Environmental Problem Solving:

Water Conservation in Prescott AMA

By Gary Beverly, January 28, 2015

Overview

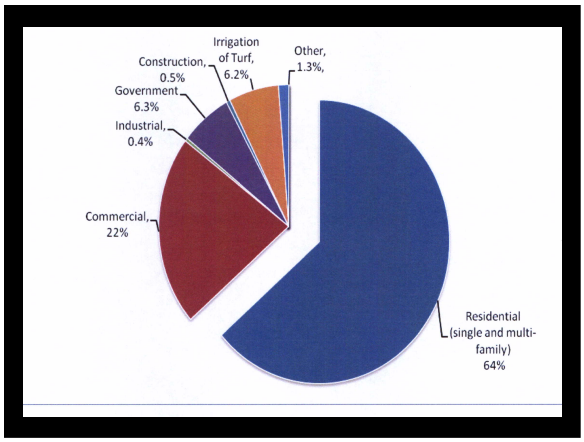
- Policy, local status, future possibilities. Not tips.
- Where our water comes from and goes to...
- Prescott area conservation programs.
- Potential savings through water conservation.
- What more can be done.
- How you can help.

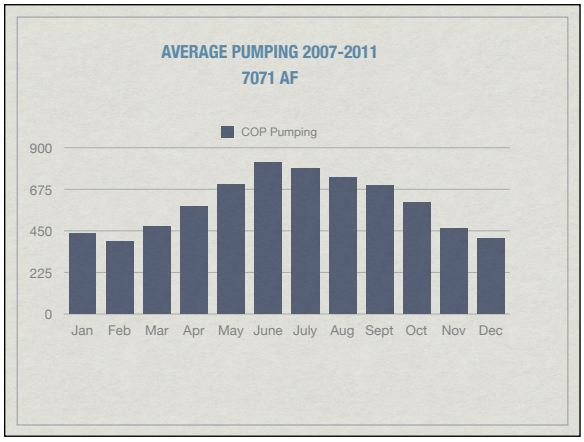
Why Conserve?

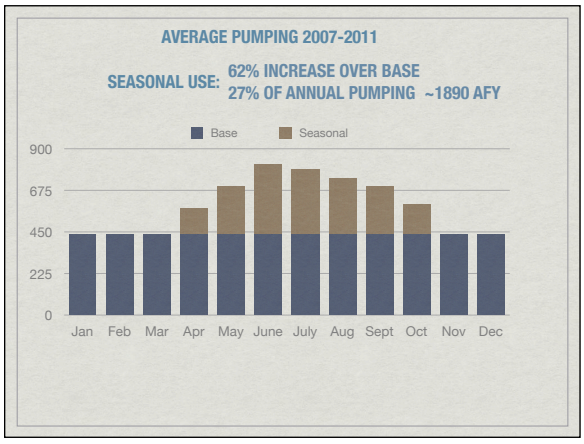
- Consumers save on water & sewer bills.
- Least expensive method to manage water.
- Quickest and easiest to implement: few legal impediments.
- Can prolong use of existing groundwater resource.
- Can reduce size and cost of expensive importation projects.
- Its the right thing to do.
- Can help protect the Verde River.

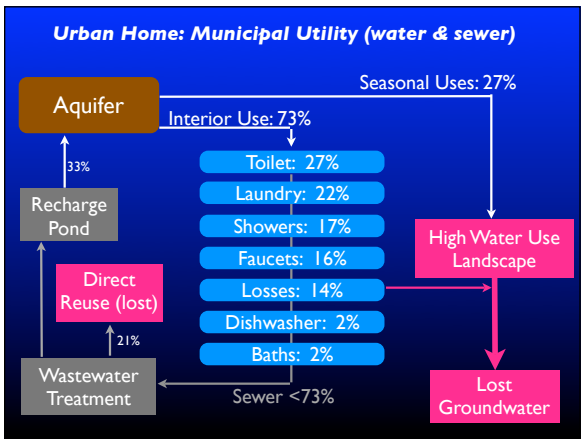
Where does Prescott water come from?

- Municipal water & sewer utility
- Approx. 23,000 customers.
- Groundwater - 7,000 afy (avg 2007-2011)
- Six production wells in Chino Valley
- Two (new) production wells near airport.
- Pipeline from Chino Valley to Prescott.


Irrigation of Turf, 6.2%
Other, 1.3%,
Construction, 0.5%
Government 6.3%
Industrial, 0.4%
Commercial, 22%
Residential (single and multi-family) 64%


AVERAGE PUMPING 2007-2011
7071 AF
COP Pumping
900
675
450
225
0
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec


AVERAGE PUMPING 2007-2011
SEASONAL USE: 62% INCREASE OVER BASE
27% OF ANNUAL PUMPING ~1890 AFY
Base
Seasonal
900
675
450
225
0
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec


Urban Home: Municipal Utility (water & sewer)
Aquifer
Seasonal Uses: 27%
Interior Use: 73%
33%
Recharge Pond
Toilet: 27%
Laundry: 22%
Showers: 17%
Faucets: 16%
Losses: 14%
Dishwasher: 2%
Baths: 2%
High Water Use Landscape
Direct Reuse (lost)
21%
Wastewater Treatment
Sewer <73%
Lost Groundwater

2012 Total Treated Effluent Recharge and Direct Delivery: 3,873 acre-feet	
Place of Use	Volume (acre-feet)
Airport WRF deliveries to the Recharge Facility	715
Sundog WWTP deliveries to the Recharge Facility	1,631
Total Volume to Recharge	**2,346**
Direct delivery to Antelope Hills Golf Course	792
Direct delivery to Prescott Lakes Golf Course	432
Direct delivery to Hassayampa Golf Course	250
Direct delivery to Hanson	53
Total Volume to direct delivery	**1,527**

Questions:

- If water used indoors is captured and recharged, should we invest in indoor water conservation?
- How well does recharge work?

Inefficient:

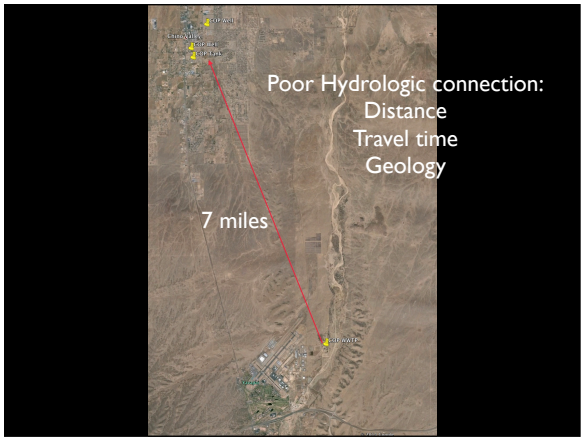
- 61% of 2012 GW pumped is recovered.
- 61% of recovered effluent is recharged
- 39% of recovered effluent is reused
- 21% of recovered effluent is diverted to direct use, mainly golf courses - a social decision.
- Turf irrigation with effluent is preferable to using potable water.
- 34% of GW pumped is recharged.

Water Law:

- COP & PV retain short-term recharge credits for future use.
- Recharge is not dedicated to safe yield
- Recharge credits are used to reduce groundwater withdrawal fees paid to ADWR.

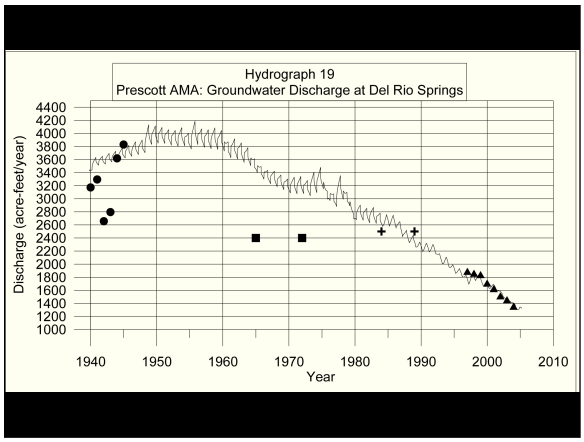
Hydrology

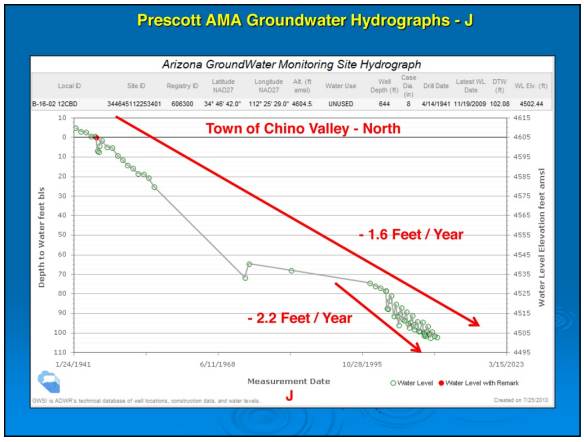
- Poor hydrologic connection:
  - Distance: recharge not near wells.
  - Time: centuries to travel from recharge -> wells.
  - Recharge into upper alluvial layer, pumping is from lower volcanic layer.



Hydrology

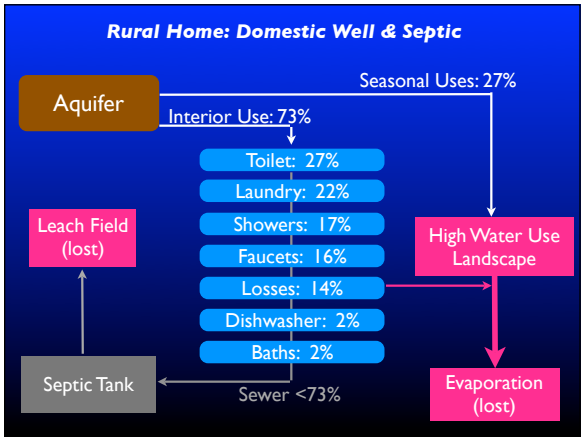
- Result: CV well water levels drop as though zero recharge, groundwater capture continues.





Summary:

- Over centuries, effluent recharge can mitigate falling water levels in Chino Valley.
- In the present, indoor conservation will reduce groundwater pumping, which will slow the decline of water levels in Chino Valley, and prolong groundwater supplies.
- However.... Del Rio Springs fate is set.
- What about homes on septic tanks?



Leach Fields Recharge?

- USGS estimates 35% recharge for Northern Arizona region.
- Depends on subsurface strata & depth to groundwater.
- Depends on surface conditions: vegetation, soil types, construction of leach field, etc
- Highly site-dependent.
- Inefficient, at best. Assume zero recharge for Prescott basin.

Septic ⟶ Sewer?

- Source: CYHWRMS data for Prescott area.
- 9714 COP citizens on septic @ 2.5 per home.
- 3886 connections, estimated potential recovery: ~500 afy.
- Estimated capital cost for lines, connections, and WWTP expansion: ~$50M in Prescott.
- Est. annual cost: ~$2,000/af or ~$6.24/1000 gall.
- Rural areas much more expensive.

Conservation Policy

- Devices (eg ULF toilet):
  - Costs & performance known.
- Behaviors (eg 5 min showers):
  - Requires continuous messaging.
  - Difficult to monitor behavior changes.
  - Difficult to estimate cost effectiveness.

Conservation Policy

- Program types:
  - Education/Voluntary
  - Incentive
  - Mandatory
- Installed demand: educational/voluntary, incentives.
- Future demand: educational/voluntary, incentives, and ordinances.

Landscape Water Conservation:

Comparison of Mandatory and Voluntary Effectiveness in Arid Areas

Allison Kutcher

Effectiveness of Municipal Water Restrictions During Drought in Colorado

TABLE 3. Water Savings During Water Restrictions (May through August, 2002).

	Basis of Percent Savings Calculation[1]									
	Entire Study Period			Voluntary Restrictions Period			Mandatory Restrictions Period			
Municipal Water Provider	Net Use (%)	Per Capita Use (%)	Expected Use Per Capita (%)	Net Use (%)	Per Capita Use (%)	Expected Use Per Capita (%)	Net Use (%)	Per Capita Use (%)	Expected Use Per Capita (%)	Model Skill (r2)
Providers Limiting Lawn Watering to Once Every Three Days (2-1/3 times/week)										
Thornton	-8	1	9	-7	2	10	–	–	–	0.71
Aurora	9	12	16	–	–	–	13	15	18	0.72
Denver Water	7	10	13	2	5	7	14	16	21	0.67
Westminster	4	7	14	3	6	11	17	19	27	0.70
Average[2]	3	7	13	0	4	9	14	17	22	--
Cities Limiting Lawn Watering to Twice a Week										
Fort Collins	9	13	18	3	7	12	17	20	24	0.63
Boulder	24	24	27	-2	-2	4	29	28	31	0.62
Louisville	39	39	41	–	–	–	43	43	45	0.77
Average[2]	24	25	29	0	2	8	30	31	33	--
Cities Limiting Lawn Watering to Once a Week										
Lafayette	46	49	50	–	–	–	53	55	56	0.69

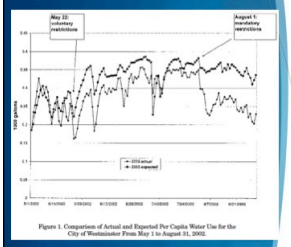
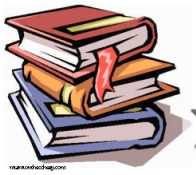


Figure 1. Comparison of Actual and Expected Per Capita Water Use for the City of Westminster From May 1 to August 31, 2002.

- Greatest savings - in the cities with greatest mandatory restrictions[11]
- Mandatory restrictions were an effective means of reducing demand and water use[11]
- Voluntary restrictions were of limited value[11]

Social Implications

- Least responsive to voluntary conservation: Wealthy educated Anglo republicans[18]



- During later mandatory stages: people with higher income and education responded best[18]

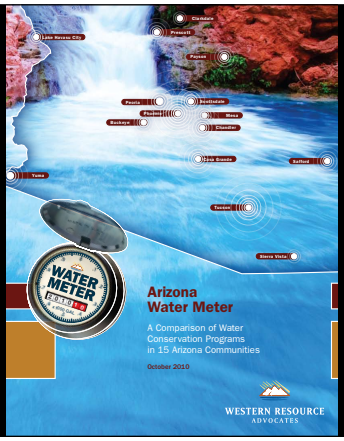
"Confronted by an aggressive industry that spends billions annually to advertise water-guzzling landscape products – What conservation program can compete and redirect scaling down outdoor water use – none. Therefore, it is water managers and officials responsibility to establish rules to save water and lessen irrigation excess"[9]

– American Water Works Association

Barriers to Effective Policy

- Voluntary/education conservation policies are acceptable but have limited effectiveness.
- Citizens' tolerance is limited. Education may help.
- Officials fear complaints from citizens and interest groups: eg CV & COP failed ordinances.
- Political beliefs conflict with effective policy.
- Decreased revenue to utility.

Prescott's Water Conservation Program



Per Capita

The city of Prescott reduced its system-wide total gallons per capita per day (GPCD) water use from 2003-2008 (-13.6% change), and significantly reduced its single-family residential (-29% change) and system-wide potable (-18% change) GPCD over the same time period.

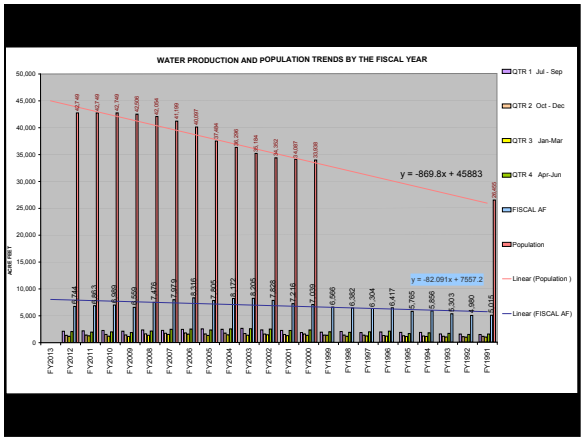
Prescott GPCD

Per Capita Water Use	2003	2007	2008
Single-Family Residential [a]	137	114	98
System-Wide Potable [b]	154	144	126
System-Wide Total [c]	193	189	167

[a] Treated water deliveries to single-family accounts ÷ single-family residential population

[b] Total treated water delivered ÷ service area population

[c] Total raw water from all supply sources + direct effluent use ÷ service area population



COP Water Conservation Education Programs

- Broadcast media messages: >1200 annual.
- Water bill messages & inserts: 8 mo. x 22,500.
- Printed literature, speaker's bureau, workshops.
- School programs, 17 brochure racks countywide.
- Web site: http://www.cityofprescott.net/services/water/conservation.php
- Landscape: PrescottWaterSmart http://www.prescottwatersmart.com/

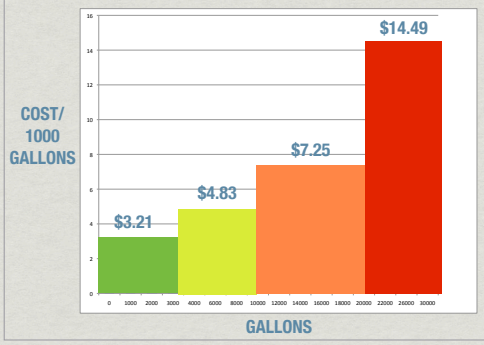
Interior Incentives: COP

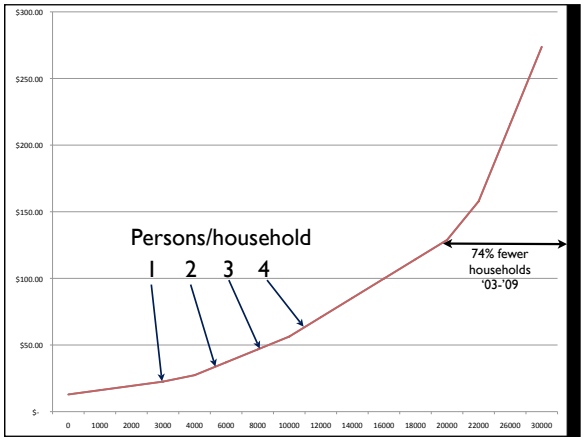
- Indoor WC Kit: $10 (rebate)
- ULF toilets: $50
- LF Shower head: $10
- Commercial urinals: $50
- Hot water recirculation: $50
- Leak repair: $5/leak up to $25
- Water history audits: free

Exterior Incentives: COP

- Landscape irrigation audit (certified): $100
- Rainwater harvesting tank: $.10/gall up to $300
- Turf conversion: $.25/sf $800 max
- Conversion to drip: $75 max

2015 Tiered Rates





Mandatory: COP

- Summer: no sprinkler use in daylight hours
- No spray fountains
- No water flowing on street

COP Incentive Program Effectiveness '06-'12

- 2469 incentive awards
- Cumulative cost: ~$380K over 6 years
- Cumulative savings: 647 af
- Cumulative water savings cost: $587/af (so far...)
- Days over 10 MGD: 2005 - 40; 2011 - 1
- Annual savings: 2011 - 98 af; 2012 - 17 af

Regional Conservation:

- COP, PV, CV, YC:
  - Building codes require low water use fixtures
  - Educational programs: "WaterSmart"
- COP, PV, CV: Tiered rates
- COP: Incentive programs
- Zero effective mandatory programs.

Performance by City

City	Gross gpcd	SFR gpcd
Prescott*	167-193	98
Prescott**	152	91
PV**	138	93
Clarkdale*	86-109	73
Payson*	130-139	66
Buckeye*	138	61

*Water Meter, 2006-8
**Larson 2007

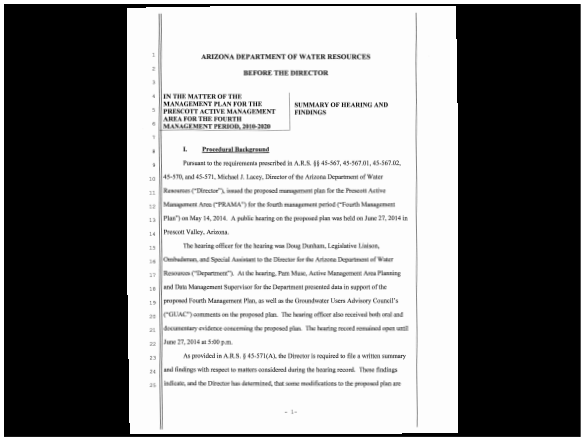
So: we can do better!

Arizona State Conservation Policy

- 1980 AGMA establishes Active Management Areas covering 13% of the state.
- 1999: PrAMA overdraft (~4 Kafy) declared, Assured Water Supply rules in effect.
- AWS rules require Management Plans and grant authority for mandatory conservation measures.
- 2000: PrAMA Third Management Plan requires 5 Reasonable Conservation Measures
- 2010: 4MP due, overdraft now ~13 Kafy

ADWR Conservation

- 2013: Fourth Management Plan Draft requires 5 Best Management Practices out of 50 listed possibilities.
- COP meets 26 BMPs without further action.
- 2013: CWAG & others ask for improved conservation in 4MP.
- 2014: ADWR releases “Strategic Vision for **Water Supply** Sustainability”: desalination!
- 2014: 4MP finalized, contains no changes to PrAMA conservation program.



ARIZONA DEPARTMENT OF WATER RESOURCES

BEFORE THE DIRECTOR

IN THE MATTER OF THE MANAGEMENT PLAN FOR THE PRESCOTT ACTIVE MANAGEMENT AREA FOR THE FOURTH MANAGEMENT PERIOD, 2010-2020

SUMMARY OF HEARING AND FINDINGS

I. Procedural Background

Pursuant to the requirements prescribed in A.R.S. §§ 45-567, 45-567.01, 45-567.02, 45-570, and 45-571, Michael J. Lacey, Director of the Arizona Department of Water Resources ("Director"), issued the proposed management plan for the Prescott Active Management Area ("PRAMA") for the fourth management period ("Fourth Management Plan") on May 14, 2014. A public hearing on the proposed plan was held on June 27, 2014 in Prescott Valley, Arizona.

The hearing officer for the hearing was Doug Dunham, Legislative Liaison, Ombudsman, and Special Assistant to the Director for the Arizona Department of Water Resources ("Department"). At the hearing, Patti Muse, Active Management Area Planning and Data Management Supervisor for the Department presented data in support of the proposed Fourth Management Plan, as well as the Groundwater Users Advisory Council's ("GUAC") comments on the proposed plan. The hearing officer also received both oral and documentary evidence concerning the proposed plan. The hearing record remained open until June 27, 2014 at 5:00 p.m.

As provided in A.R.S. § 45-571(A), the Director is required to file a written summary and findings with respect to matters considered during the hearing record. These findings indicate, and the Director has determined, that some modifications to the proposed plan are

- 1 -

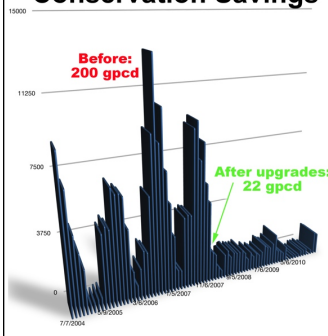
ADWR Conservation Responses

- “No authority to do that”: 7x
- “Our conservation program is reasonable”: 3x
- “Good suggestion, maybe next time”: 1x
- Conclusions:
  - Don’t expect regulatory assistance from ADWR.
  - Conservation is our responsibility.

Living within our means

- PrAMA overdraft: ~15,000 afy
- PrAMA population: ~123,000
- Overdraft is ~~100 gpcd gross
- Current use: ~~150 gpcd gross
- Goal: ~~50 gpcd gross, one-third of current use
- Personal Goal: 35 gpcd (single family residence)
- Possible? Probable?

Conservation Savings



Conservation Checklist

- ☑ *Install rainwater harvesting system.*
- ☑ *Update landscaping.*
- ☑ *Install interior water conservation devices: low-flush toilets, efficient laundry, faucts*
- ☑ *Change personal behavior.*
- ☑ *Result: 22 gpcd*

Water Conservation Results

Before:
12,000 gall/month

50% Interior (Recycled)

50% Exterior (Evaporated)

After:
1,200 gallon/month

100% Interior (Recycled)

Dual Flush Toilet

Solids:
1.26 gall/flush

Liquids:
0.8 gall/flush

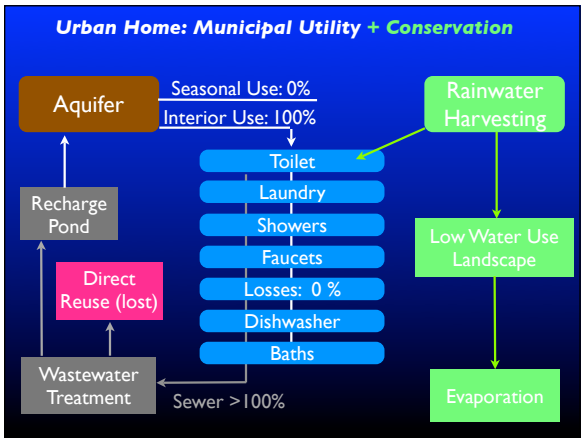
Look for this logo:

WaterSense Meets EPA Criteria
Certified by IAPMO R&T

WaterSense Meets EPA Criteria
Certified by CSA Group

1.5 gall/min


Outdated,
Inefficient
Washer:
50 gall/load
High-efficiency washer:
12 gall/load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Direct Reuse (lost)
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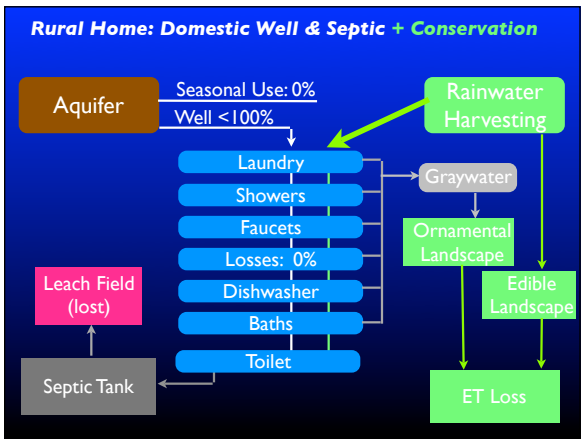
Sewer >100%
Evaporation


Rural Home: Domestic Well & Septic + Conservation
Aquifer
Seasonal Use: 0%
Well <100%
Rainwater Harvesting
Laundry
Showers
Faucets
Losses: 0%
Dishwasher
Baths
Toilet
Graywater
Ornamental Landscape
Edible Landscape
Leach Field (lost)
Septic Tank
ET Loss

Technology Solutions

- Desalination?
  - Expensive. Saline disposal.
- Net-zero groundwater homes for new growth?
  - Unproven but possible.
- Direct reuse to potable system?
  - Proven. Customer acceptance issues.

Prescott Potential Water Conservation

- Seasonal uses (landscape water): ~2000 afy
- Interior use: septic tanks: 500 afy
- Interior use: on sewer: 2500 afy
- Remaining conservation potential: ~5000 afy is > 2/3 of annual average pumping.
- Conservation is one of several necessary solutions and can make a significant contribution.
- IF we have the political will to do it (other cities do...)

COP Program Improvements

- Review and analyze historical performance.
- Set performance goals for consumers.
- Increase RWH & landscape water incentives.
- Add demonstration projects.
- Connect existing septic systems, discourage new.
- Improve commercial program.
- Control future landscape demand.

Regional Water Management

- Regional water resource planning, including conservation, is essential.
- Control future demand in the Big Chino.
- Develop programs for domestic wells.
- All are extremely difficult, especially...

Problem: Population Growth

- Aggressive conservation can theoretically resolve issue for current population.
- Population growth is inevitable & politically sensitive.
- Growth depends on many regional factors that are not easily regulated.
- Net-zero groundwater construction is feasible in this area.

CWAG Efforts

- Public Education: Op-Ed, programs, field trips, classes, collaborate with COP on WC education.
- Developing continuing education class for Realtors.
- Web Site: FAQ, upgraded resource library, new section for water conservation.
- Demonstration low water use landscape.
- Developing Conserve To Enhance program.

Environmental Problem

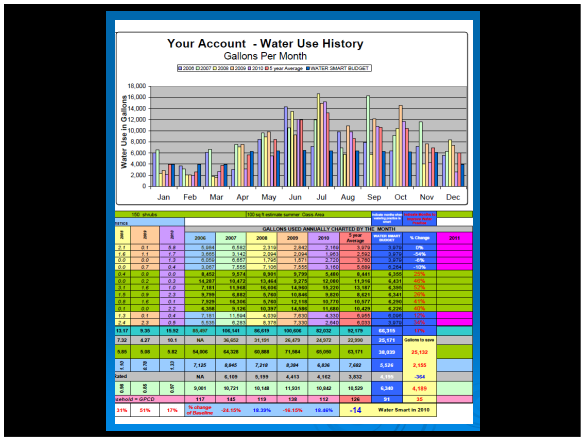
- We can solve this problem.
- Water ethic: Value & Conserve. Water is life.
- Personal responsibility to conserve.
- Stewardship!

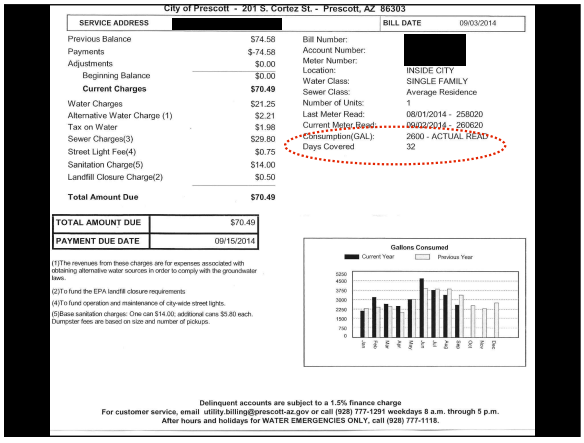
Get involved! Practice Stewardship

- Donate to CWAG water conservation efforts.
- Volunteer to help. Ask CWAG for a task list.
- Vote for candidates that know and care about water resources and the Verde River.
- Practice personal WC at home; talk to your neighbors.

What is your water use?

- Ask for a water history audit
- Read your water bill





City of Prescott - 201 S. Cortez St. - Prescott, AZ 86303

SERVICE ADDRESS	[redacted]	BILL DATE	09/03/2014

Previous Balance	$74.58
Payments	$-74.58
Adjustments	$0.00
Beginning Balance	$0.00
Current Charges	**$70.49**
Water Charges	$21.25
Alternative Water Charge (1)	$2.21
Tax on Water	$1.98
Sewer Charges(3)	$29.80
Street Light Fee(4)	$0.75
Sanitation Charge(5)	$14.00
Landfill Closure Charge(2)	$0.50
Total Amount Due	**$70.49**

Bill Number:	
Account Number:	[redacted]
Meter Number:	
Location:	INSIDE CITY
Water Class:	SINGLE FAMILY
Sewer Class:	Average Residence
Number of Units:	1
Last Meter Read:	08/01/2014 - 258020
Current Meter Read:	09/02/2014 - 260620
Consumption(GAL):	2600 - ACTUAL READ
Days Covered	32

TOTAL AMOUNT DUE	$70.49
PAYMENT DUE DATE	09/15/2014

(1)The revenues from these charges are for expenses associated with obtaining alternative water sources in order to comply with the groundwater laws.

(2)To fund the EPA landfill closure requirements

(4)To fund operation and maintenance of city-wide street lights.

(5)Base sanitation charges: One can $14.00; additional cans $5.60 each. Dumpster fees are based on size and number of pickups.

Delinquent accounts are subject to a 1.5% finance charge
For customer service, email utility.billing@prescott-az.gov or call (928) 777-1291 weekdays 8 a.m. through 5 p.m.
After hours and holidays for WATER EMERGENCIES ONLY, call (928) 777-1118.

Calculate:

- August:
  2600 gall ÷ 32 days ÷ 2 persons = 40.6 gpcd
- Base:
  ~2250 gall ÷ 32 days ÷ 2 persons = 35 gpcd base
- VERY GOOD!

Conservation Myth

- “If I conserve water it will support more growth.”
- NO:
  - Less water use means less pumping.
  - Conserve To Enhance