
- Note if rain sensor or other is attached and if appropriately located.
- Write down # of programs, current schedule etc on work sheet
- Operate stations manually one at a time to insure operating properly.
- Make note of any failings or less than satisfactory operations on worksheet



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management for a sustainable future

Terms used to Program Controllers

5 **Start Time:** Time at which specific valves/ programs will operate a station or zone.

1 **Off /Stop:** Ends irrigation activities

2 **Program:** Where specific information on irrigation activities are stored.

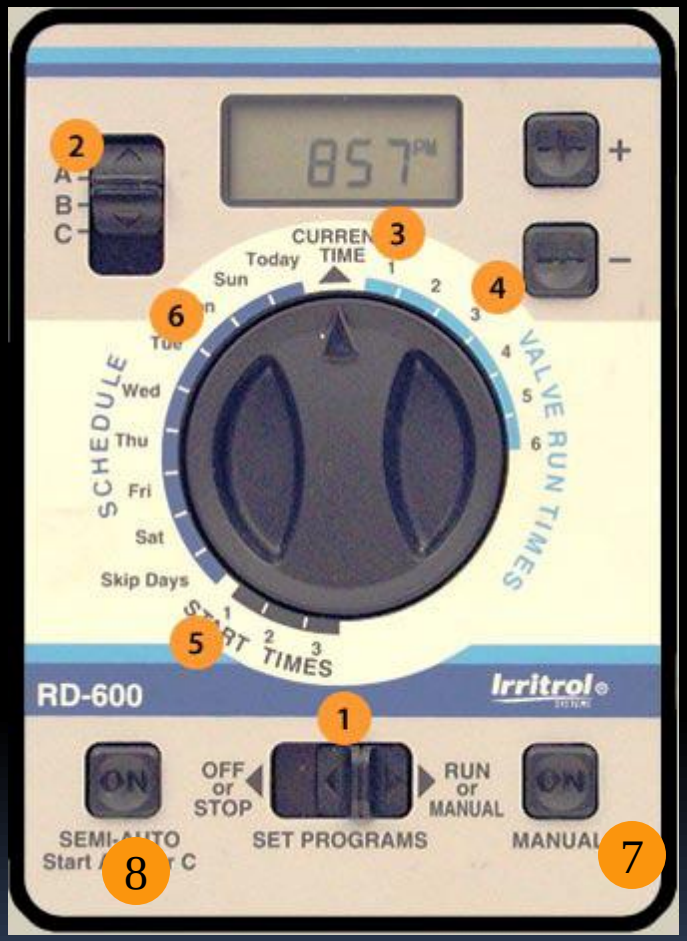
4 **Run Time /Station Duration:** Time, in minutes, a specific valve will stay on

6 **Cycle/ Run Days:** Days of the week/month scheduled to allow irrigation

3 Current time

8 **Semi-Auto:** Operates (cycles through) entire program regardless of start times.

7 **Manual:** Operation of single selected station



Cycle and soak

Sensor bypass (on/off)

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Residential Irrigation Audit

Customer: _____ Reference/WO#: _____

Address: _____ Date: _____

_____

PH#: _____

Make/Model

1) Controller: _____ #of Stations_____ # of Sta. operating: _____--_____

2) Controller: _____ #of Stations_____ # of Sta. operating: _____--_____

Zones *#1* *#2* *#3* *#4* *#5* *#6*

(A)

Controller Info Here

Scheduling: Run Times: _____min _____ min _____min _____ min _____ min _____min

Scheduling: Run Times: _____min _____ min _____min _____ min _____ min _____min

Scheduling: Run Times: _____min _____ min _____min _____ min _____ min _____min

Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____

Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____

Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____

Landscaping: _____

_____

_____ (B) _____

_____

Equipment:

BFP: ___ Size: ____ Type: Vacuum BRKR PVB DoubleCHK RPP Comments: _____

_____

Valves: Model/Manf: _____ Size: __ Comments: _____ (C) _____

_____

Turf: Y/N Total # of Zones: ____ Type of Heads: _____Comments:_____

_____

Total GPM: (By Zone) #1 _____ #2_____ #3_____ #4_____ #5_____ #6_____ Comments:_____

_____

_____

Recommendations:

Equipment: _____

_____

_____ (D) _____

_____

Scheduling: _____

_____

_____

_____

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Assessing the Landscape

(B)
The Walk Through

- Note any particular difficulties/ issues the resident may be having
- Note any topographical issues (slopes, declivities)
- Note the maturity and density of the overall plantings (shrubs, flowers, trees)
- Note the general health of the turf. Any areas not getting enough water? Getting too much?

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management for a sustainable future

The Walk Through continued

Use the time to talk with the customer(s) about:

Planting plants in groups with similar water needs

Reducing turf size

From this……to this

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The Walk Through continued

CALCULATING WATER NEED: SHRUBS/TREES

- Based upon canopy area more than total area
- Deeper watering-less frequently

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The Walk Through continued

Talk about planting alternatives to turf in difficult areas:

Under Trees

- Steep slopes

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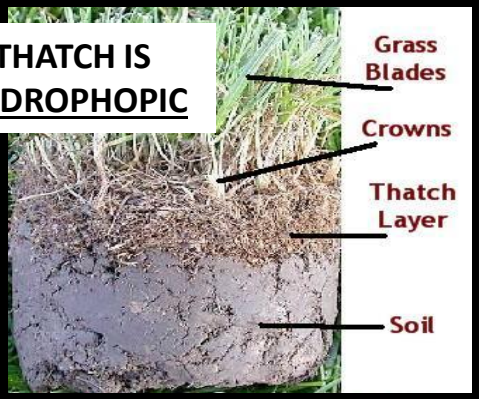
The Walk Through continued

Talk about thatching and aerating:



Thatch

- Hydrophobic
- Not grass clippings
- Inhibits nutrients from reaching the root system
- Rake and dispose of residue

Aeration

- De - compacts soils
- Facilitates broader / deeper root growth
- Allows better penetration of water and nutrients
- Rake up plugs and remove from lawn

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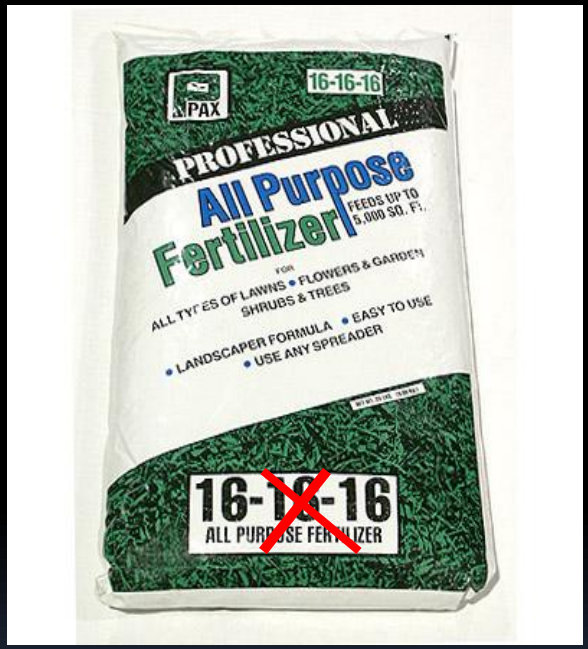
The Walk Through continued

Talk about Fertilization : Knowing what is needed

- Soil tests
- 0-Low phosphate fertilizers
- no broadcast spreading



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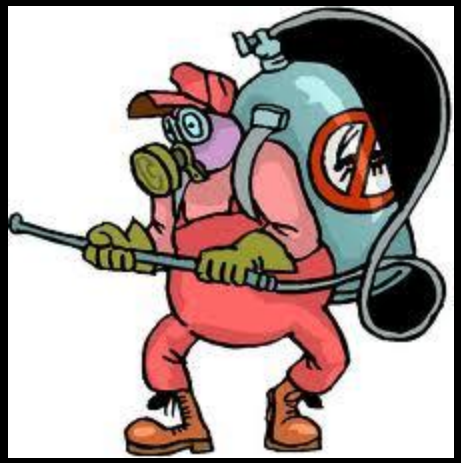
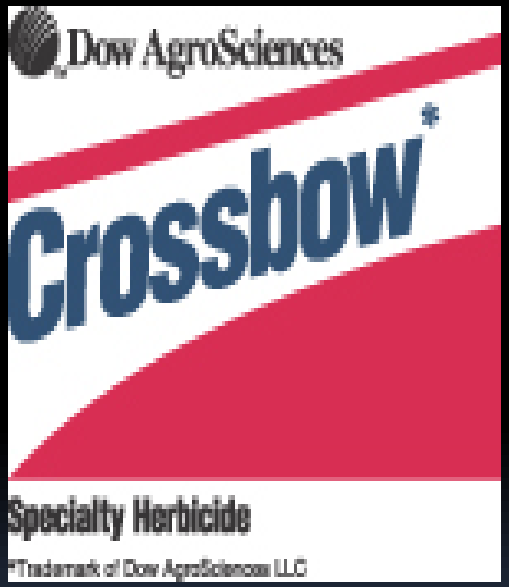
The Walk Through continued

Talk about chemical Usage: Responsible applications

- Follow the directions carefully
- Don’t add to it or over do it
- Pesticides are indiscriminant





Residential Irrigation Audit

Customer: _____ Reference/WO#: _____

Address: _____ Date: _____

_____

PH#: _____

Make/Model

1) Controller: _____ #of Stations_____ # of Sta. operating: _____--_____

2) Controller: _____ #of Stations_____ # of Sta. operating: _____--_____

Zones *#1* *#2* *#3* *#4* *#5* *#6*

Controller Info Here (A)

Scheduling: Run Times: _____min _____ min _____min _____ min _____ min _____min

Scheduling: Run Times: _____min _____ min _____min _____ min _____ min _____min

Scheduling: Run Times: _____min _____ min _____min _____ min _____ min _____min

Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____

Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____

Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____

Landscaping:_____

_____

Walk through Info Here (B)

_____

_____

Equipment:

BFP: ___ Size: ____ Type: Vacuum BRKR PVB DoubleCHK RPP Comments: _____

_____

Valves: Model/Manf: _____ Size: __ Comments:_____ (C)

_____

Turf: Y/N Total # of Zones: ____ Type of Heads: _____Comments:_____

_____

Total GPM: (By Zone) #1 _____ #2_____ #3_____ #4_____ #5_____ #6_____ Comments:_____

_____

_____

Recommendations:

Equipment: _____

_____

_____ (D)

_____

Scheduling: _____

_____

_____

_____

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Assessing the irrigation system

(C)

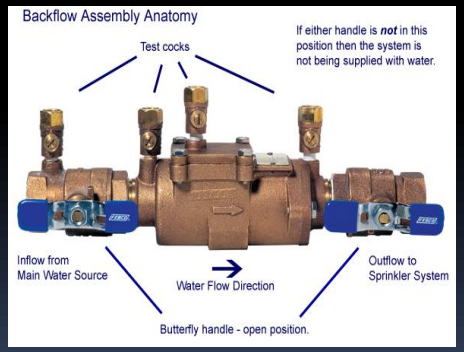
Equipment

Backflow preventers: Follow current municipal code as to acceptable types and installation. Note appearance and any discrepancies in installation protocols.

Atmospheric Vacuum Breaker:

Pressure Vacuum Breaker:

Double Check:



Reduced Pressure Principle:

Hose Bibs:

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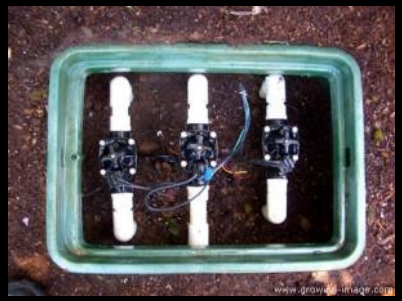
Assessing the irrigation system

(C)

Equipment Continued

Valves:



- Note the (manufacturer) if you can and the size .
- Comment on accessibility & serviceability (slow opening, slow closing). If it operates on command from the controller. Any damage or leaks.

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Assessing the irrigation system

- Make sure controller is on and operate one station on manual
- Does the valve operate correctly? Open and close completely and upon command
- Observe the sprinkler operation: Note Adjustments, broken risers/heads, broken lines, leaks and blockages. Note pressure: too much (misting) Too little (thick streams w/ no diffusion)
- Note coverage: Turf , shrubs, planters etc. Is there good overlap w/other zone(s)? Does it cover turf as well as shrubs?

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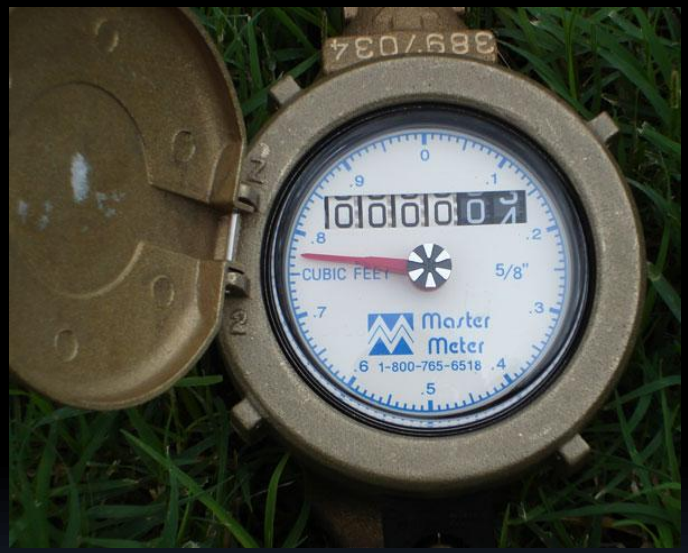
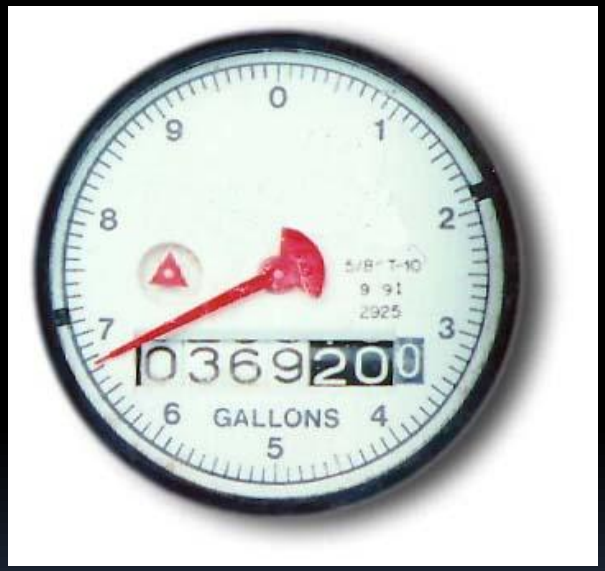
Assessing the irrigation system

Calculate precipitation rate for each zone by observing and measuring how far the sweep hand on the meter moves in 1 minute while zone is operating.
And multiply: by .75 for CCF and 1 for gallons





Repeat process for all stations

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Residential Irrigation Audit

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Address: _____ Date: _____

_____

PH#: _____

Make/Model

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2) Controller: _____ #of Stations_____ # of Sta. operating: _____--_____

Zones #1 #2 #3 #4 #5 #6

Controller Info Here

(A)

Scheduling: Run Times: _____min _____ min _____min _____ min _____ min _____min

Scheduling: Run Times: _____min _____ min _____min _____ min _____ min _____min

Scheduling: Run Times: _____min _____ min _____min _____ min _____ min _____min

Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____

Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____

Programs: ___ Start Times: ____ per ____day/week/mo @ ____am/pm ____am/pm ____am/pm _____

Landscaping: _____

_____

Walk through Info Here

(B)

_____

_____

Equipment:

BFP: ___ Size: ____ Type: Vacuum BRKR PVB DoubleCHK RPP Comments: _____

_____

Valves: Model/Manf: _____ Size: __ Comments: _____

(C)

_____

Irrigation Assessment Here

Turf: Y/N Total # of Zones: ____ Type of Heads: _____Comments: _____

_____

Total GPM: (By Zone) #1 _____ #2_____ #3_____ #4_____ #5_____ #6_____ Comments: _____

_____

_____

Recommendations:

Equipment: _____

_____

_____

(D)

_____

Scheduling: _____

_____

_____

_____

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Writing down what you've Observed

Recommendations **(D)**

Landscaping

1) Quick Fixes: Water reduction on turf (Stress management, dormancy). Aeration, thatching, mowing height.
2) Significant fixes: Remove and replace non-native plants with native and regionally adapted species. Adding mulches and soil amendments
3) Major Fixes: Lawn alternatives, landscape re-design

Equipment

1) Quick fixes: Broken risers/heads, sprinkler adjustments (raising, lowering, etc.), pruning or trimming away blockages, changing nozzles, installing rain sensors
2) Significant fixes: Replacing sprinklers & valves. Repairing leaks, adding sprinklers, replacing controllers
3) Major fixes: Adding zones. Replacing/installing control wires. Replacing/installing backflow prevention assemblies

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Writing down what you've Observed

Recommendations **(D)**

Scheduling

1) Break it down into seasonal periods: spring/summer/fall
2) Give them a rough estimate of when they should change their programming and how they should change it. (days per week, minutes per station etc)
3) Point out trouble areas and offer advice about how to mitigate problems. (cycle and soak, separate programs, etc.)
4) Demonstrate operating the controller
5) Show them how to make programming changes

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LUNCH

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Field work: Practice Audit

Determining your pace:

Need 100’ tape and some uneven ground

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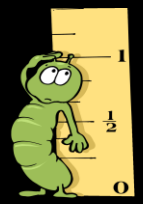
HOW MUCH IS 1 INCH?



Simple equations to calculate water needs of turf grass

- Turf: 1” per week (Higher during peak) 1”of water = .62 gallons per sqft

- (1) Precipitation rate: $\frac{96.3 \times GPM}{Area\ (SqFt)}$ = inches per Hour
- (2) Run time per week: $\frac{Area\ (sqft) \times .62}{GPM}$ = minutes weekly to apply 1” of water.

Example 1: $\frac{96.3 \times 22\ GPM}{2500\ sqft} = \frac{2118.6}{2500} = .84$ inches per hour or $\frac{1}{.84}$ = 1.19 hrs per week

Example 2: $\frac{2500 \times .62}{22\ GPM} = \frac{1550}{22} = \frac{70.45}{60}$ minutes = 1.17 hours or $\frac{60}{70.45}$ = .85 inches per hour

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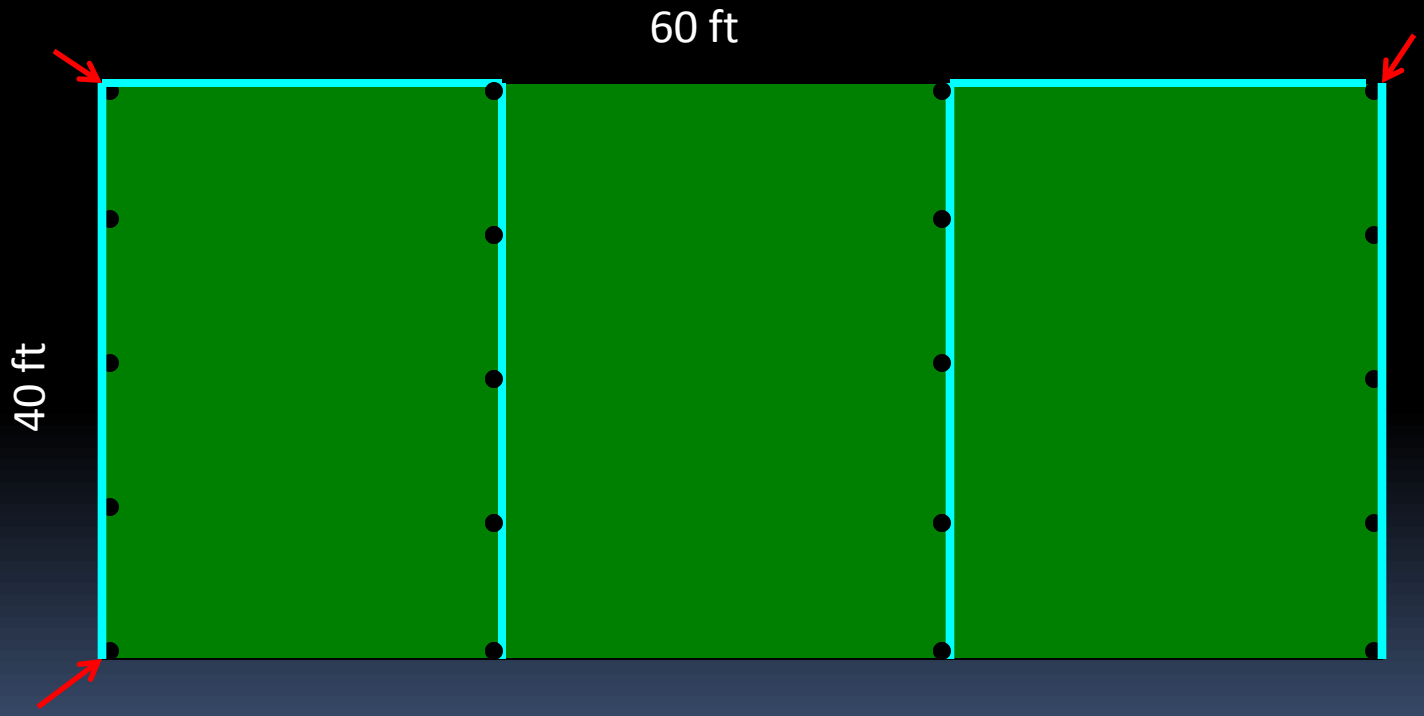
Calculating a Schedule

 # 1

Measure square footage of each area of grass to be watered. Multiply that number by .62 to get the amount of water needed weekly to equal 1". In this example: 2400 X .62 = 1,488 gallons to equal 1"



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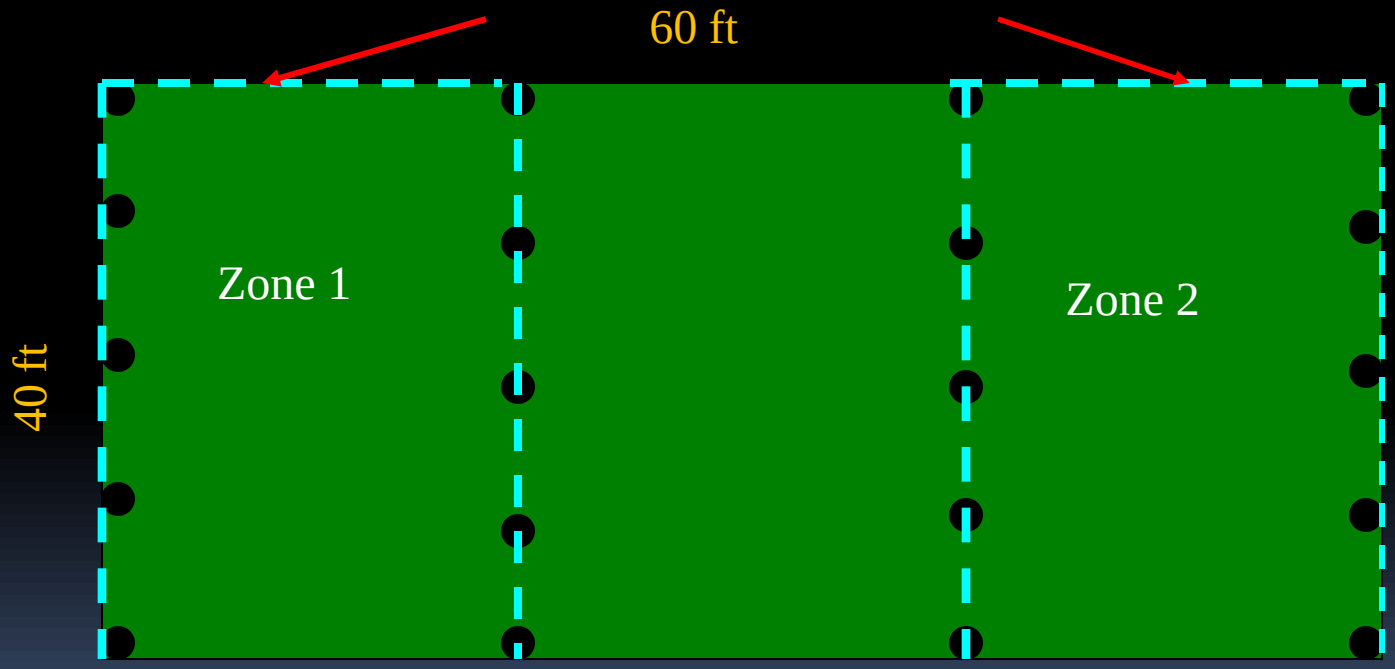
Calculating a Schedule

 # 2

Run each zone for 1 minute. Write down the number of times the sweep hand goes around for each.

Example: Zone 1- 1.5 times or 11.25 gallons Zone 2- 1.2 times or 9 gallons

Add both zones to get total applied. In this case: 11.25 + 9 = 20.25 (round down) 20 gallons per minute



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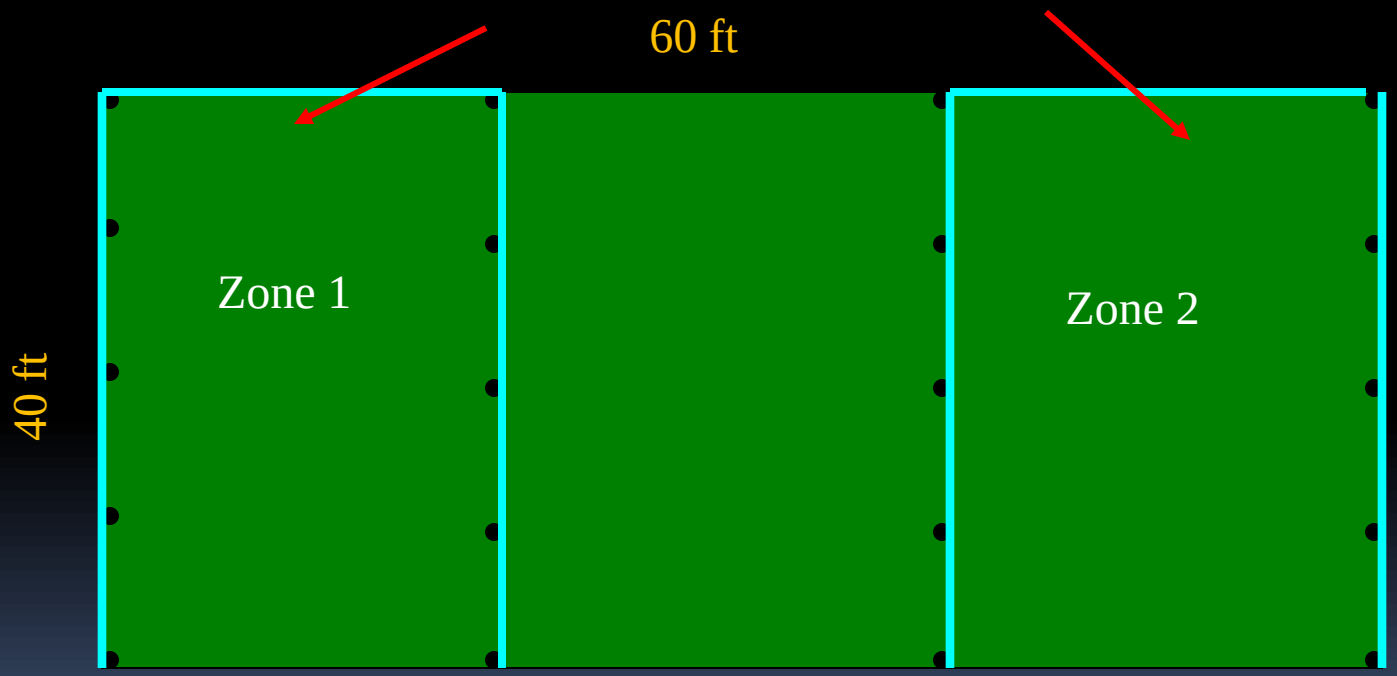
Calculating a Schedule

3

Divide the gallons per minute into the total gallons needed weekly to get a schedule of how long each zone must run to provide 1” of water.

Example: 1488 ÷ 20 = 74.4 or 75 minutes weekly per zone



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Calculating a schedule for Turf

 # 5 **What we know so far:**

a) 2400 sqft of grass needs 1488 gallons per week to recieve 1” of water

b) Precipitation Rate for both zones is 20 gallons per minute.

c) 1488 gallons ÷ 20 gallons per minute = 75 minutes run time per zone per week

d) Divide time by number of days to water (how many days a week) judgment call.

e) Add time for Months in the season:

April: Manually and only if needed

May: 1st half (manually) 2nd half 2 per week 25 minutes

June: Same as May add third day @ 25 minutes. Add 5 minutes per cycle if needed.

July/August: Days remain. Add additional time (15 to 20 per cycle) if needed

September: 1st half Same as June, 2nd half same as May

October: Same as April

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Calculating Schedules for Shrubs

- Same Basic technique as Turf: Variations are that we are concerned with total canopy area
- Deeper watering-less frequently

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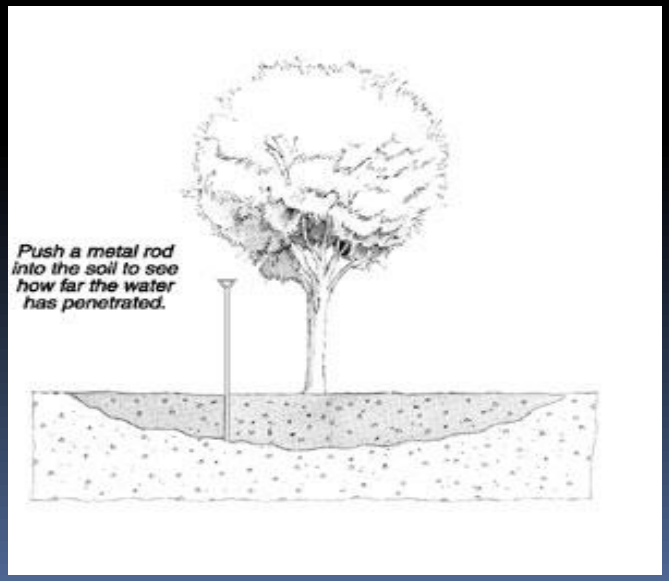
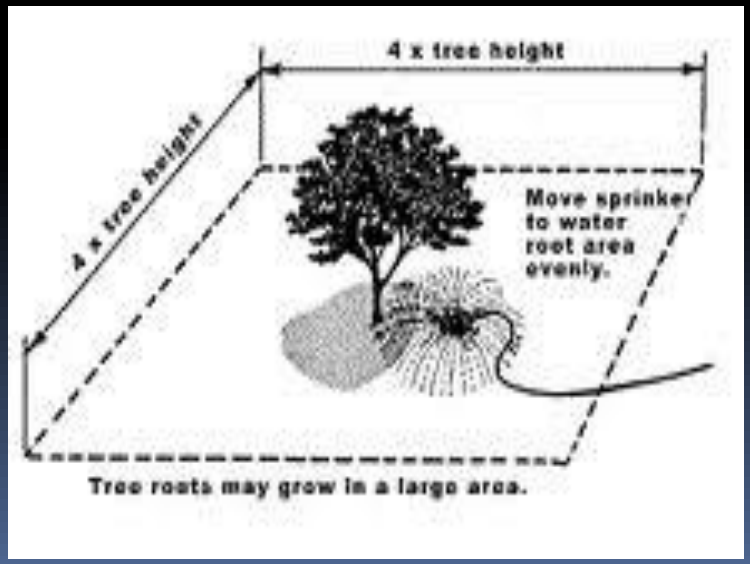
Calculating Schedules for Shrubs

- **Rules of thumb:**
- Trees: Area of Canopy(est.) X 2.5 = gallons monthly
- Lg shrubs: Area of Canopy X 1.25 = gallons weekly
- Small Shrubs/Perennials: Total area or canopy X 1= gallons weekly
- Annuals: as needed
- Varies with time of year and type of plant





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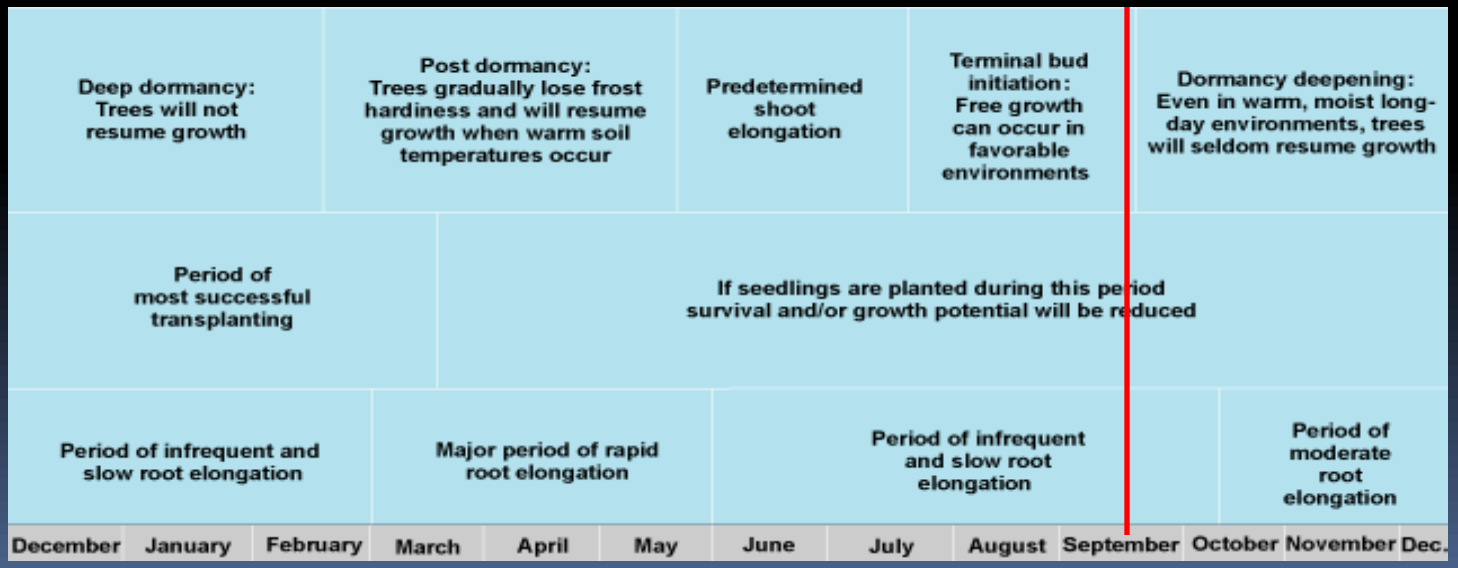
A little bit about seasonal dormancy

- Dormancy is triggered by length of day and intensity of sunlight more so than temperature
- As days get significantly shorter, the sun's position makes the intensity less direct, less energy for the plant
- By mid September, plants are already moving towards winter dormancy and require mostly infrequent waterings
- All irrigation should cease by mid October at the latest



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Pools and ponds

- A 25’X 20’ pool can easily lose 1” to 2” of water to evaporation in a week. (300 - 600 gals)

- Cover the pool

- Reduce temperature

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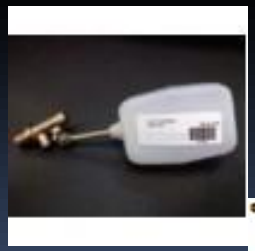
Pools and ponds

- Back flushing: **(Use the water on plants)**

- Check for Leaks



Malfunctioning fill valves #1 swimming pool/pond water waster

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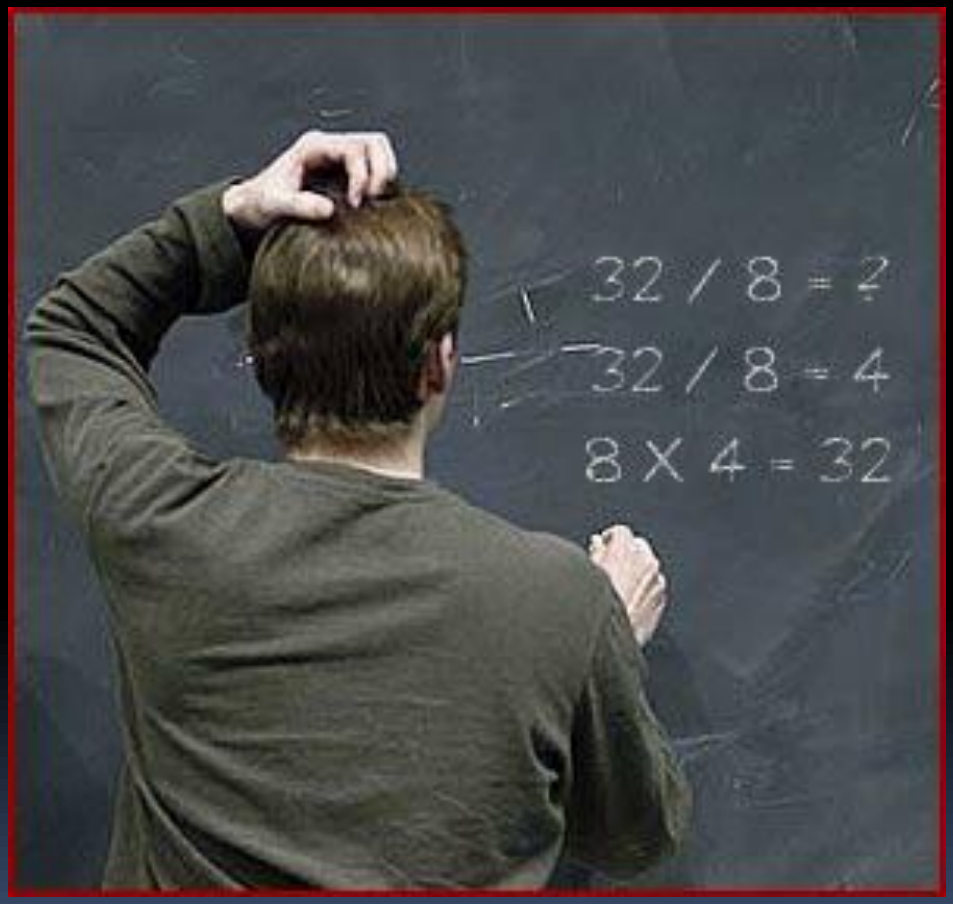
Let’s go do one in the field



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Results

What did we see?

- Leaks:
- Faucets:
- Toilets:
- Showers:
- Other:

Outside:

- Landscape
- Plants
- Grass
- Controller
- Back flow
- Valves
- Sprinklers

Reccommendations:

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Thank you

Questions?

Flow Down….





…….. LEAVE A LITTLE FOR THE REST OF US




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Contact Information

- Kevin McCaleb, Conservation Specialist City of Lake Oswego kmccaleb@ci.oswego.or.us
- Irrigation Association: http://www.irrigation.org/
- EPA Water Sense: http://www.epa.gov/watersense/
- Regional Water Providers Consortium : www.conserveh2o.org

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Regional Water Providers Consortium

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