Tucson's Civano: Design Implications for Water Savings in Non-Arid Climates

Achieving sustainability necessitates a rethinking of relationships between the built environment and the natural world. Tucson's Civano project, an 818 acre development touted as America's first sustainable community, stands as an original vision of such preservative design. Though hardly sustainable, in that the community does not balance its overall consumption with matching resource regeneration efforts, project results point to significant water and energy conservation achievements reproducible elsewhere. Civano's most practical implications apply to the field of water management, where demand-reduction efforts indicate promising potential for incremental resource savings outside, as well as in arid climates.

As the brainchild of an enthusiastic governor, a progressive city council, and a coalition of architects, developers, and city planners, Civano enjoys a demonstration project status along with a host of municipal concessions conditional upon conservational design. In return for initial procedural support and infrastructure financing, the Master Developer demands that all builders operating on site must incorporate specific design components to reduce residential energy and potable water use by 60 and 65%.[1] These requisites' hydrodynamic implications more specifically dictate the use of water-saving planting, plumbing, and irrigation techniques.

In order to achieve stated water use reductions, builders must outfit all properties with xeriscape landscaping, rainwater harvesting infrastructure, and secondary reclaimed water systems. Utilizing these techniques, which require, respectively, zoned landscaping with native plants to parse and reduce coverage of consumption intense lawns, holding tanks called cisterns to catch

rainwater collected from roofs, and special plumbing to utilize treated municipal effluent, has the cumulative effect of eliminating potable water use from residential irrigation. From a water management perspective, such reductions are invaluable, as residential irrigation is generally seen as a draw down threat to existing supplies and as the culprit responsible for worsening periods of summertime drought. Early reports examining water use in Civano's first neighborhoods indicate that homes utilizing rainwater harvesting systems rely on minimal amounts of reclaimed irrigation water even in drier seasons, despite the fact that Tucson typically receives less than 8" of rainfall each year (see figure below).

Other results tendered in those reports indicate substantial community-wide achievements. The average Civano resident, according to these academic and engineering evaluations, uses 57.5 daily gallons of potable water as opposed to the 141 gallons used by residents of new Tucson homes[2] and the 152 gallons used by the average Tucson resident across all homes. These represent daily potable water savings of 59.44% and 62.18%, respectively. These early figures will likely be characteristic of the entire five thousand home community, once it is completed, since the design techniques by which the 300 current Civano homes achieve their water-use reductions are mandated for each residential structure to be built therein. More importantly, given the simple technical nature of water-saving measures employed at Civano, there is reason to believe that similar, substantial demand-reduction could likewise be achieved elsewhere. Other communities with similar trends of residential construction through large-scale development might immediately benefit from such reductions, and to prove their potential a group of communities in southwestern Florida is submitted below as a

Month	Average Monthly Rainfall in Tucson in Inches	Amount (in gallons) Collected off 1500 sq. ft roof	Amount (In gallons) needed for Irrigation	Surplus or (Deficit)
January	1.2	1072.5	300	772.5
February	1.0	825	450	375
March	.9	742.5	450	292.5
April	.3	247.5	540	(292.5)
May	.3	247.5	540	(292.5)
June	0	0	1040	(1040)
July	1.3	1072.5	1040	32.5
August	1.8	1485	1040	445
September	1.0	825	890	(65)
October	.7	577.5	740	(162.5)
November	.7	577.5	450	127.5
December	1.4	1155	300	855
Total	**12**	**8825**	**6740**	**997**

Monthly Tucson Rainfall - Even with minimal rainfall, the average Tucson home can collect enough rainwater for most all of its irrigation needs.

case study appropriate for feasibility-analysis.

Sarasota county is comprised of several retirement communities, and its 200,000 person population is growing due to profligate development in the area. In terms of water use, this means that over 85% of demand for municipal supplies comes from the residential sector, and such a consumption trend will likely continue as more people come to occupy vacancies among the 5000 new homes built each year. To address this growing residential drain upon its ground and surface water supplies, and to prevent future damage of the Floridian aquifer by overdrawing and subsequent saltwater intrusion,[3] Sarasota county has implemented a number of programs aimed a reworking residents' consumption behavior. The foci of Sarasota's programs are a reliance upon conservational appliances to reduce in home use and a dependence on rainwater to prevent irrigation from tapping potable supplies. To date, the

county maintains showerhead and toilet rebate programs, a municipal reclaimed water system, and a mandated retrofitting program to fit irrigation systems with rain sensors. The last two initiatives mentioned, the reclaimed water system and rain-sensing technology, represent wise steps taken towards water conservation. However, given that Sarasota county receives about 50” of annual rainfall and that projections of future water supply gaps persist despite conservation efforts so far, it seems that using other, traditionally ignored but existent potable sources may make the greatest impacts in limiting county-wide ground and surface water consumption.

A look through Sarasota’s newer developments suggests that private agents are doing more to harvest rainwater than simply fitting sensors onto irrigation systems so as not to water lawns during rainstorms. Some developments like Palmer Ranch and Lakewood Ranch have made both spot-oriented, incremental and more community-wide commitments to tailor landscapes with xeriscape designs. But water-conserving design is hardly the norm for the county at

large, and only one development, Lakewood Ranch, has arranged access to available reclaimed water hook ups. Consider once again that Sarasota, under pressure from stifling irrigation demands, receives 50" of annual rainfall as compared to the 8" with which Civano residents, harvesting fallen rainwater, almost completely irrigate their properties,[4] and it becomes obvious that Sarasota county's story is one of untapped opportunities.

How might rainwater harvesting be achieved in Sarasota? The answer is not tremendously complicated; initial studies suggest that southern Floridians, who have to date entered enthusiastically into shower and toilet rebate programs, would likely accept rebates for multiple 500-gallon cistern systems similar to those used at Civano.[5] And more importantly, the same studies suggest that initiating such a rebate program would achieve significant water savings at a fraction[6] of estimated costs for other current water conservation proposals, which seek to expand centralized, county-managed reclaimed water hook-ups. Clearly, the potential for outfitting all new homes and retrofitting old ones with rainwater harvesting infrastructure is substantial and deserves further exploration. Eliminating irrigation drains on potable water might prove to political actors that incentiving sustainable design is a viable means of coercing conservation efficiency. The success of programs like these could also initiate a political tipping point, encouraging broader conservation-oriented municipal action and more legislation requiring sustainable development in the future.

Sources:

2002 Civano Water Use, Report, at www.civanoneighbors.com/civano/environment.htm#reports [3/23/04]

Hawkins, Lovins, and Lovins, *Natural Capitalism: Creating the Next Industrial Revolution*, RMI Press, Boulder, 2003. Chapter 11, entitled "Aqueous Solutions" found at rmi.org/images/other/Businesses/NC99-19k_AqueousSltns.pdf [Accessed 3/23/04]

Texas Rainwater Harvesting Guide at www.twdb.state.tx.us/publications/reports/RainHarv.pdf [3/9/04]

Pictures from:

http://www.twdb.state.tx.us/publications/reports/RainHarv.pdf

http://www.civanoneighbors.com/civano/environment.htm#reports

http://it.ifas.ufl.edu/landscapeselector/twoeight.html

Citations:

1 - These goals take large conservation leaps, and further study of energy-use and CO_2 reduction efforts is encouraged but not pursued here. For information on these topics please see the "Guiding Documents" & "News" sections of civanoneighbors.com

2 - Homes constructed according to 1990 Tucson Baselines. For sample sizes and other statistical information, see reports by the University of Arizona and Al Nichols Engineering at civanoneighbors.com.

3 - For more information on Floridian aquifer health, draw down, and the relationship between aquifer levels and salt intrusion into aquifers, see http://coastgis.marsci.uga.edu/summit/aquifers_fla.htm. For more information on Sarasota county's specific conservation measures, please consult links at www.sarasotagov.com/LivingInSarasota/Contents/PublicWorks/PWPDFFiles/WaterBrochure.pdf

4 - Readers should be aware that landscape water requirements in Florida are different than those in Arizona, and that larger Floridian lawns require more water than desert-planted properties. These figures nevertheless show vast potential for potable water savings using rainwater harvesting.

5 - Cistern costs are about $1 per gallon stored.

6 - See http://www.rmi.org/sitepages/pid172.php.