Some notes on the model for reclaimed, rainwater, and greywater options

Economic Funding Working Group
Blue Ribbon Panel On Water Sustainability

City of Tucson Water Department

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Extending the life of your potable water supply is the primary driver – But solutions for a community must be economically feasible

You may obtain funding to construct a system, but you will have to continue to maintain it and to remain in compliance

Options available

- Rainwater harvesting
- Greywater reuse
- Reclaimed water use
- Indirect potable reuse
- Depending on size and resources of community, some options may be unavailable

Below a certain size, there is limited opportunity to use reclaimed water

High costs per household may limit you to encouraging rainwater harvesting and greywater reuse on an individual or company basis.

Seasonal demand varies

The largest users of effluent / reclaimed water are golf courses, agriculture, and cooling towers.

A typical 18-hole golf course uses 0.8 - 1.25 MGD in the summer and 0.3 MGD in the winter.

During periods of extended rainfall, demand drops to zero and the ground is saturated. A place must be provided to put the effluent when demand drops.

The key to a successful reclaimed water system is effluent management.

We will look at differing circumstances, then at costs, incentives, and impediments

- Sun Lakes - originally sent all effluent to lagoons then to farmland; as effluent quantity increased, began recharging
- Saddlebrooke - uses effluent to irrigate turf in summer, discharges under AzPDES in winter
- Arrowhead Ranch - recharged in winter, used to supplement supply in summer
- With a small community, the only complexity is regulatory compliance and permitting. With a larger community, especially if there is multiple ownership of agencies, the levels of complexity are increased by IGAs, differing strategic directions, and differences in policies and practices.

Large utility - City of Tucson

- Tucson's reclaimed water system delivers up to 32MGD on peak days (summer, overseeding)
- Some effluent is treated in a plant, some is recharged and recovered, some is discharged
- The supply varies and the demand varies; diurnal supply curve and seasonal demand curves
- 900 sites are served, including 18 golf courses; 39 parks; 52 schools (the University of Arizona and Pima Community College included); and more than 700 single family homes

Multiple agencies: Tucson & Pima County

	Tucson Water	Pima County RWRD
Regional Water Agency	X	
Regional Wastewater Agency		X
Regional Reclaimed Water Agency	X	

Division of effluent rights

Per 1979 IGA between Pima County and the City of Tucson, wastewater assets transferred from City to County, County quit-claimed effluent to City, City made 10% of effluent available to County for specific uses.

Of the 90% effluent Tucson owns, small effluent entitlements have been transferred through subsequent IGAs to the Town of Oro Valley and to Metro Water.

Under SAWRSA settlement, a pool of 28,200 AF/yr is assigned to the Secretary of the Interior to meet federal obligations. Up to 10,000 AF/yr is set aside for approved habitat projects.

A question of scale

Small systems may need to rely on individual rainwater harvesting or greywater reuse; large systems have multiple options and a larger customer base to cover costs.

Medium-sized systems may want to look at "turnkey" or "package" treatment plants.

Treatment Plants 101

- Any plant requires careful analysis of loading conditions and site conditions
- Temperature, altitude important
- Package plants must be carefully designed for the specific application
- Whatever its details, plant must provide optimized environment for bacteria to stabilize sewage and remove nitrogen

Cost of 3 typical manufactured plants

- .35 MGD steel plant with influent pump station, clarifier, anoxic & anaerobic tanks, aerobic sludge digester, tertiary filter, chlorination; $3M or $9/gpd
- .3 MGD steel plant as above but without tertiary filter; higher altitude, larger tanks; $4.5M or $15/gpd
- .3 MGD two-train plant with rectangular reactors, clarifiers, aerobic digesters. Influent & effluent pump station, tertiary filter, UV disinfection, electrical building, laboratory. Second train tanks built but not equipped to reduce cost; $3.5M.

Additional Costs as Percentage of Construction Costs

- Engineering: 8 - 10% for design; may be as high as 15% for small plants
- Permitting: variable and hard to predict; avg $75,000
- Construction Management: 15 - 25% - even a small "package plant" needs submittals review, RFI's, O&M manuals in addition to onsite inspections, progress payment request reviews, project closeout
- Solids Handling: variable - below .3 MGD use ADEQ licensed sludge hauler; above, dewater and ship out
- O&M Costs: Up to 5%, costly on gallon treated basis

Remember - there are more costs than the initial capital costs

The cost of the treatment plant is only part of the total cost. Each recovery well costs $.25M or more, and recharge basins are costly. Pump stations, transmission and distribution piping, instrumentation and controls may be needed. And you will need backflow and cross-connection control equipment, inspections, and certification.

Incentives

- Ability to grow your community
- Avoided cost of additional potable water source
- When large individual residential lots use reclaimed water, they can save hundreds of dollars monthly
- Rebates to customers for low water use toilets and showerheads
- Preferential rates for first customers

Impediments

- High initial cost
- Lack of funding mechanisms unless you meet requirements
- Competition for available funding
- Regulatory requirements
- Ongoing backflow and cross-connection control requirements
- Public perception

Now for the matrix

- We used a model from *An Economic Framework for Evaluating the Benefits and Costs of Water Reuse,* a book from the national organization WateReuse of which Tucson Water is a member
- The matrix is based on existing sizes of treatment facilities in Pima County
- Assumptions have been noted in your handouts

References

- For rainwater harvesting: http://www.harvestingrainwater.com/
- For greywater: http://oasisdesign.net/
- For WateReuse: http://www.watereuse.org/
- For backflow and cross-connection control: http://www.backflow.com/

Questions?