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Water Reuse in Arizona

Driven by Need, Enabled by Legal Framework

CIFA Conference
November 2015
Tampa, Florida

Water Infrastructure Finance Authority of Arizona

- Independent state agency
- Manage Arizona's Clean Water and Drinking Water State Revolving Funds

Our mission: Maintain and improve water quality in Arizona by providing financial and technical assistance for basic water infrastructure.

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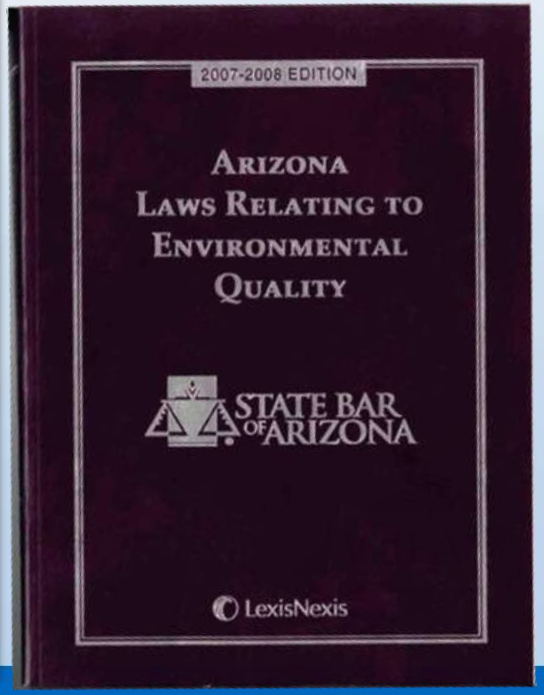
Reuse - Why Arizona?

Climate + Growth + Groundwater Regulations + Comprehensive legal framework for reuse




I'LL HAVE A GLASS OF YOUR LAKE MEAD 2007 AND SHE'LL HAVE A GLASS OF YOUR ARIZONA VINTAGE AQUIFER. AND BRING US A BOTTLE OF YOUR FINEST RECYCLED EFFLUENT 2020.
OF COURSE... COULD I INTEREST YOU IN A GLASS OF OUR DESALINATED PACIFIC 2018?
FITZSIMMONS
THE ARIZONA DAILY STAR 2014
WATER 2025

A Trip Back in Time

Grand Canyon 1920s - first WWTP in US built specifically to allow reuse (0.13 mgd capacity)

- Toilet flushing
- Boiler feed for power generation
- Water for steam locomotives

A Trip Back in Time

Irrigation with raw sewage

- Popular in arid west due to limited water supplies
- Reached peak in 1923
- Over 70 cities had sewage farms for growing food crops
- 1923-28: Raw sewage from 30-inch main irrigates Tucson farm

Sewer farm near Salt Lake City, Utah
Source: Utah Historical Society, ca. 1908

A Trip Back in Time

1932 – Irrigated agriculture receives reclaimed water from Phoenix 23rd Avenue WWTP

A Trip Back in Time

1983 – Phx 91st Ave WWTP delivers treated wastewater to Palo Verde NGS

- Largest nuclear power plant in US
- Unique in world: 100%-cooled by reclaimed water
- 3% of entire US reuse!
- Receives 60 mgd - 45% of WWTP flow

Palo Verde Nuclear Generating Station

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A Trip Back in Time

1989 – Tucson Sweetwater Recharge Facility

- First full-scale engineered recharge project in AZ utilizing reclaimed water
- Recharges 10 mgd under state permits

Credit: City of Tucson

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Back to the Present…
Management Options for AZ WWTPs

- **Surface water courses**
  - Discharge to dry streambeds
  - Streams, rivers, lakes, reservoirs
- **Recharge - managed infiltration**
  - Not considered or regulated as disposalll
  - Significant practice to reduce groundwater over-pumping
  - Recharge credits offset limits on groundwater pumping
- **Infiltration**
  - Basins (rapid infiltration basins or RIBs)
  - Tend to be smaller facilities
- **Reuse**
  - Not considered or regulated as disposalll
  - Agriculture, landscape irrigation, power generation, etc.

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Reuse Driver: Groundwater Regulations

Arizona's Water Supply
Annual Water Budget 2013

Water Source	Million Acre-Feet (MAF)		% of Total
SURFACE WATER			
Colorado River		**2.8**	**40 %**
CAP	*1.6*		*23%*
On-River	*1.2*		*17%*
In-State Rivers		**1.2**	**17%**
Salt-Verde	*.7*		
Gila & others	*.5*		
GROUNDWATER		**2.7**	**40%**
RECLAIMED WATER		**0.2**	**3%**
Total		7 MAF	

Source: ADWR, 2011

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Reuse Driver: Groundwater Regulations

Groundwater Management Act of 1980

- Regulatory incentive for reuse and recharge
- Goal – do not withdraw more than what is replaced
- Based on a system of "groundwater credits" established for safe yield
- Recharging earns credits to offset groundwater pumping

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Reuse Driver: Groundwater Regulations

As a side note…

- Cities and towns also use recharge basins to store surface water and reduce groundwater pumping
- Canal system brings water to central and southern AZ – recharged to replenish groundwater
- Some groundwater recharge facilities mix reclaimed and surface water

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Reuse Driver: Legal framework

1972 - first reclaimed water rules

2001 - new rules transform program

- **All new & expanding WWTPs must employ high-performance, tertiary treatment**
- Five reclaimed water quality classes
  (A+, A, B+, B, C) with corresponding allowed end uses
- Two permits
  - **WWTP responsible for quality of effluent and all monitoring**
  - Reclaimed water permits issued to end users - simple O&M and reporting requirements

Reuse Driver: Legal framework

Class A	Class B	Class C
• Food crop and landscape irrigation	• Golf course and orchard/vineyard irrigation	• Irrigation of sod farms, fiber, seed, forage crops
• Fire protection systems	• Dust control	• Silviculture
• Toilet/urinal flushing	• Pasture/watering (dairy animals)	• Pasture/watering (non-dairy animals)
• Snowmaking	• Street cleaning	
• Vehicle/equipment washing	• Construction activities	

Irrigating athletic field with reclaimed water, University of Arizona

AZ Stats

Of Arizona's 98 largest WWTPs (design flow ≥ 1 mgd)…

93% distribute at least some reclaimed water for reuse

56% distribute Class A+ water

Viticulture with reclaimed water, Cottonwood (Yavapai College photo)

Reclaimed Water Fire Hydrant

AZ Stats

More than 82% of treated wastewater generated in the Phoenix metro area is reused

represents wastewater from 60% of AZ population

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AZ Stats

Use of treated wastewater in Phoenix area

- Power	22%
- Agriculture	22%
- Recharge	21%
- Environmental	11%
- Landscape, turf irrigation	6%
SUBTOTAL THAT IS REUSED	**82%**
- Discharged (uncommitted)	18%
TOTAL	100%

Note: Greater Phoenix area has 60% of Arizona's population

Source: "Water Reuse in Central Arizona," ASU Decision Center for a Desert City, 2013

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Includes recharged effluent!!

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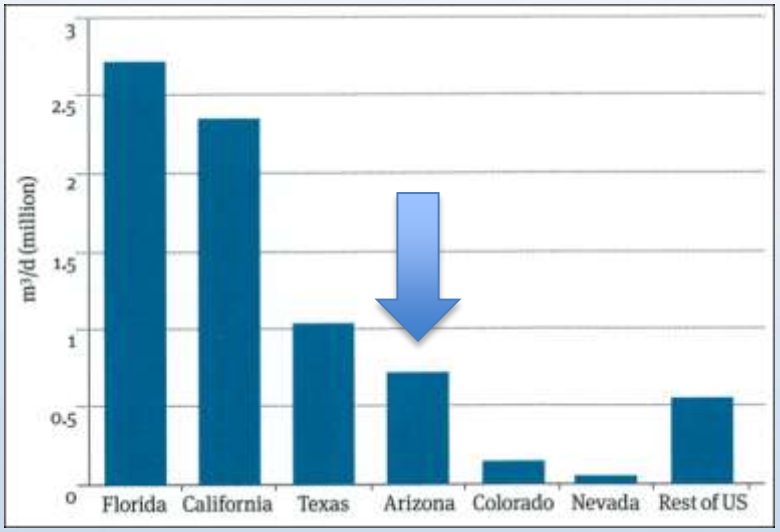
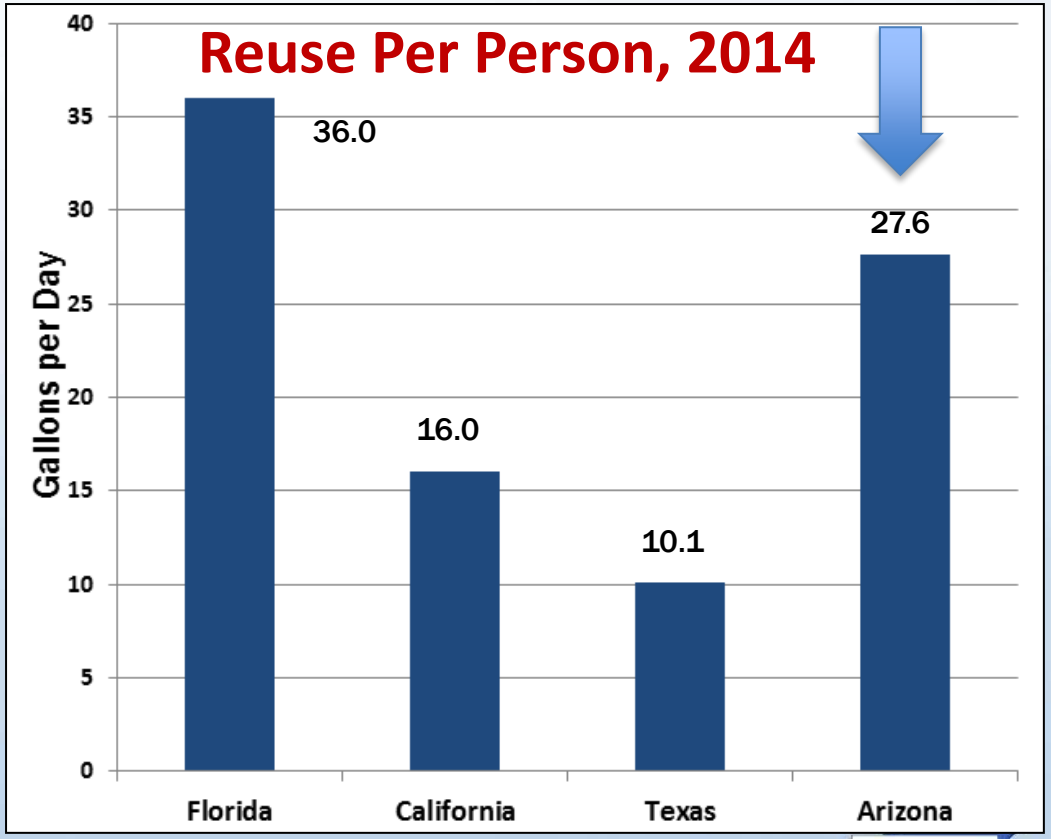
AZ Stats

Arizona is 2nd highest nationally in per capita reuse



4th in overall reuse



Source: Bluefield Research

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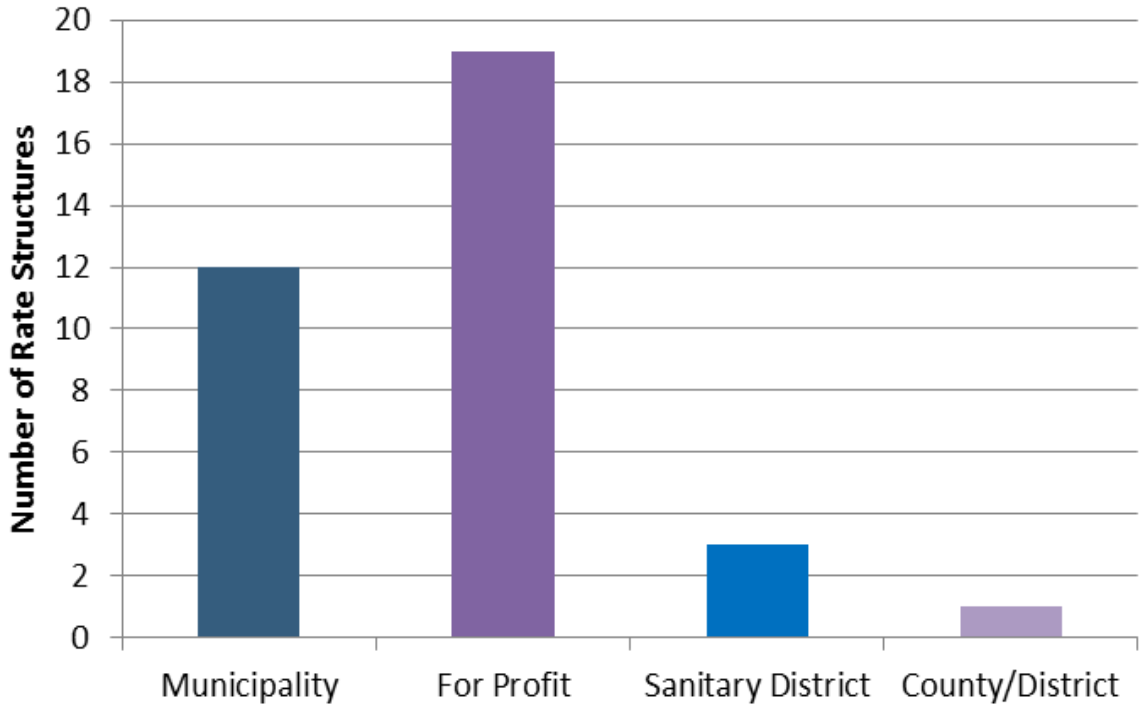
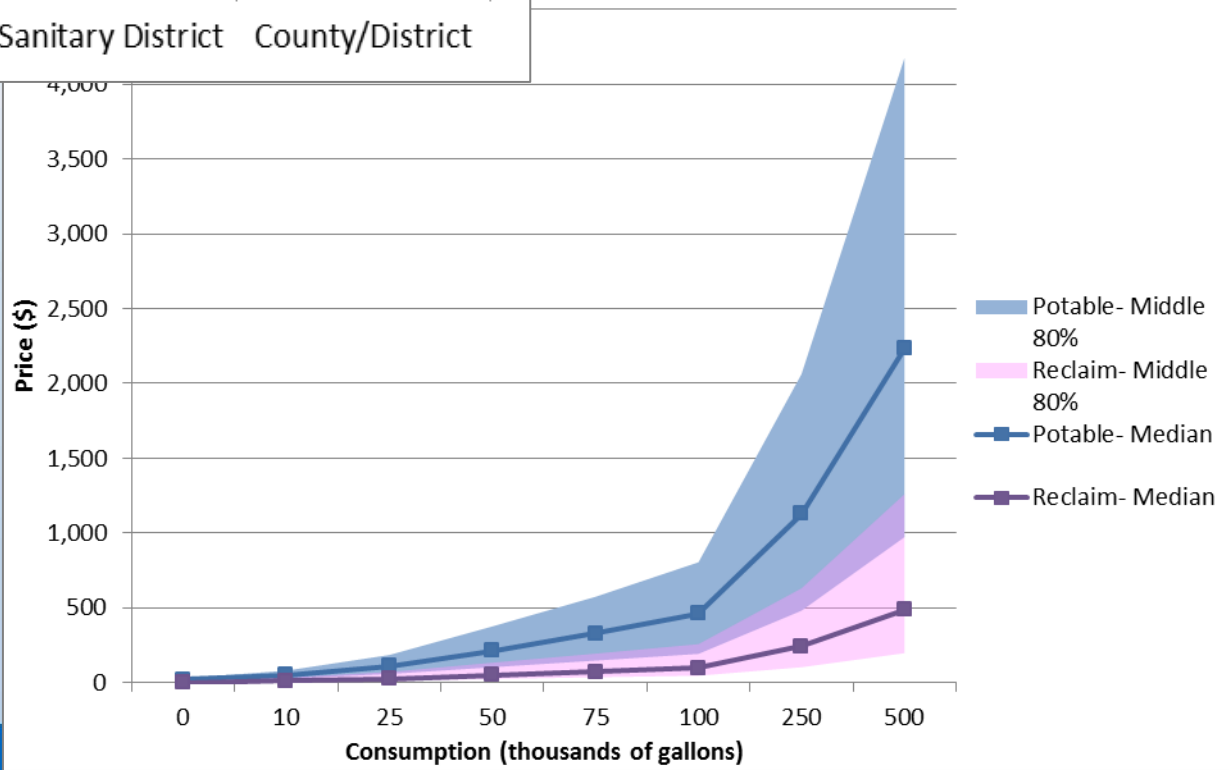


Reclaimed Water Rate Structures in 2015 WIFA-EFC Arizona Rates Survey, by Utility Type (n=35)

2015 Arizona Commercial Water Bills for Potable versus Reclaimed Water, by Monthly Consumption



Potential Areas of Concern

Contaminants of Emerging Concern (CECs - pharmaceuticals, personal care products)

- Risk so far looks minimal
- AZ mandates high-performance treatment with nitrogen removal in all new & expanding WWTPs
  - Corollary benefit: this treatment also greatly reduces CEC levels
  - Work by UA & others shows high CEC removal
    - Secondary treatment: 20-40%
    - **Tertiary treatment with N-removal: 60-99%**

Potential Areas of Concern

Unintended Consequences?

Is reclaimed water becoming so valuable that riparian areas dependent on it are becoming threatened?

Santa Cruz River below Nogales International WWTP

Photo: Channing Turner, Cronkite News

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A Developing Trend

Kino Environmental Restoration Project (combined reclaimed/ stormwater)
Credit: Pima County

Riparian Preserve
Town of Gilbert

Anthem Community Park
Credit: MCM Group

Birdwatching blind, Veterans Oasis Park, Chandler
Credit: Buck-Fever

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Early SRF projects

2000

Town of Kearny Wastewater Reclamation Facility

Reclaimed water to wetland area, golf course, and Kearny's ball fields

2004

City of Tucson Reclaimed Transmission Main

Reclaimed water to rodeo, park, 10 schools

Recent SRF Incentives

Incentives for Reuse and other Green Projects

- Interest rate reduction
- Forgivable Principal

Beardsley Water Reclamation Facility Upgrades
City of Peoria

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Types of Reuse Projects

- New water reclamation facilities
- Facility upgrades
- Reclaimed water transmission mains, booster stations

WWTP Expansion and Upgrades
City of Buckeye

CW SRF Dollars since 2009:

$203M included Reuse

out of

$390M total CW loans

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Town of Cave Creek - Water Ranch

New 0.75 MGD Water Reclamation Facility

- Administration building, four miles of sewage collection system, four miles of effluent return line
- Decommissioning and dismantling of the existing wastewater treatment plant
- A+ effluent
- Effluent conveyed to storage ponds and used for irrigation

Loan Amount
$22.9 million

City of Prescott – Airport WWTP Upgrades

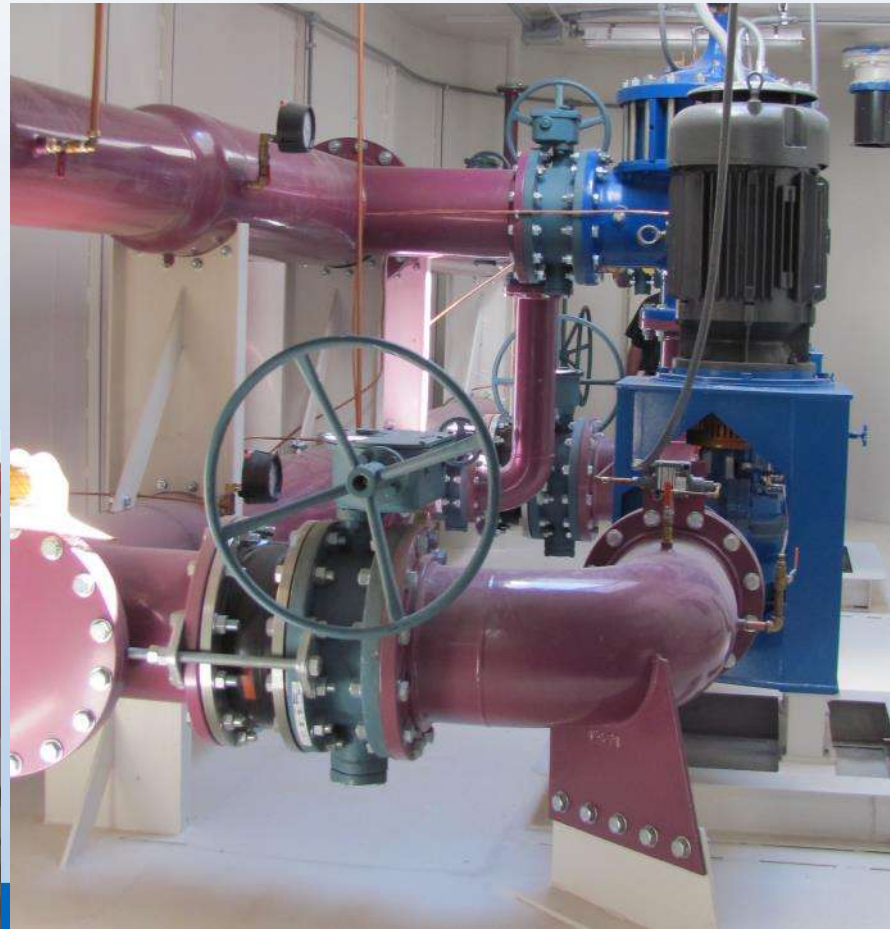
- Expanded from 1.2 to 3.75 mgd capacity
- Upgraded from B+ to A+ effluent
- Aeration system, blower building, tertiary filtration, disinfection, and effluent pump station
- Increased volume of reclaimed water produced by the WWTP
- Irrigating sports fields, golf courses, and commercial landscapes, restoring riparian habitats and recharging groundwater aquifers

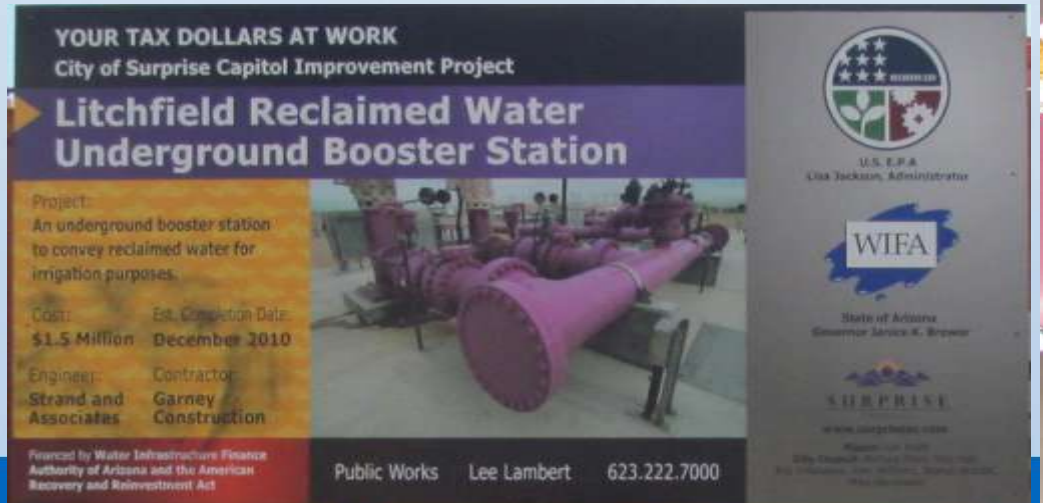
Loan Amount
$45.8 million

City of Surprise – Reclaimed Water Booster Station

- Modified the Reclaimed Booster Station
- Pressurized reclaimed water to the City Stadium, ball fields, green belts and landscaping
- Estimated amount of groundwater that will not be pumped: approximately 2,000 acre feet/year

Loan Amount
$1.5 million





City of Buckeye – Reclaimed Water System Improvements

- Irrigation of Sundance Park – ball fields and dog parks
- School and subdivision landscaping

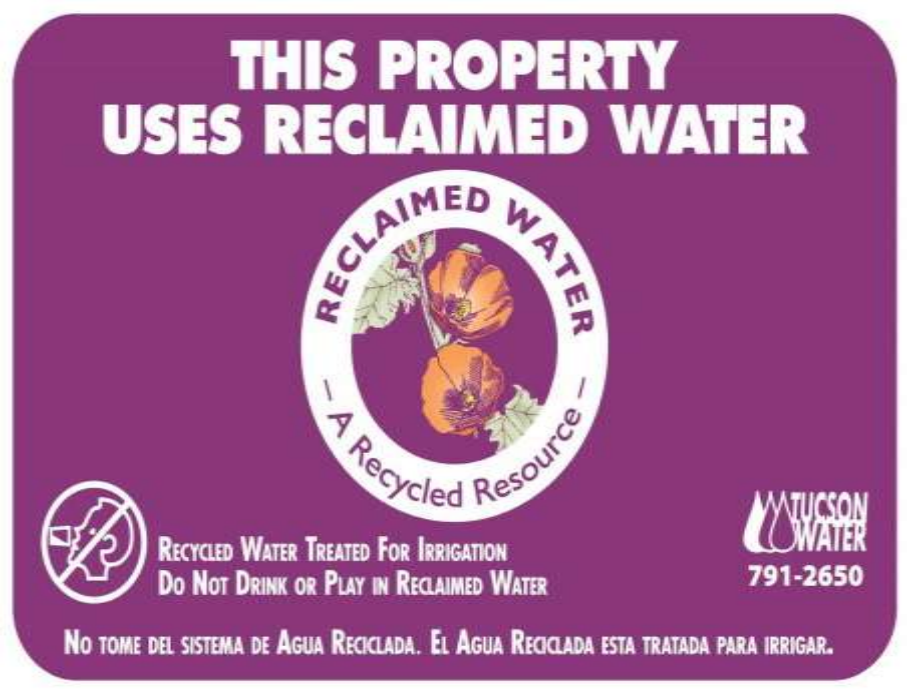
Improvements:

- 6.25 miles of reclaimed water line
- One PRV between pressure delivery zones
- 16 turnouts along the reclaimed water pipeline
- Electrical, instrumentation and operational modifications

Loan Amount
$7.37 million

Reclaimed water not used for irrigation is recharged at local irrigation district Groundwater Savings Facilities

Reuse and the AZ SRF Program: Conclusions



Source: https://www.tucsonaz.gov/water/reclaimed-signs

- Natural fit for SRF program – standard practice for WWTPs in AZ
- Financial needs of the community are the driver for SRF funding
- Incentives are also offered

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Green Valley Lake
Town of Payson

Tres Rios Wastewater Treatment Wetlands
City of Phoenix

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Thank you!

Chuck Graf, R.G.
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Back-up slides

Reuse Driver: Legal framework

Five Reclaimed Water Quality Classes

Class A+, A → open access uses

- pathogen-free
- denitrified (A+)

} **BADCT**

- filtration to meet turbidity <2 NTU

Class B+, B → restricted access uses

Class C → limited restricted uses

Note: Total N <10 mg/l to gain the A+ or B+

Reuse Driver: Legal framework

Stringent Treatment Standards

WWTP must employ Best Available Demonstrated Control Technology (BADCT)

Pathogen-free effluent
- No *E. coli*, 4 of 7 daily samples
- *E. coli* never >15 cfu/100 ml

Nitrogen removal to <10 mg/l

Odor control

Newly upgraded Nogales International Wastewater Treatment Plant

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