Background:

- The Colorado River and its tributaries provide water to nearly 40 million people; the Salt-Verde Rivers add about 1 million acre-feet annually to our water supply.
- Sixteenth year of drought in the Basin.
- The Sustainable Futures Scenarios project has co-developed a set of potential future scenarios for 2060 with local community leaders.
- The Adaptive drought scenario (2015-2060) represents one of the plausible, although unpopular, pathways to cope with diminishing water supplies (Fig.1).
- This drought scenario is characterized by:
  - Rainwater/gray water/storm water harvesting
  - Urban infill/increased residential density/integrated development (see artists future rendition)
  - Reductions in large scale agriculture
  - Shifting energy sources to more renewable forms
  - Education regarding water conservation.

We used WaterSim 6 to explore three of the water conservation strategies: we focused on rainwater, gray water, and storm water capture/harvesting.

Water Supplies are diminishing

Methods:

- Adaption to Drought Scenario
- 2060 Land Form

Figure 2a & 2b. Adaptive drought scenario

Methods:

Integrating the Drought Scenario into WaterSim

- Water harvesting techniques added to the model
- Rainfall data at the water utility scale now incorporated into the modeling
- Incorporated storm water capture/use
- Enhanced land cover/land form drivers

Figure 3. “City-water” module of WaterSim 6

New Functionality

- Enhanced land cover/land form drivers
- Incorporation of storm water capture
- Water harvesting techniques added to the model
- Rainfall data at the water utility scale now incorporated into the modeling

Preliminary Results:

- Figure 4. Rain water harvesting and (surface and groundwater) savings
- Figure 5. Reduction in personal water use (gallons per capita per day) with gray water capture/use
- Figure 6. Storm water capture for three different unit sizes and the number of units installed per square mile, and rainfall

Early Conclusions:

- WaterSim 6 allows us to explore the impact of policies and strategies designed to meet water sustainability goals in the face of climate change and drought.
- Water conservation (including rainwater harvesting and storm water capture) can play an important role; the direct impact will depend on adoption and design.
- The Adaptation for Drought scenarios does appear that it could add resilience to drought (current simulations sans drought). This suggests the importance of the three urban water strategies examined (i.e., rainwater, gray water, & storm water capture). Ongoing integration with WaterSim will allow us to better assess water sustainability and drought resilience of the scenario set.

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References

- The time series of annual rainfall for each water provider were obtained by averaging the rainfall at the gages included within the water provider.
- A random component was added to account for the spatial variability of the annual rainfall at each gage.
- We used a Gamma distribution to represent the statistical distribution of the spatial mean annual rainfall in the valley.
- The effect of gage elevation was taken into account.
- We used records with >25 years of the rain gages managed by the Flood Control District of Maricopa County.
- We used the records with >25 years of the gages managed by the Water Resources Research Center (Western States Water Council and California State Water Resources Control Board, 2005) and mean monthly rainfall in the period 2003-2015 was calculated.