



Analysis of Goodyear's Water Curtailment Plan

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Background

- Goodyear has 10 wells; All have a history of breaking down, which in the past has created a great deal of trouble, especially during peak months.
- Goodyear developed a water curtailment plan in 2008, which categorized 4 stages of a water crisis. Each stage contains a list of actions to reduce consumption, especially outdoor usage.
- Stage 1 is voluntary; stages 2, 3 & 4 are mandatory.
- Since stage 4 actions were either based of decisions by the city manager or unquantifiable, they were not taken into consideration.
- This project aims to quantify actions taken to reduce water use. Most actions were unquantifiable due to limited data and time. I focused on the residential sector, since it had higher consumption in 2017 than irrigation and commercial sectors combined (see figure 1).
- From that point on I began to find the percentage of water savings for those actions if implemented for the entire year of 2017 and for the month of June because it had the highest amount of water consumed on the residential scale as compared to other months in the year.

TOTAL WATER USAGE IN 2017

Residential Irrigation Commercial

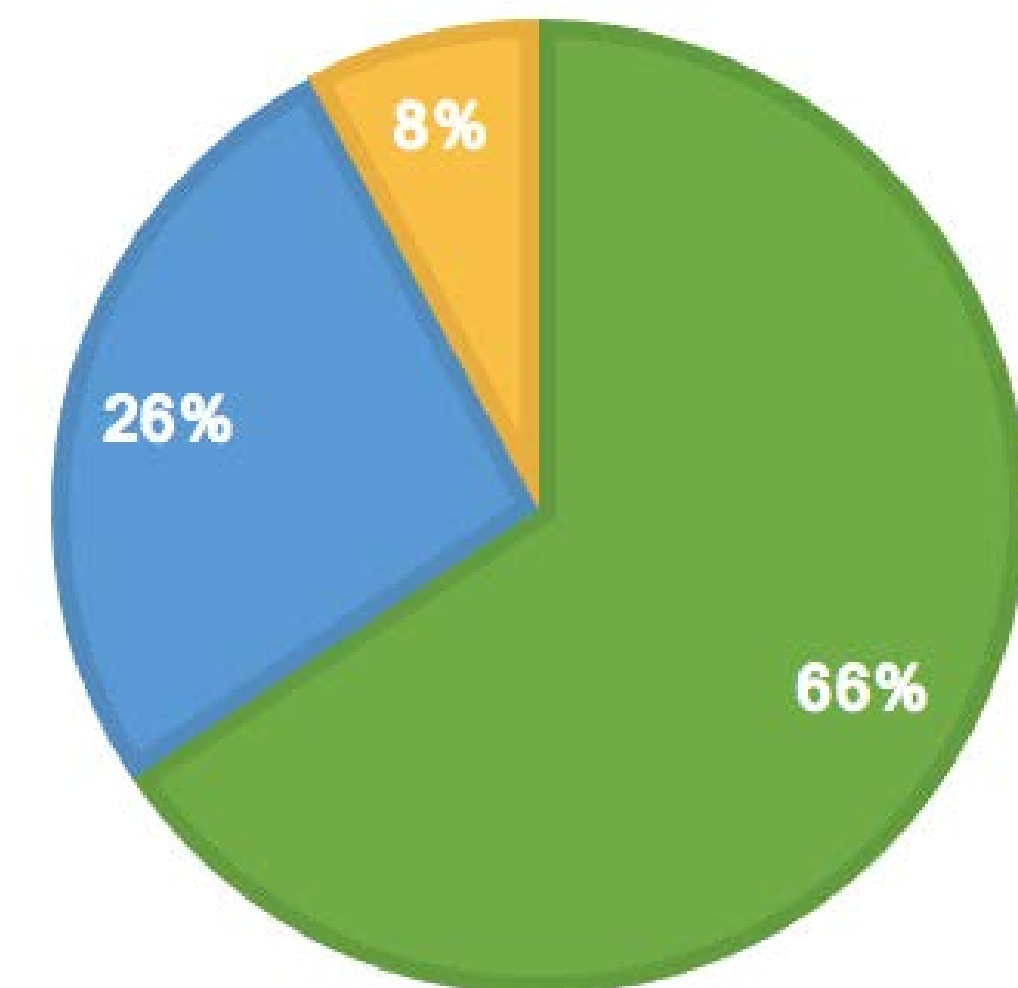


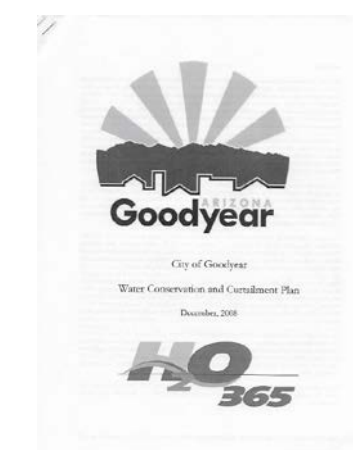
Fig. 1 total water consumption for each sector.

Objectives

- Evaluate the feasibility and expected success of demand reduction strategies.
- Make recommendations that will reduce water consumption to meet the plan's goals.

Methods

- Data set of 2017 residential water consumption was provided by the City of Goodyear Water department.
- First I calculated the amount of residential consumption for the entire year of 2017 and for the month of June.
- For each action I calculated the estimated demand and subtracted that from the total consumption and found the percentage of savings if said action was implemented.



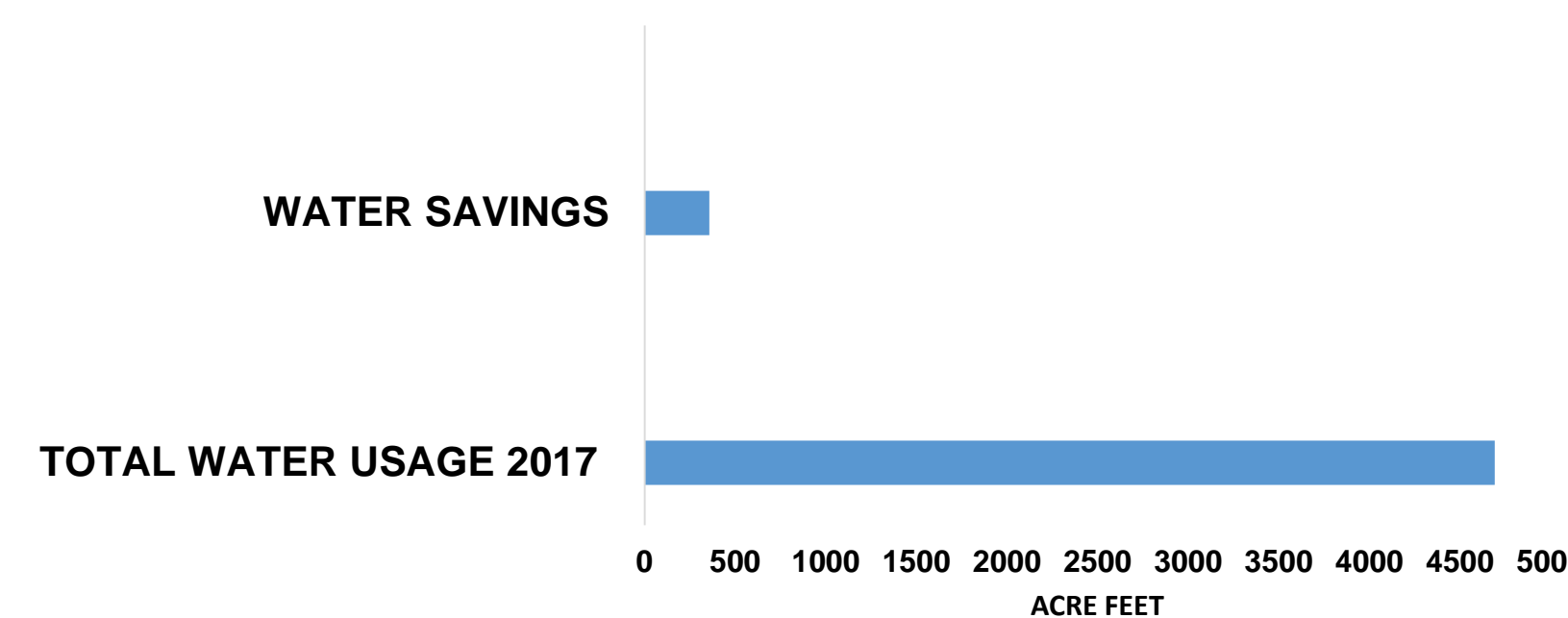
- Quantitative savings were calculated in an Excel spreadsheet.

Will Goodyear's water curtailment plan reduce the city's water consumption by 5% from stage 1, 10% by stage 2, and 15% by stage 3? If these steps do not meet that requirement, what actions will reduce consumption to meet Goodyear's goals?

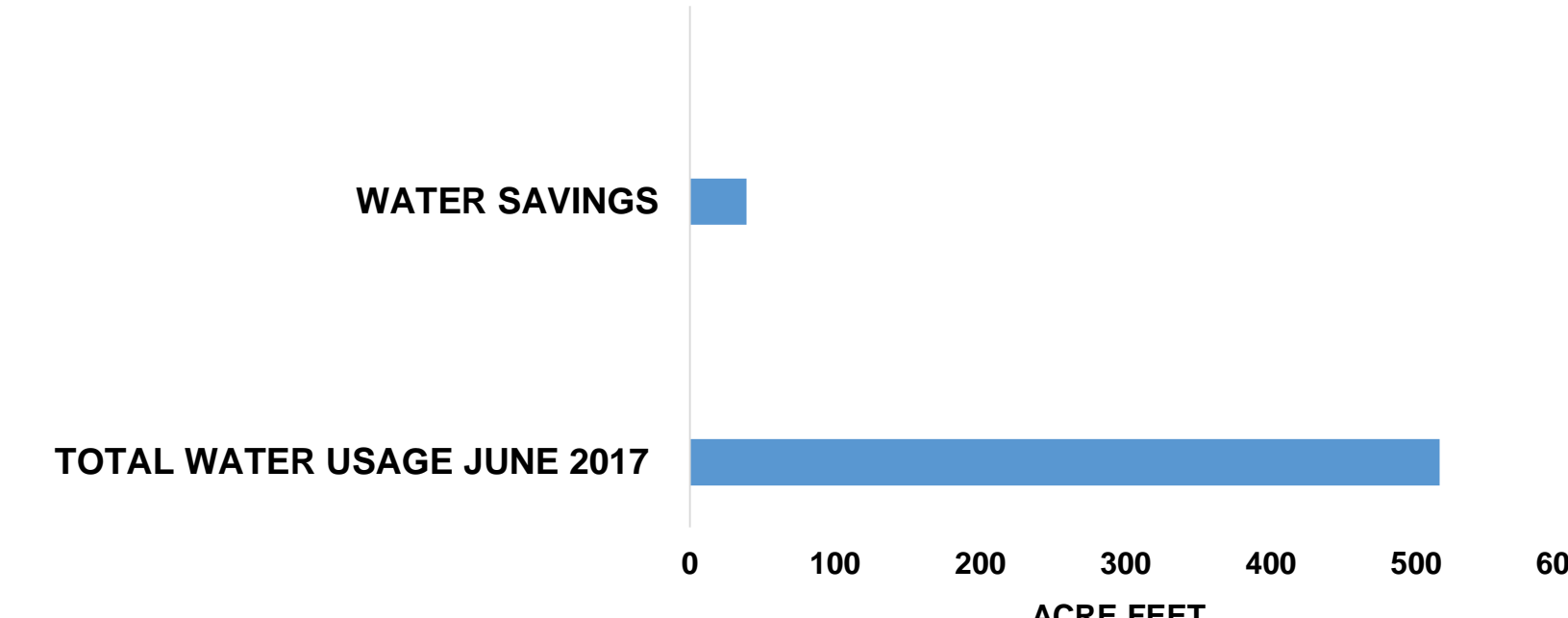
Findings

- Stage 1: Water Watch (Voluntary)**
 - If outdoor consumption was limited to odds days through the entire year of 2017 or only the month of June there will be an 8% savings (see fig. 2). Assuming 25% of residents will take part.

OUTDOOR WATER SAVINGS IF RESTRICTED TO ODD DAYS: 2017

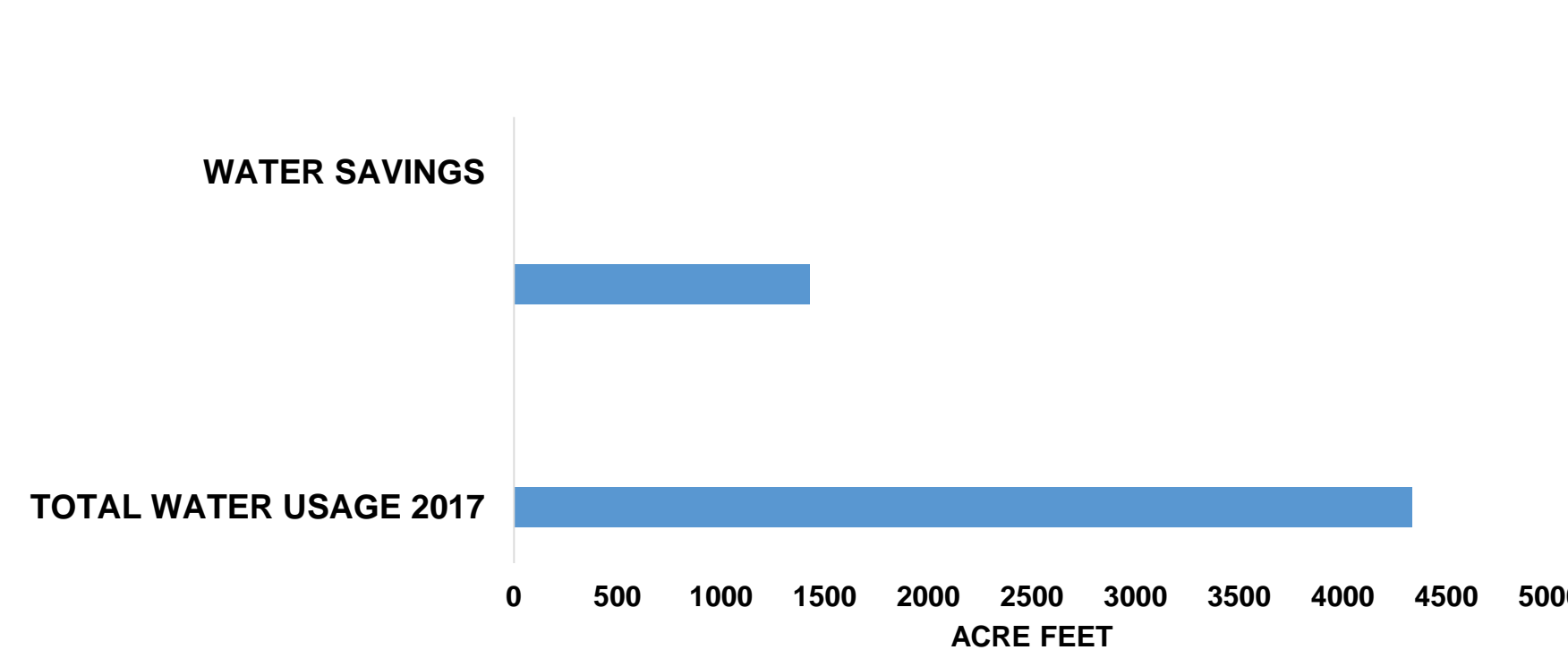


OUTDOOR WATER SAVINGS IF RESTRICTED TO ODD DAYS: JUNE 2017

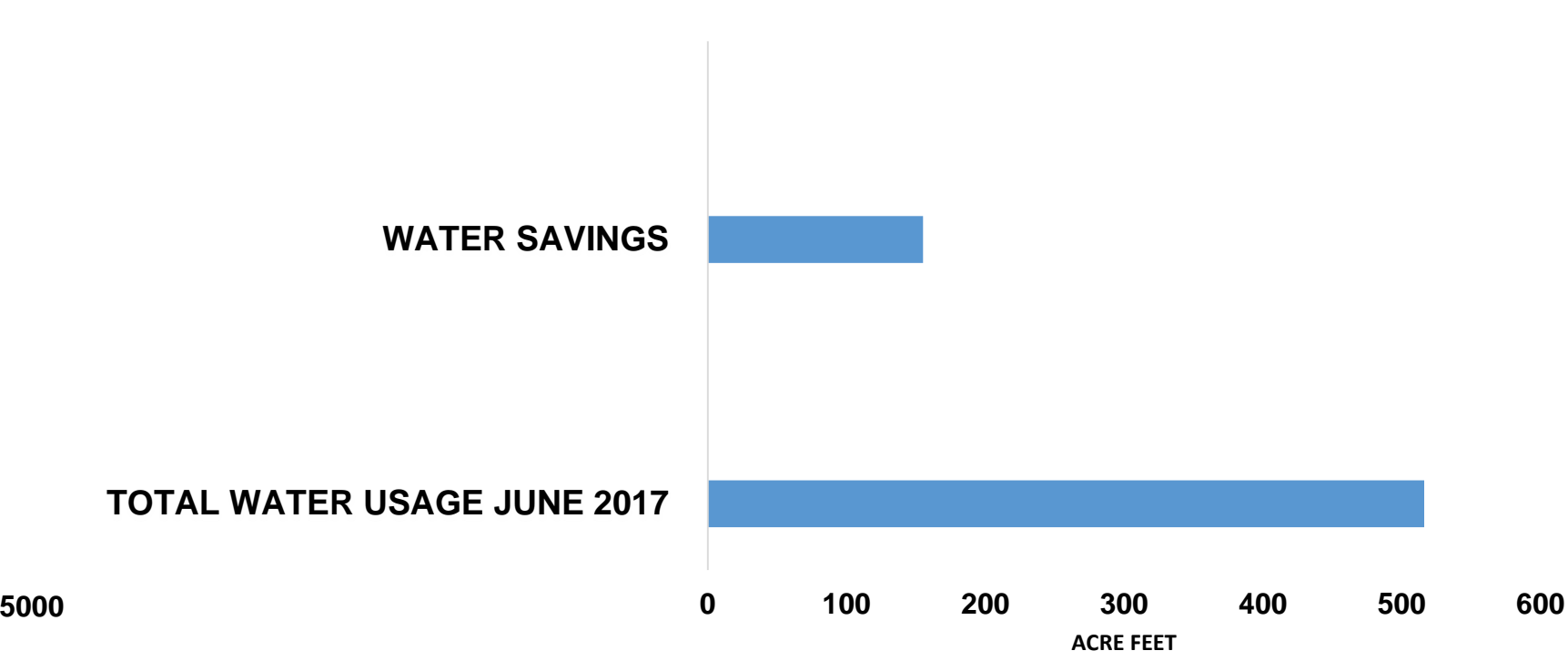


- Stage 2: Water Alert (Mandatory)**
 - In stage 2 all actions are now mandatory. Calculated savings if outdoor usage was restricted to odds days equates to 30% (see fig. 2), this meets stage 2, 3 and 4 goals.

OUTDOOR WATER SAVINGS IF RESTRICTED TO ODDS DAYS: 2017

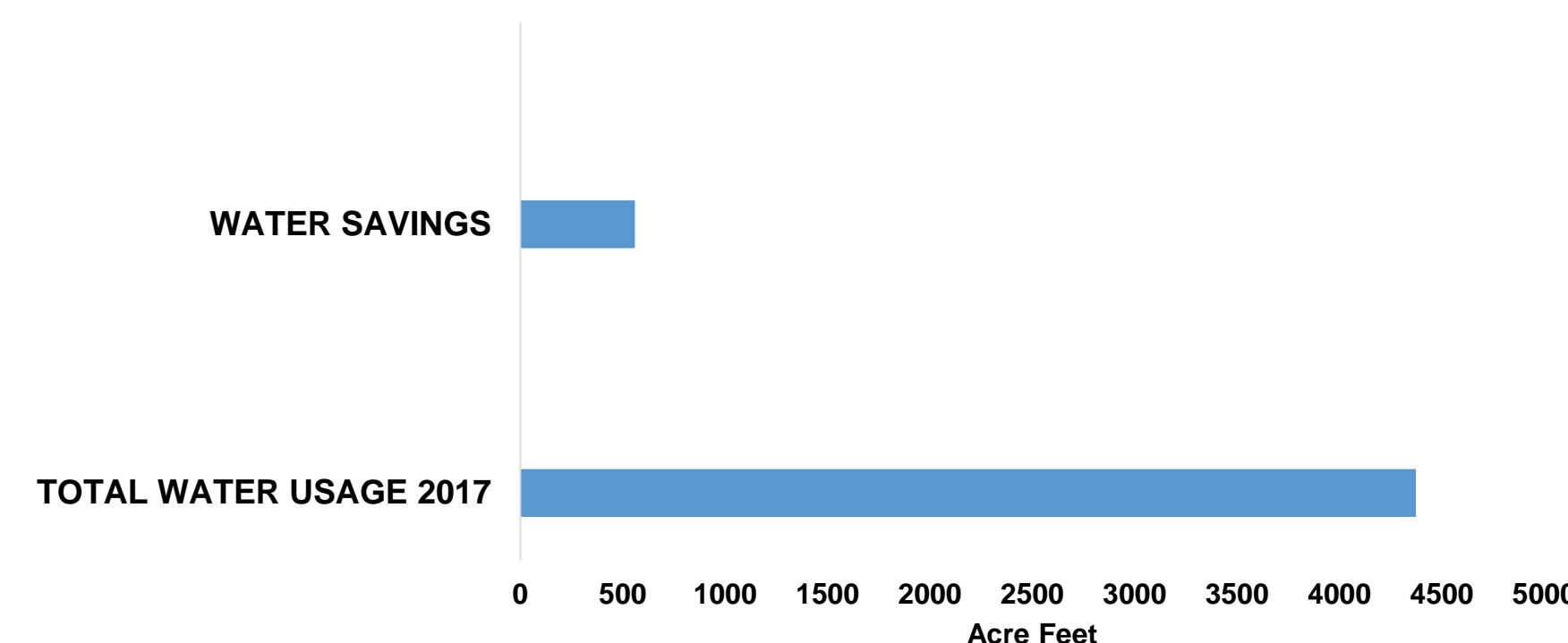


OUTDOOR WATER SAVINGS IF RESTRICTED TO ODDS DAYS: JUNE 2017

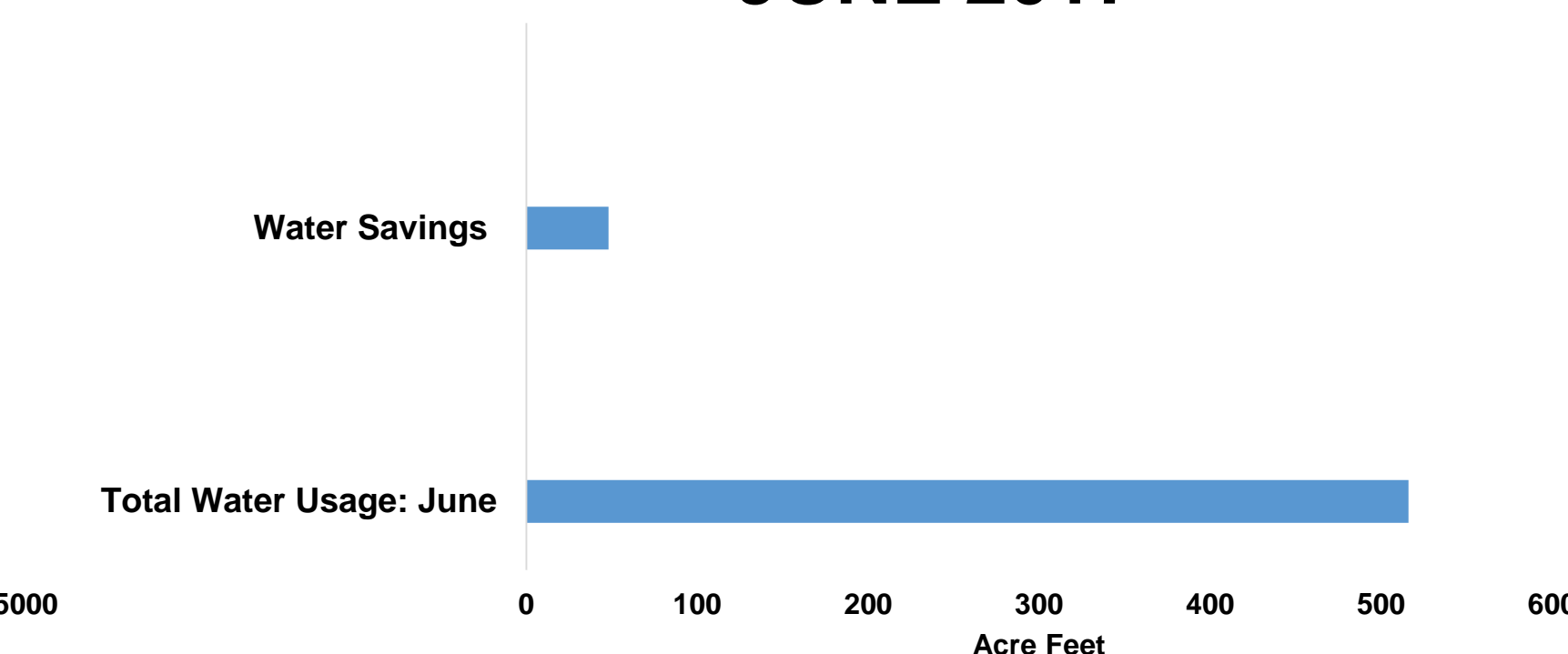


- Stage 3: Water Warning (Mandatory)**
 - No filling or refill of pools will add an extra 10% savings (see fig. 2) because the actions in stage 2 carry over into stage 3.

NO FILL OR REFILL OF POOLS: 2017



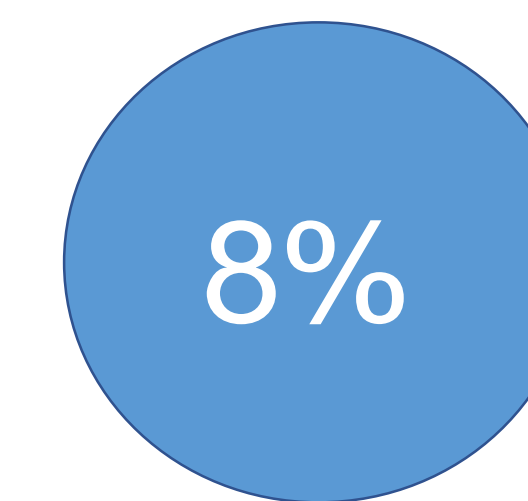
NO FILL OR REFILL OF POOLS: JUNE 2017



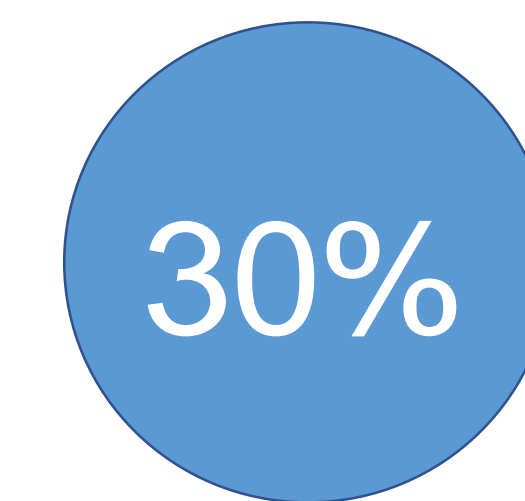
Conclusion

- The estimated savings meet the plan's goals of reducing residential consumptions by 5% at stage 1, 10% by stage 2 and 15% by stage 3.
- At stage 3, pool (re)fill restrictions offer limited water savings compared to restricted outdoor usage, which carries over from stage 2.
- Restricted outdoor usage has an extremely high savings, meeting all of the plan's goals. If this is the only enforced action, then other actions could be voluntary.
- All outdoor savings could happen if enforced by, for example:
 - Reminding residents of odd-day watering.
 - Monitoring irrigation through visible signs of watering (i.e. dark soil, water in street) on non-watering days.
- The curtailment strategies from each stage will reduce consumption, allowing the city to manage its water supplies.
- These savings apply to summer months and year-round because the savings from yearly to monthly are either equal or within +/- 2%.

Stage 1



Stage 2



Stage 3

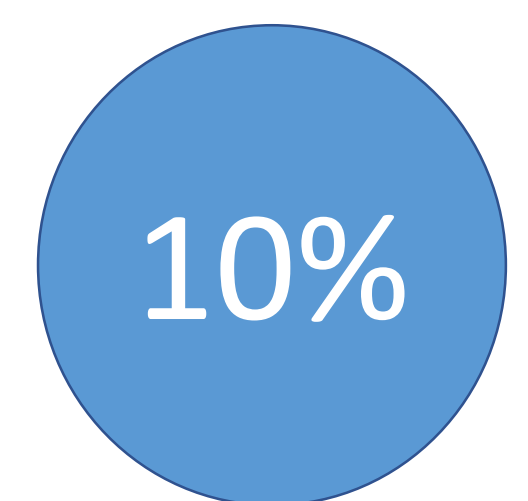


Fig. 2 is the percentage of water savings from stages 1-3.

Future Recommendations

- Re-write the plan to make outdoor water usage the only enforced mandatory action and list the rest as optional.
- Outline enforcement of mandatory actions, which is currently unmentioned.
 - Enforcement could include HOA involvement, community watch programs and social media. Police patrol would be a last resort since it could leave a negative, untrustworthy attitude between residents and city officials.
- Make the plan easily accessible to the public so residents fully understand their part, like how the actions will be enforced and the penalties for any violations.
 - Viable options would be to leave paper copies on driveways or front doors, email, public meetings, local news/newspaper or door to door.

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