This presentation premiered at WaterSmart Innovations

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Water Scarcity and Energy: The Nexus Strengthens

WaterSmart Innovations Conference

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Global Water

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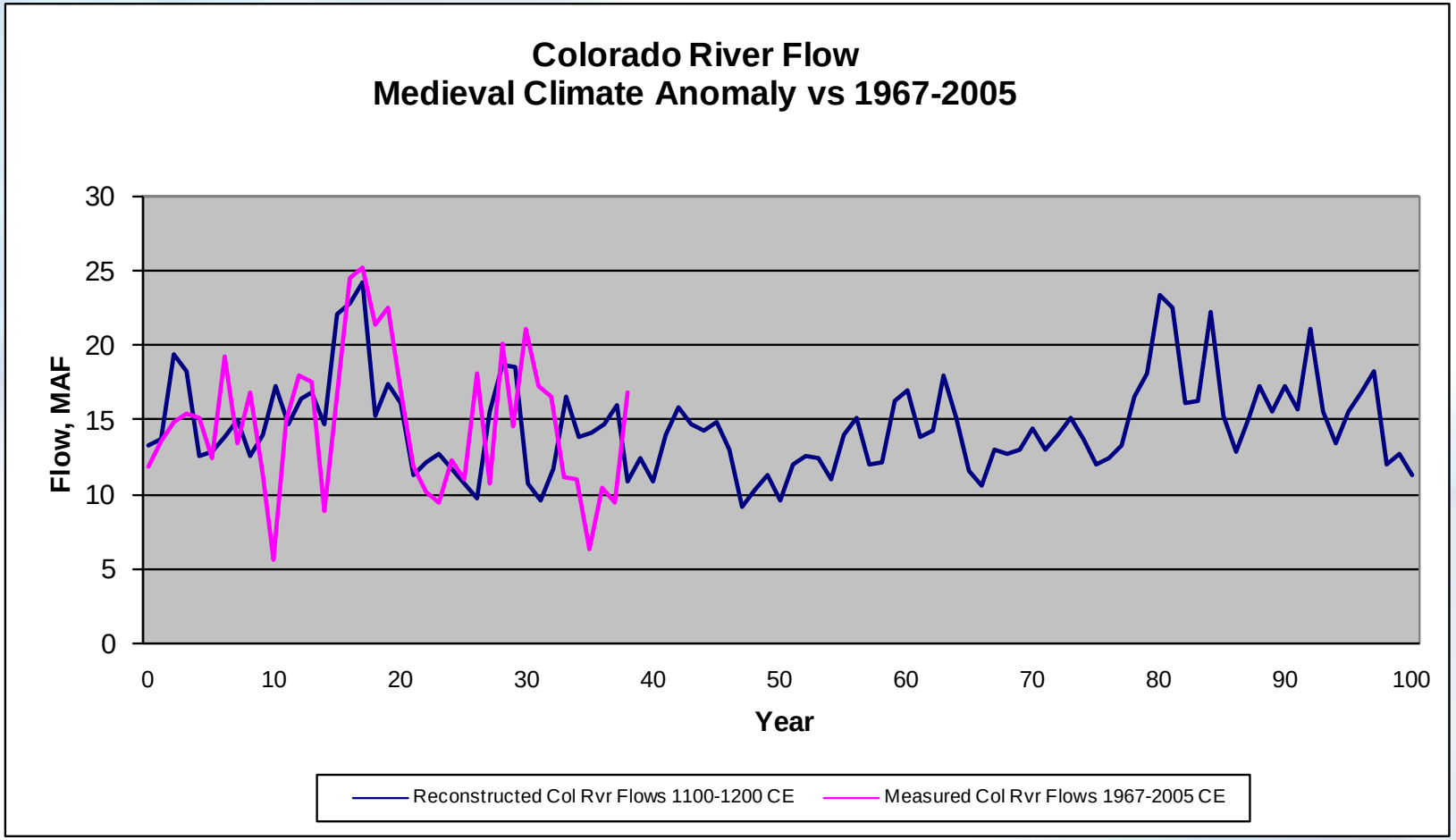
Overview

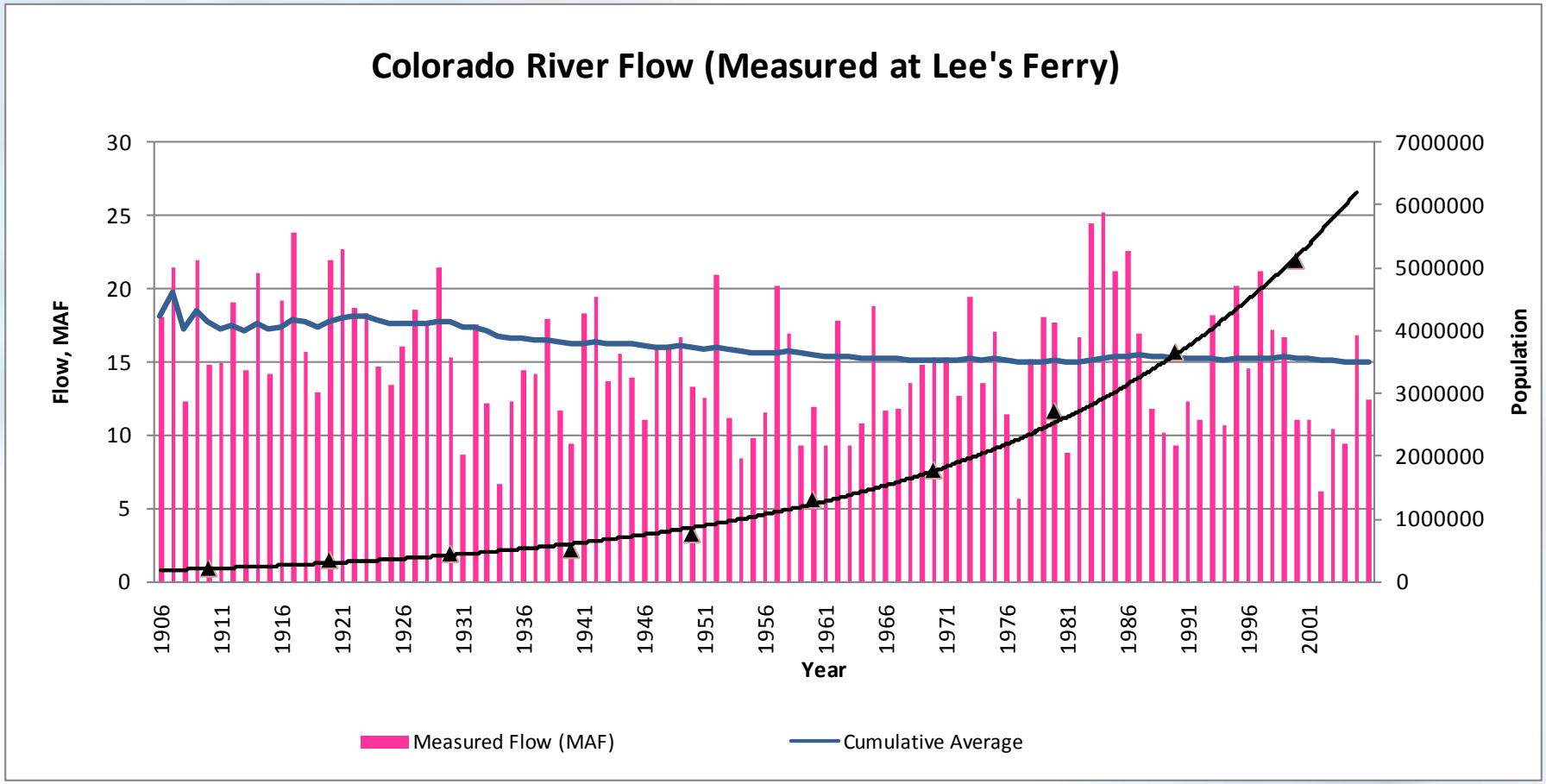
- Water Availability
  - Impacts of climate change
  - Impacts of population growth
- Water Scarcity and Power Scarcity
  - Hydro availability
  - New water for power plants
- Total Water Management
  - Types of reuse
  - Water efficiency of reuse
  - Power efficiency of reuse

Water Scarcity – A Millennial Perspective



Source: Adapted from Meko, et al (2007)

Water Scarcity - A Century of Flow

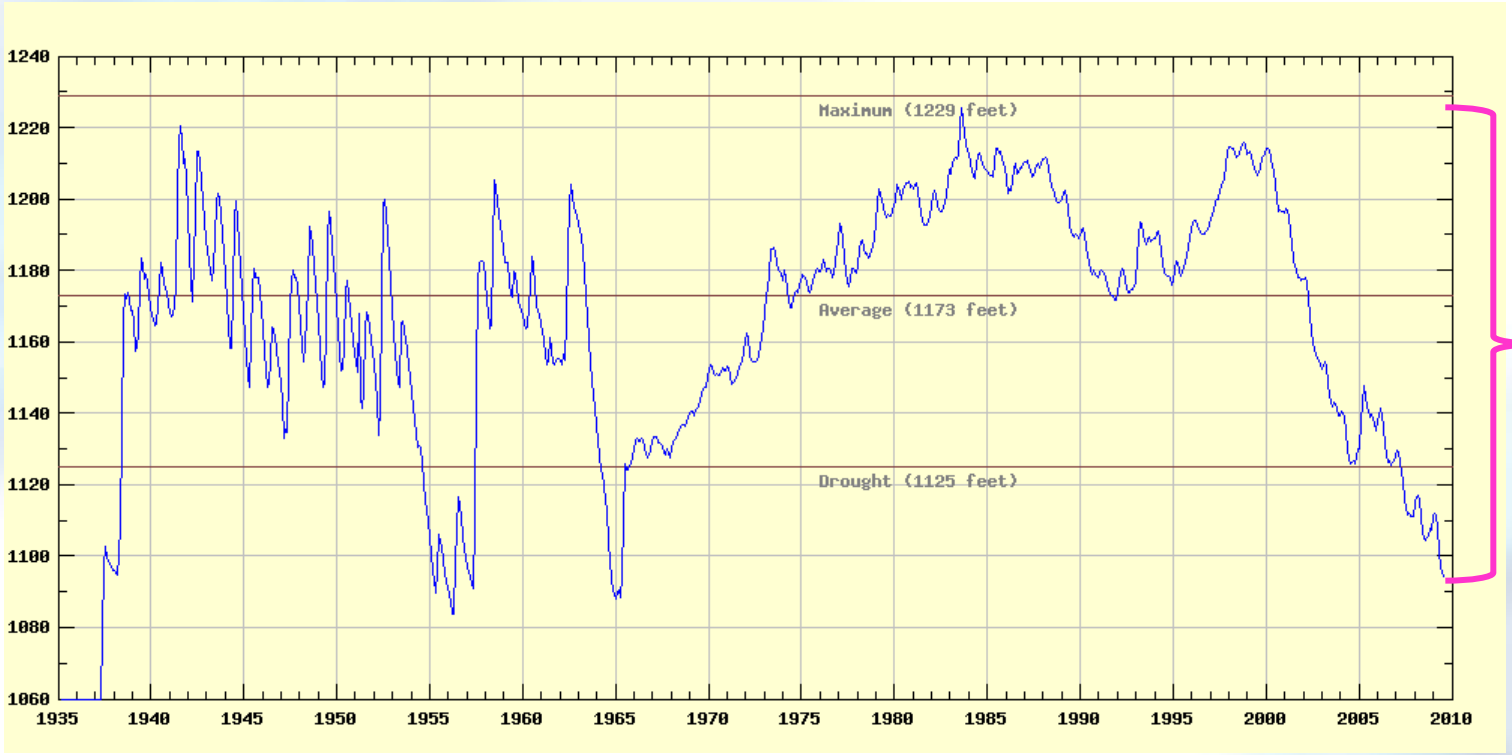


Source: USBR (2009), US Census Bureau (2008)

Population projections for Arizona (U.S. Census Bureau)

Arizona Population Projections	
2007 Estimated Population	6.3 million
Projected Population Growth 2030	10.7 million
Total Percentage Growth 2007-2030	67.2%

Water Scarcity = Power Scarcity



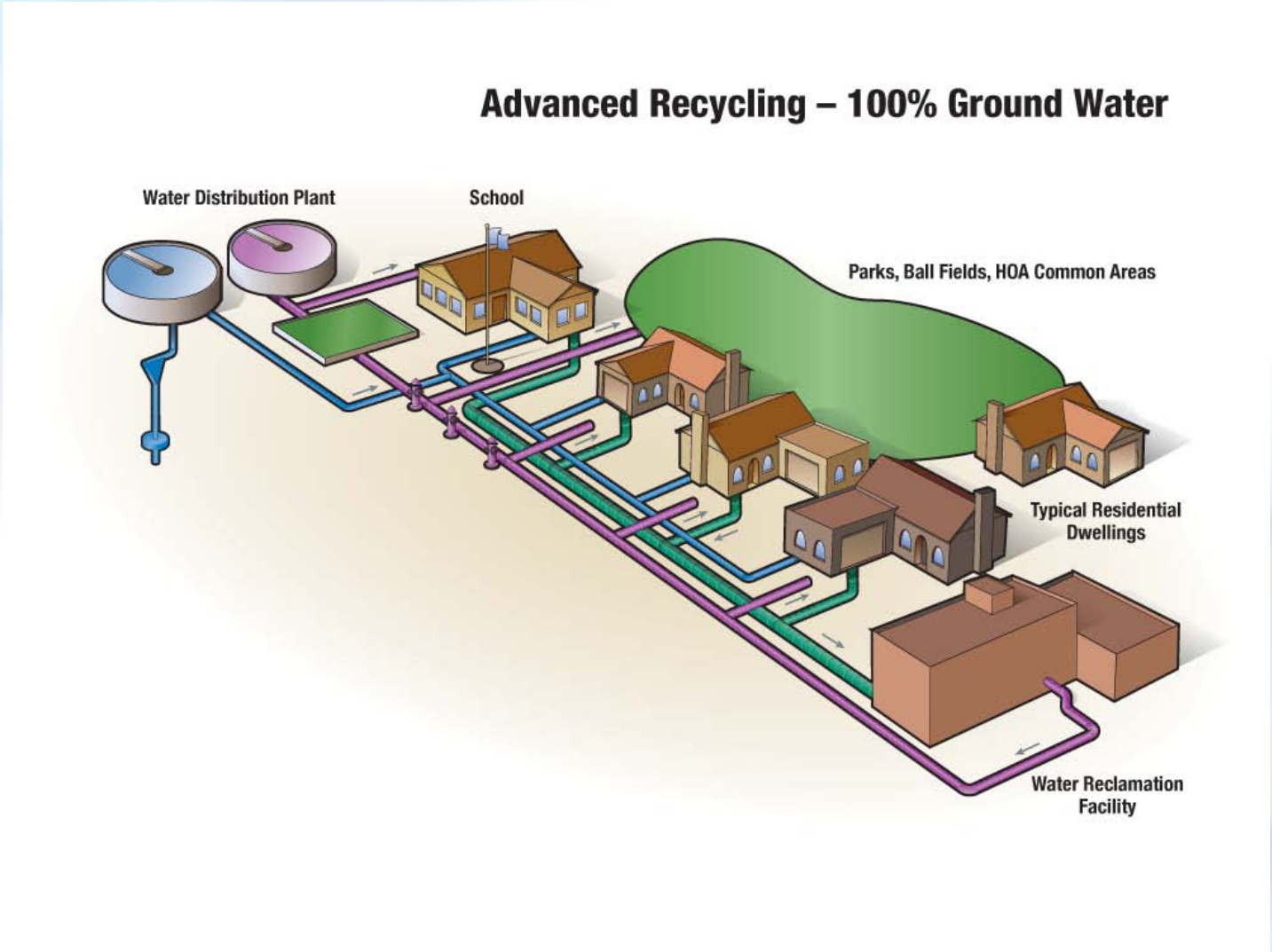
Lower water availability

Lower hydro power availability

Requirement for a Power/Water Partnership

Source: USBR Data via http://www.arachnoid.com/NaturalResources/

Total Water Management

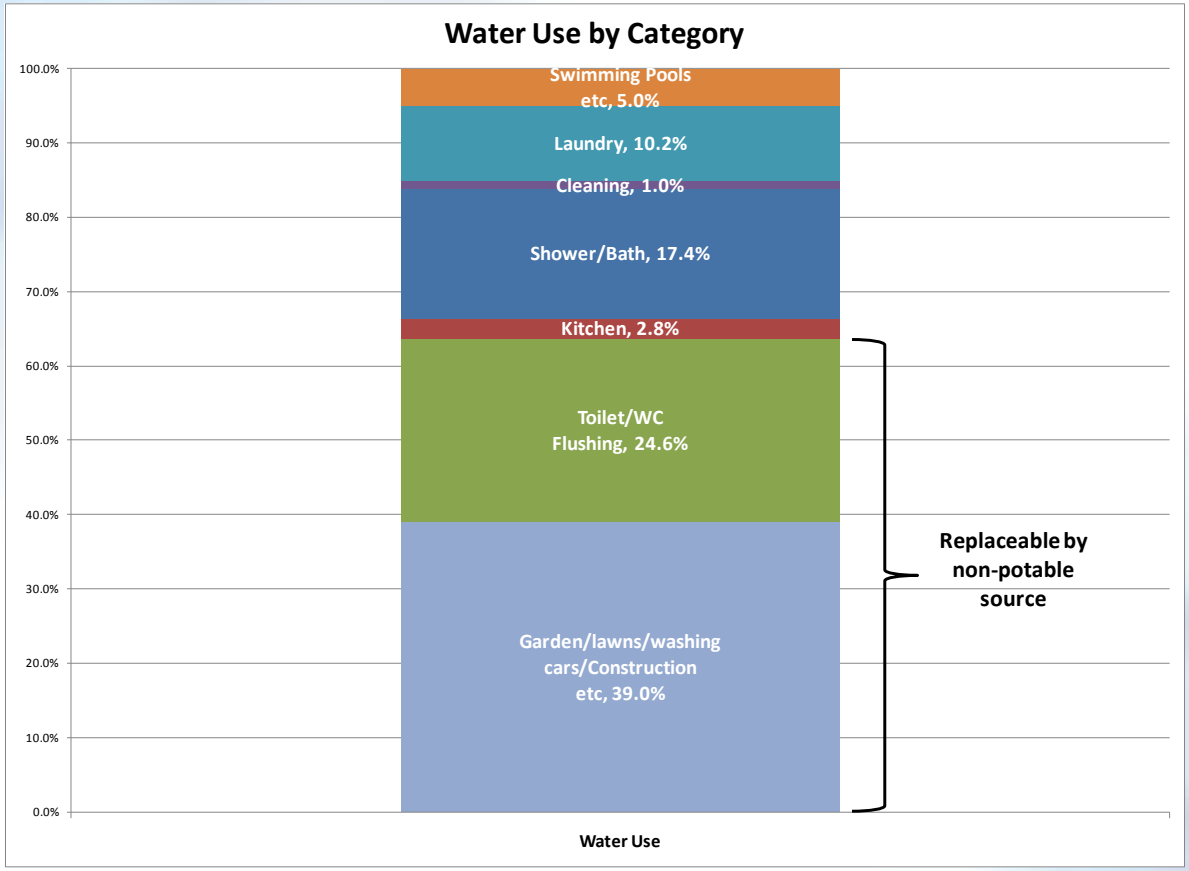


Total Water Management = Power Management

- The right water for the right use
- Keeps the water at the surface and where it is needed
- Locates WRFs where the recycled water demand is
- Using recycled water for irrigation mitigates the Heat Island Effect

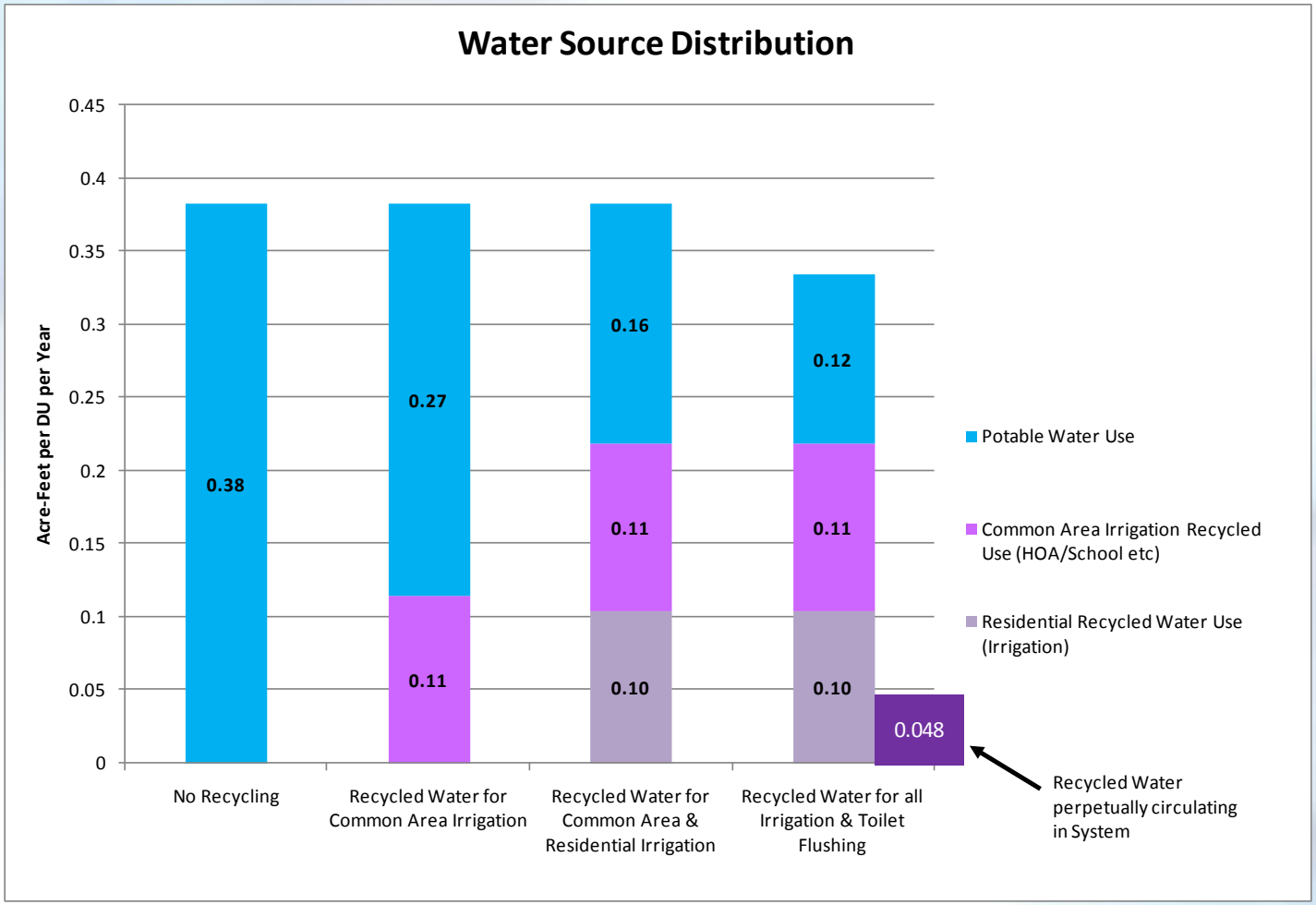
- Reduces treatment costs
- Reduces distribution costs
- Reduces the amount of potable water required
- Reduces pumping costs associated with recharge and recovery
- Reduces impact of TDS/PCPP etc on aquifers and ultimate treatment costs.
- Reduces transportation costs
- Community power consumption increases 3-4% per degree C

Potential for Residential Reuse



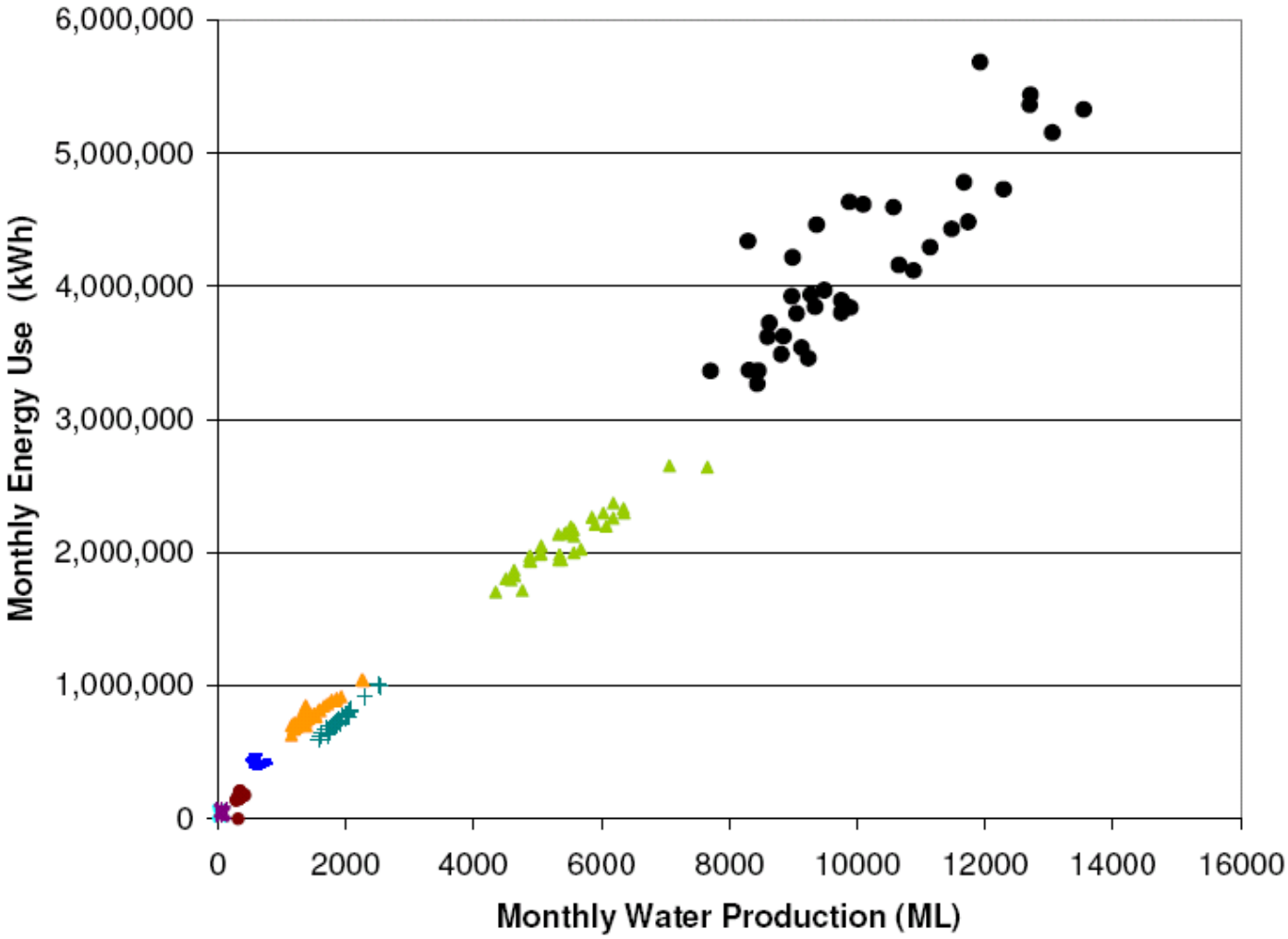
Source: USEPA

Water Savings by Reuse



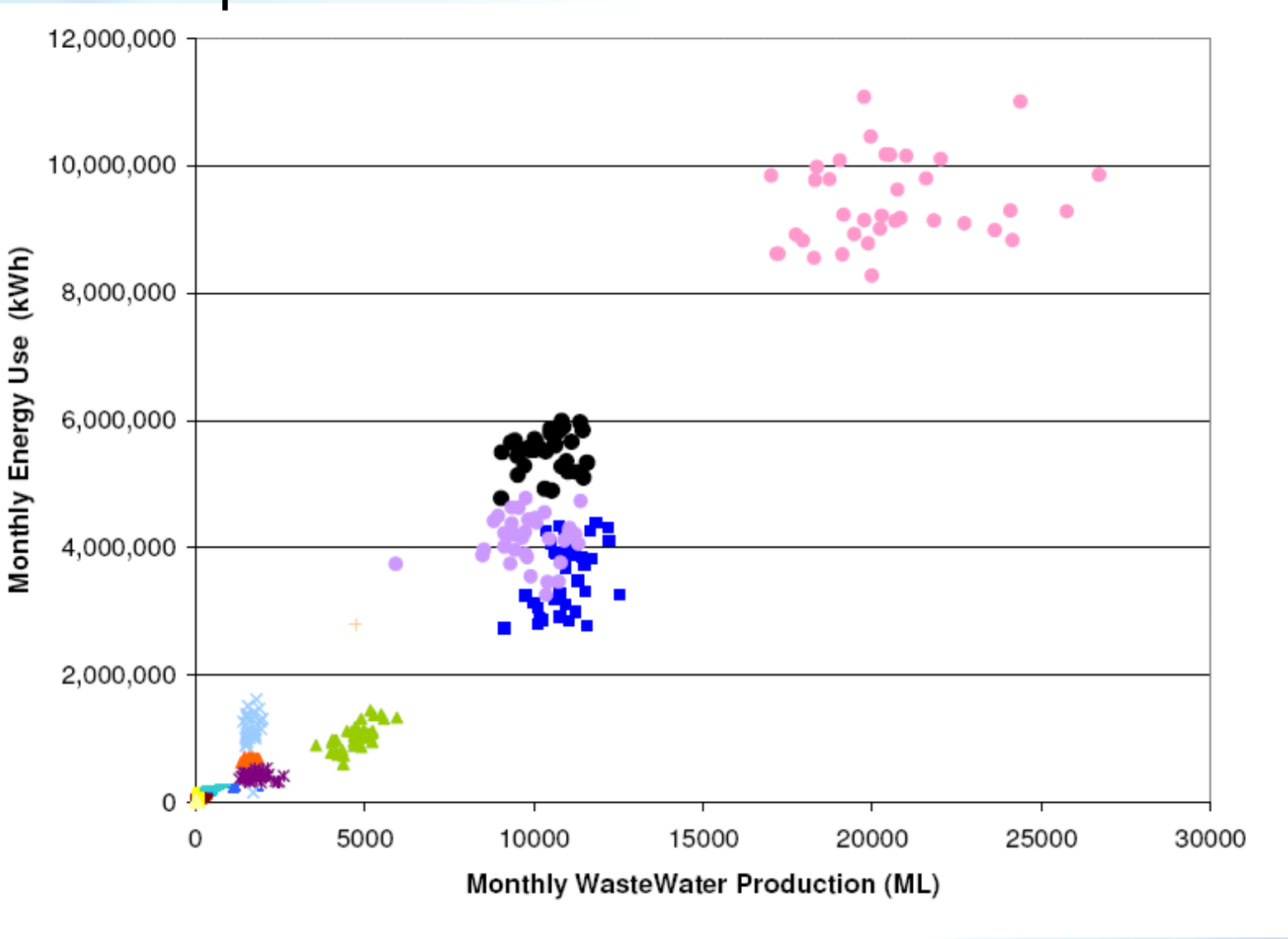
Source: Global Water

Power Requirements of Water Production



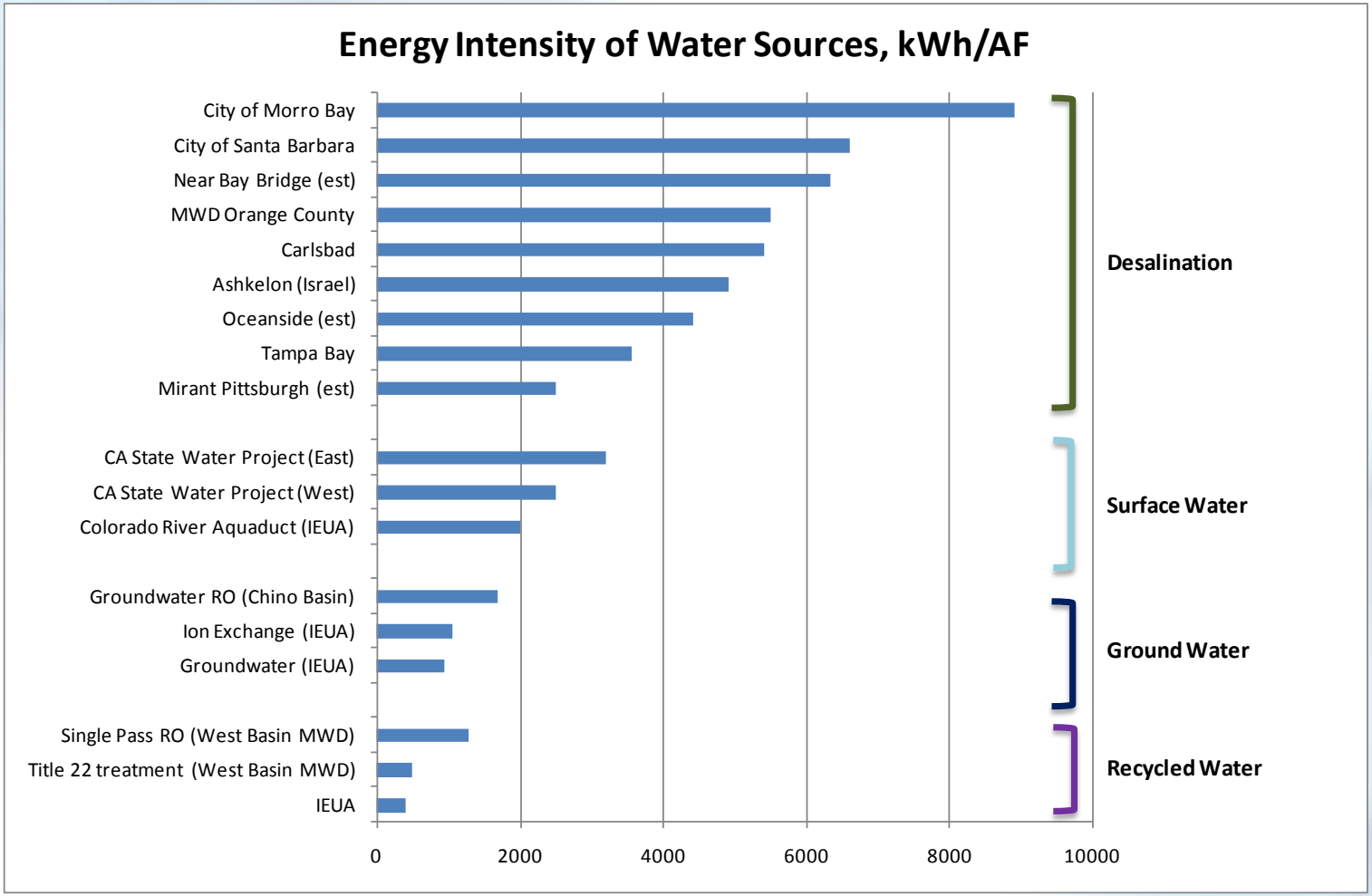
Source: Greenhouse Gas and Energy Benefits of Water Conservation (Maas, 2009)

Power Requirements of Wastewater Treatment

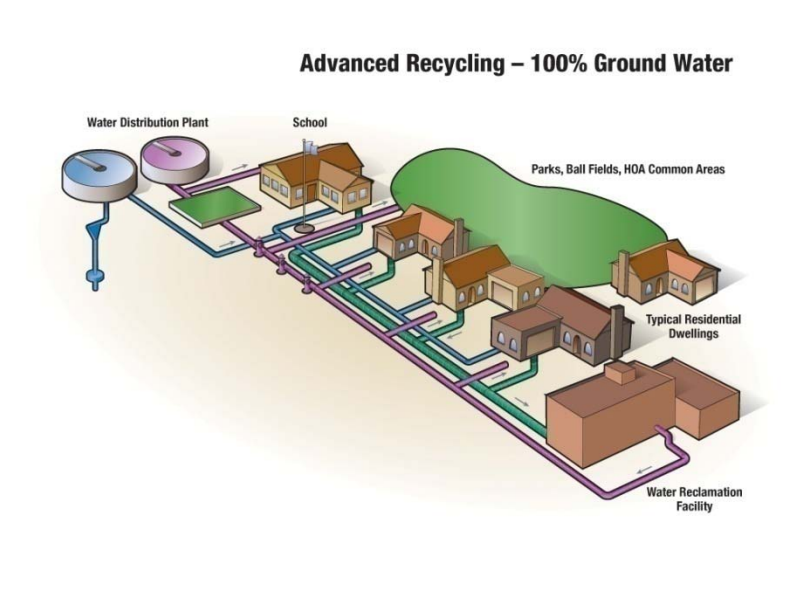


Source: Greenhouse Gas and Energy Benefits of Water Conservation (Maas, 2009)

Power Intensity of Water



Source: R.C. Wilkinson, University of California, Santa Barbara, 2007)



8.0 kWh/DU/day

5.7 kWh/DU/day

3.9 kWh/DU/day

3.4 kWh/DU/day

2.7 kWh/DU/day

2.2 kWh/DU/day

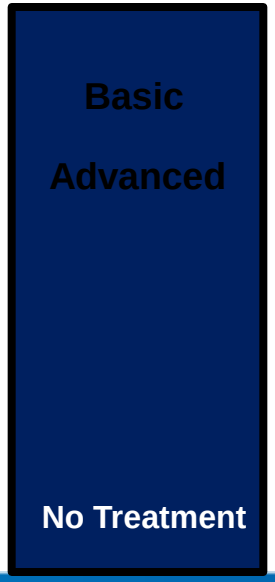
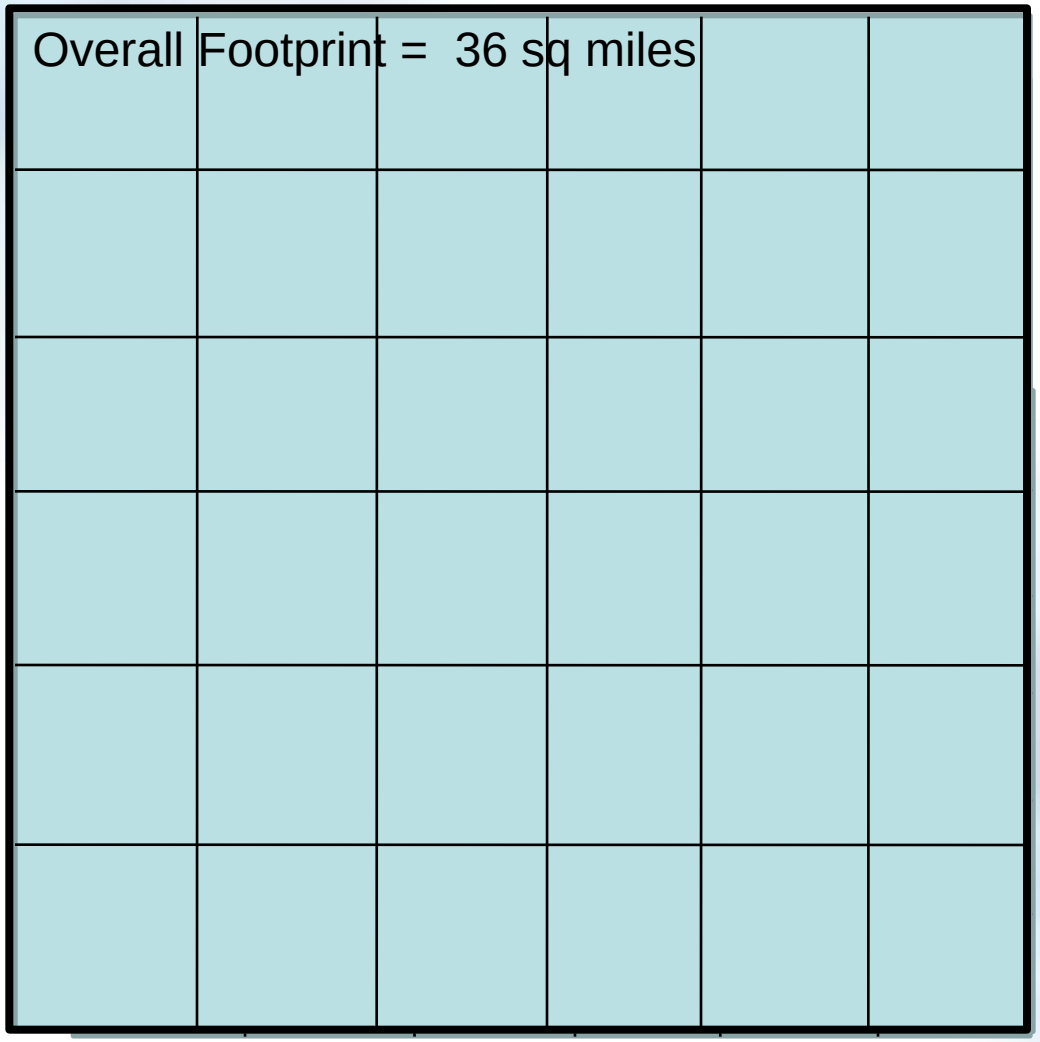


TABLE 5. Effect of water table depth on specific power consumption (kWh/DU/d).

	Groundwater + No Treatment + No Recycling	**Groundwater + No Treatment + Basic Recycling**	**Groundwater + No Treatment + Advanced Recycling**
Water Table @ 300 ft BLS	3.4	2.7	2.2
Water Table @ 1100 ft BLS	7.0	5.0	3.5
Increase in specific power consumption	106%	85%	59%

Source: Global Water 2008

Power & Water Footprints



California Energy Commission (CEC):

> The CEC found that implementation of all identified urban water conservation measures could “achieve 95 percent of the savings expected from the 2006-2008 energy efficiency programs, at 58 percent of the cost” (Klein, G. et al., 2005).

International Development Research Center (IDRC)

> [Water conservation] is a strategic and effective adaptive strategy to the current challenge of water scarcity and will become more so as climatic variability and climate change impacts intensify.
>
> [Water Conservation] increases social resilience and contributes to preparedness policies, as opposed to the current responsiveness-policies to climate change.

Summary

1. Water is very power intensive
   - 4% of power nationally is consumed in the production and transport of water
   - 20% in California
   - The City of Toronto, the Region of Peel and the City of Guelph have each identified water and wastewater facilities as significant energy consumers, reportedly accounting for between 25 to 60% of their respective municipal electricity bills (Harrison, 2007; Farbridge, 2008; OCMBP, 2006).

2. The savings represent 10 to 12% of the overall residential power demand from a 70,000 unit community, while saving 40% of the water resources.

3. Total Water Management maximizes water resource conservation while substantially reducing power demand.