



Analysis of Water Demand Management Options in Tempe

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Water Shortage Planning in Tempe

Drought Preparedness Plans (DPP) are tools used by cities to prepare for water shortages. Through my research and analysis of these plans I determined that the most common action items in these plans are creating irrigation schedules for water users and prohibiting fall overseeding on turfgrass. To examine the efficiencies of these restrictions I examined two datasets, one from Tempe with water meter data from municipal parks which overseed and ones that do not. The second had meter data from Las Vegas prior to their mandatory irrigation schedules and after their implementation.

The Crossing Park, Las Vegas



Courtesy of yelp.com

Kiwanis Park, Tempe



Courtesy of fitinphoenix.wordpress.com

- Tempe's most recent DPP was created in 2004. The document sorts demand and supply management strategies into two stages.
- In stage 1, irrigation schedules and overseeding restrictions are voluntary, in stage 2 these measures become mandatory.
- Fall overseeding will typically take place in October or November and temporarily increases water demand in parks.
- Southern Nevada Water Authority (SNWA) shared a dataset with water meter data from 22 municipal parks over the timespan of 1998-2007.
- In 2003 SNWA enacted mandatory outdoor irrigation schedules restricting the number of days and time-of-day in which watering is allowed.
- These mandatory schedules are divided by season where in summer months irrigation may happen 7 days per week, fall and spring 3 days/week, and winter only 1 day/week.

Intentions of this Study

- To determine whether restrictions on irrigation and overseeding are effective in desert climates as demand reduction strategies and therefore valid action items in Drought Preparedness Plans.
- To better inform future revisions to Tempe's DPP and help efforts to project potential water savings in each stage.

Tools of Analysis



Excel was used to conduct analysis on both water meter datasets



Google Earth Pro was used for remote visual analysis of landscapes and to determine square footage of parks.



R was used to determine the statistical significance of water savings

How can municipal parks in arid climates maintain the quality of public green spaces while mitigating water use?

Analysis and Results

Fall Overseeding: figure 1 - To investigate the immediate impact of fall overseeding on water use I compared the proportion of monthly irrigation levels for October and November between parks which practice overseeding and parks which do not overseed.

Overseeded parks are labeled as 'Y' while non-overseeded are labeled 'N'. The light blue columns represent the average of each sample sizes for overseeded and non-overseeded parks.

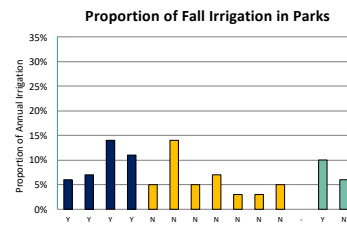


Figure 1

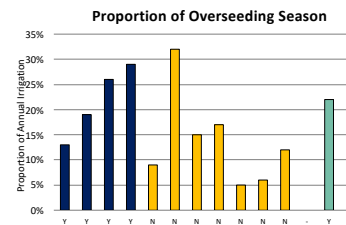


Figure 2

figure 2 - This graph demonstrates the impacts of overseeding throughout both the fall and winter seasons. During this timeframe the difference between average proportions doubled, suggesting the practice of overseeding has significant impacts throughout the fall and winter.

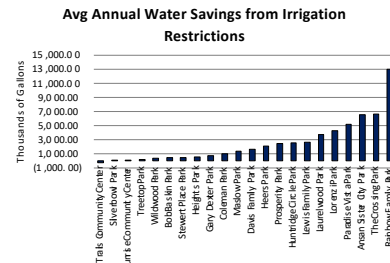


Figure 3

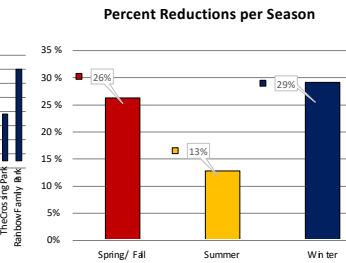


Figure 4

Irrigation Schedules: figure 3 - Across the 22 parks examined all but one saw water savings as a result of these mandatory restrictions. **On average each park saved 2,554,206 gal/yr** with SNWA saving an average of **56,698,100 gal/yr across these 22 parks**. This represents a total water use **reduction of 21%** since the implementation of restrictions in 2003.

figure 4 - This graph gives us a clear understanding of how SNWA's irrigation restrictions impact water savings in each season. Winter, spring, and fall have higher percent reductions than summer. This is likely because SNWA does not restrict the number of days in which residents and parks can water in summer, only the time-of-day. Therefore the summer savings expressed in this graph are likely a product of reduced evapotranspiration levels.

Discussion of Findings

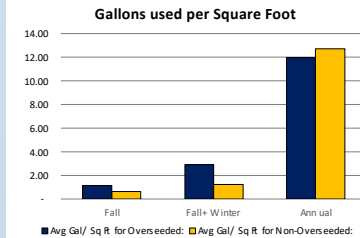


Figure 5



Courtesy of Greentech.co.uk

- Irrigation schedules and restrictions on overseeding would be successful at curtailing demand in a water shortage scenario.
- The practice of overseeding increases water demand in green spaces in both the fall and winter months creating a statistically greater water use per square foot than non-overseeded parks.
- Irrigation Schedules have a larger potential for demand reduction of water than overseeding restrictions.
- Time-of-day scheduling alone can create significant reductions in water demand by reducing evapotranspiration levels.



Typical Turfgrass Irrigation

Courtesy of phoenixirrigationservices.com

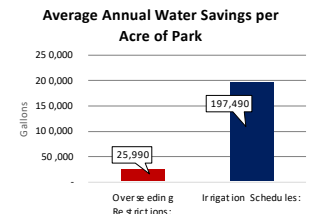


Figure 6

Goals for the Future

As the American Southwest continues to see more variable drought periods due to climate change, Tempe and other desert cities must prepare with comprehensive water shortage planning in their DPPs.

- Tempe should consider moving to a 4 stage DPP to allow for less dramatic scaling of restrictions and other demand management strategies.
- Future DPP revisions should allow for dynamic response strategies through flexible suites of potential action items.
- Continue and increase water conservation programs, awareness, rebates, workshops, audits, and education to promote sustainable irrigation practices

Acknowledgement

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