

## Executive Summary and Conclusions

The major conclusions of this research are as follows:

1. Xeriscape conversion projects can save vast quantities of water at single-family residences. Homes in this study saved an average of 96,000 gallons annually following completion of an average-size conversion project. This is a savings of 30% in total annual consumption; a finding in line with those yielded by other research studies in this region.
2. Over the long timeframe of this study, total yearly savings have neither eroded nor improved across the years. On average, household consumption drops immediately and quickly stabilizes.
3. There is an enormous difference in application of water to locally used turfgrasses and xeric landscape by residents. On average, each year residents applied 73.0 gallons per square foot (117.2 inches) of water to grow turfgrass in this area and just 17.2 gallons per square foot (27.6 inches) to xeric landscape areas. The difference between these two figures, 55.8 gallons per square foot (89.6 inches) is the theoretical average savings yielded annually by having xeriscape in lieu of turf in this area. This is a *substantial* savings (76.4%) when considered in the context of the available residential water conservation measures. A sub-study of other commercial properties with xeriscape found the average application to xeric areas by these customers to be essentially equivalent to that observed for the residential customers.
4. Over the course of a year, the difference in application between turf and xeric areas varies in a predictable bell-shaped-curve manner, with the greatest difference occurring in summer. This is because turf irrigation peaks to a much greater extent in summer than xeric irrigation. The difference in irrigation between these two types of landscape varies from as little as 1.56 gallons per square foot for the month of December, on up to 9.62 gallons per square foot for the month of July.
5. In comparing irrigation application to the reference evapotranspirational rate ( $ET_0$ ), it was found that on average application to turf exceeded  $ET_0$  in every month except March, exceeding it the most May through November. In contrast, xeric application remained well below  $ET_0$  year round.
6. The author experimented with using a locally invoked “rule-of-thumb” which holds that xeric plantings require about a third of the evapotranspirational rate as needed for turf. In comparing this developed reference,  $0.33(ET_0)$ , to application, it was found that these values were, in absolute terms, somewhat close month to month and very close over the entire year. In comparing this developed reference to application, it was found that xeric application was below  $0.33(ET_0)$  half the year and above it the other half of the year (September-February).

7. Relative to questions about irrigation management and the potential for further efficiency gains, findings associated with conclusions 4 through 6 and subsequent analyses led the author to suggest that (i.) the greatest absolute savings from assorted improvements in irrigation will be realized in the summer, but (ii.) the most readily obtained efficiency improvements (i.e., not requiring capital outlays) yielded from better controller management may be obtained September through January, as this is the period when a lot of residents fail to successfully decrease irrigation in response to lower irrigation requirements (for both types of landscape).
8. Multivariate regression modeling was used to help discover some of the factors associated with variability in water consumption at single-family residences. These are:
  - i. The amount of turf at the residence (positive correlation).
  - ii. The property value of the residence (as indicated by the local assessor's office; positive correlation).
  - iii. The age of the residence (positive correlation).
  - iv. The total income of the property's residents (positive correlation).
  - v. Whether or not the turfgrass present at the residence is Fescue (a locally popular cool-season grass; positive correlation). As a side-result from one of the multivariate analyses, Bermuda grass may be receiving approximately 59 gallons per square foot per year – certainly less than the application for the much more common cool-season grass in this study.

Some variables which were significant in many other incarnations of the model (but not the final model) include parcel size, surface area of open water for pools and spas, the total number of occupants living at the residence, and total landscapeable area.

9. A similar approach was used to identify some of the factors associated with variability in irrigation application to monitored xeric areas. These are:
  - i. The total canopy coverage within the xeric area (positive correlation).
  - ii. The average per-station flow rate of the installed irrigation system serving the xeric area (positive correlation).
  - iii. The size of the xeric area (positive correlation).
  - iv. The property value of the residence (positive correlation).
  - v. Parcel size (inverse correlation).
  - vi. Whether or not the irrigation system was exclusively a drip irrigation system (i.e., not composed of microsprays, bubblers, other higher flow emitters, or combinations of emitters; inverse correlation).
  - vii. Whether or not the resident responsible for managing irrigation at the home is knowledgeable about enforcement of local provisions prohibiting outdoor water waste (inverse correlation).
10. Tracking of the costs residents incurred when converting their landscapes from turf to xeric landscape revealed that at the time of the study, the average conversion cost was \$1.55 per square foot across all of the conversion projects for which data was available. The average cost for those who did the work themselves was \$1.37 per square foot, and for those employing a contractor, it was \$1.93 per square foot. All of these costs are probably higher today due to inflation and a strong market for conversion projects.

11. In comparing those with 60% or more of their landscape as xeric landscaping and those whose landscape was 60% or more turf, it was found that those with the majority as xeriscape condition enjoyed a 2.2 hrs-per-month reduction in landscape maintenance and an additional \$206 per annum savings in direct maintenance expenditures as well. This represented a savings of about a third in total landscape labor and maintenance expenditures, respectively.
12. A model of two identical homes, one near the average for consumption (technically in the fifth decile for consumption), the other the same, but having completed an average-size conversion, revealed the following:
  - i. The annual water bill savings yielded by landscape conversion projects can be large. For the Las Vegas Valley Water District customer modeled, the annual financial savings was \$239.92 (figure includes all applicable surcharges). This equates to a savings of nearly \$0.15 per square foot.
  - ii. This is a large savings of 54% in total annual charges for water consumption. This level of savings is elevated over what might have been initially anticipated due to an aggressive tiered water rate structure. The effective average fifth-decile annual water charges with all surcharges added would be \$2.13/kgal for the typical traditional home and \$1.85/kgal for the one having completed the average-size conversion.
  - iii. The savings vary by season as expected by the findings associated with the submeter data. Whereas the bill payer of the home having done the conversion saved 25% (\$5.68) in charges for December vs. the typical homeowner, the same individual would realize an enormous savings of 70% (\$40.84) for July. One of the great benefits of xeriscape is that it drastically mediates “peaking” in summer, making summer bills much more affordable for households, especially since power bills also peak in summer.
13. A model was also created to explore payback time and the appropriateness of the financial incentive. This revealed that payback time varies in part on whether or not homeowners do the work themselves or enlist the assistance of a contractor and whether or not savings in maintenance labor is actually realized. Modeling proceeded such that different combinations of these scenarios were explored. The results suggest that in most situations the current SNWA incentive is sufficient to help facilitate conversions such that there is an acceptable time to return on investment (ROI) for the homeowner. In order of increasing time to ROI from the point of conversion, with a dollar-per-square foot incentive from SNWA, these are as follows:
  - Situations where only the material costs of the conversion are valued and where savings in both maintenance goods and labor can be realized (average payback time of one to two years).
  - Situations where both the material costs of the conversion and the labor cost of the conversion are valued and where savings in both maintenance goods and labor can be realized (average payback time of two to three years).

- Situations where only the material costs of the conversion are valued and where only savings in maintenance goods (not labor) can be realized (average payback time of three to four years).
- Situations where both the material costs of the conversion and the labor cost of the conversion are valued and where only savings in maintenance goods (not labor) can be realized (average payback time of five to six years).

14. An economic analysis of the cost-efficiency of SNWA's Water Smart Landscapes Program suggests that in theory the program is cost-efficient and could be bringing in the equivalent of \$1.58 for each \$1.00 spent on rebate incentives (a 37% positive return) by way of effectively freeing up local water resources for immediate use. When the opportunity cost is included in the calculation, it is determined that the theoretical maximum incentive SNWA should be currently willing to pay in 2004 dollars is \$1.55 per square foot (the actual maximum is less due to program administration costs). In practice, this means it is probably not cost-effective to raise the incentive further at this time as the level necessary to yield a 3-yr ROI for those not yet facilitated to convert (i.e., the final bulleted scenario in Conclusion 13) equates to \$2.23, an incentive level far in excess of the theoretical top-out point for an incentive provided by SNWA. Furthermore, in the majority of modeled scenarios, the dollar per-square-foot is sufficient incentive for homeowners to justify the landscape conversion project.