2014 Excellence in Environmental Engineering & Science Awards

Grand Prize - Planning

Washington, DC
April 24, 2014

City of San Diego
PUBLIC UTILITIES
Water & Wastewater

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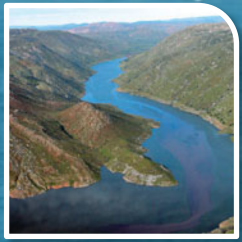
City of San Diego Long-Range Water Resources Plan



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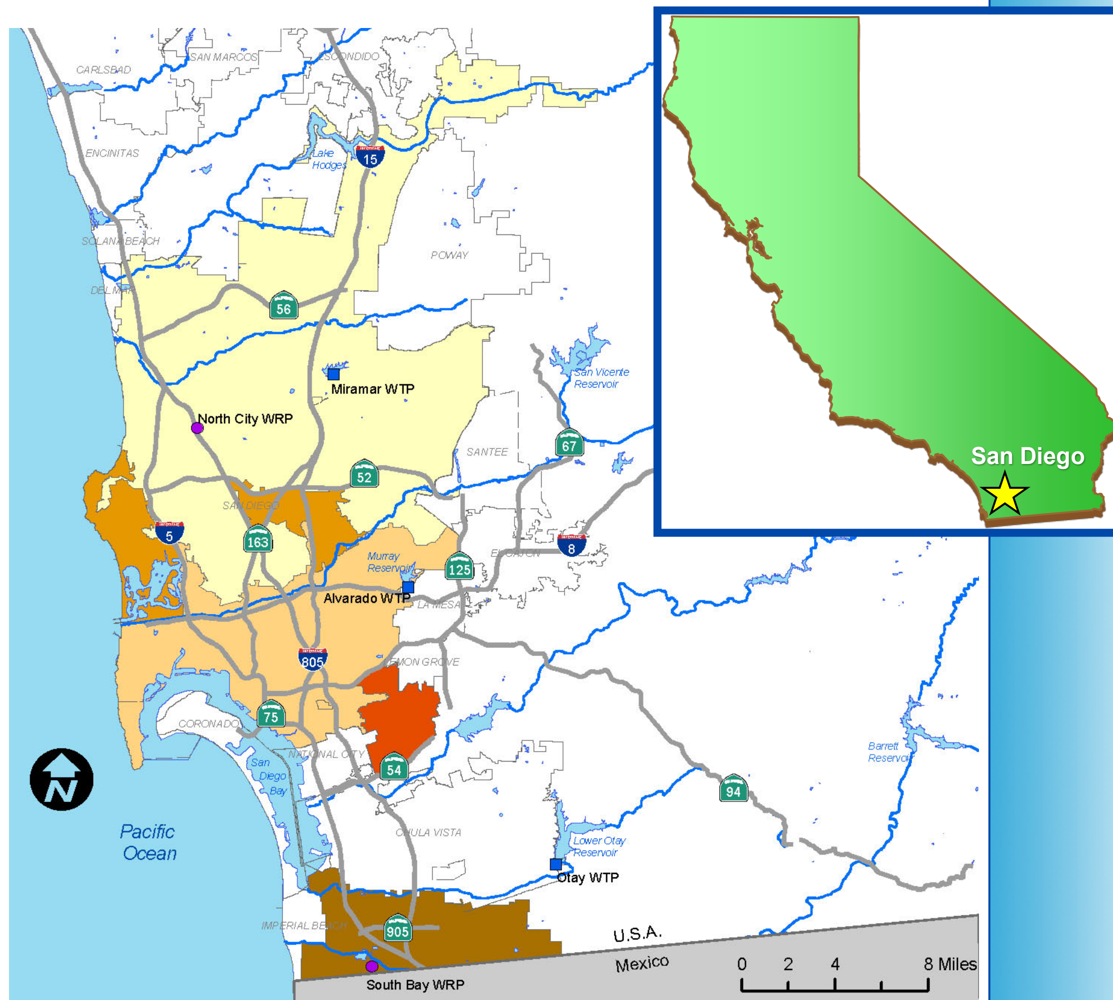
City of San Diego Background

City of San Diego PUBLIC UTILITIES Water & Wastewater

- San Diego Public Utilities Department provides water, wastewater and recycled water to City
- Population ~ 1.3 million
- Water demand ~ 180 mgd
- Average rainfall:
  - 15-30 inches in mountains
  - 10 inches in coastal plain



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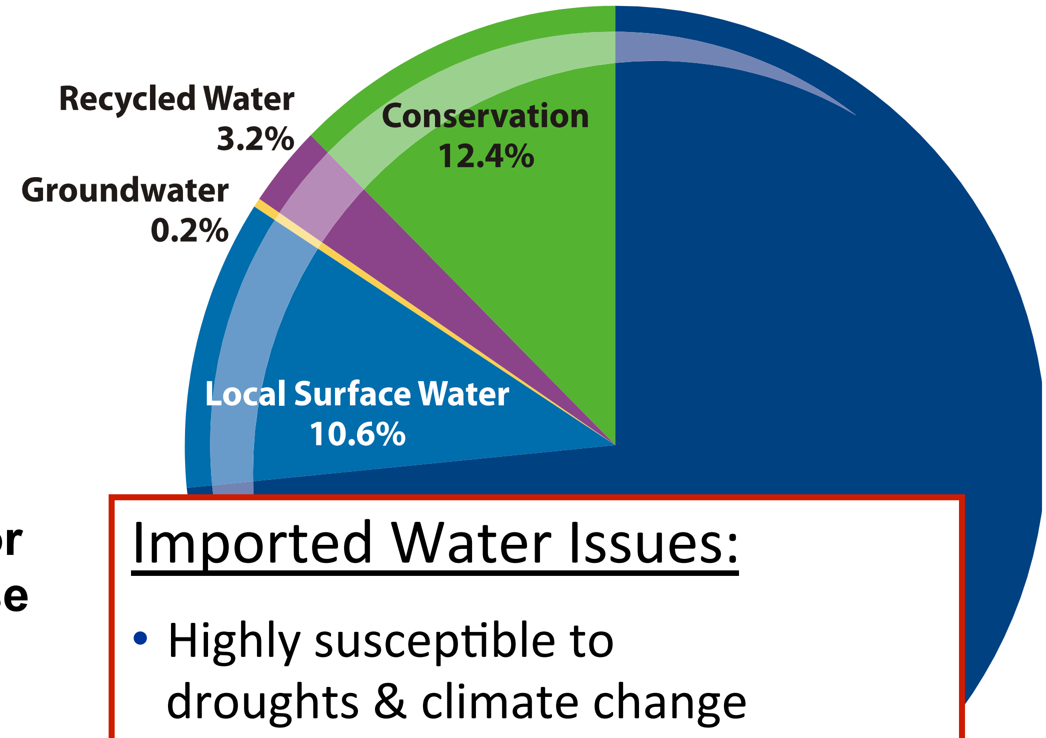
Current Sources of San Diego's Water Supply

Imported Water
(Colorado River &
N. California)

Local Reservoirs
(runoff capture)

Recycled Water for Non-Potable Reuse

Water Conservation



Imported Water Issues:

- Highly susceptible to droughts & climate change
- Sometimes restricted due to environmental regulations
- Energy intensive

Long-Range Water Resources Plan (LRWRP)

The SDPUD worked with public stakeholders to develop a LRWRP in order to:

- Characterize **risks** of supply shortages from climate change, environmental regulations and other factors
- Identify and analyze new conservation and supply options, from a **triple-bottom-line** perspective
- Develop a preferred strategy using an **adaptive management** framework

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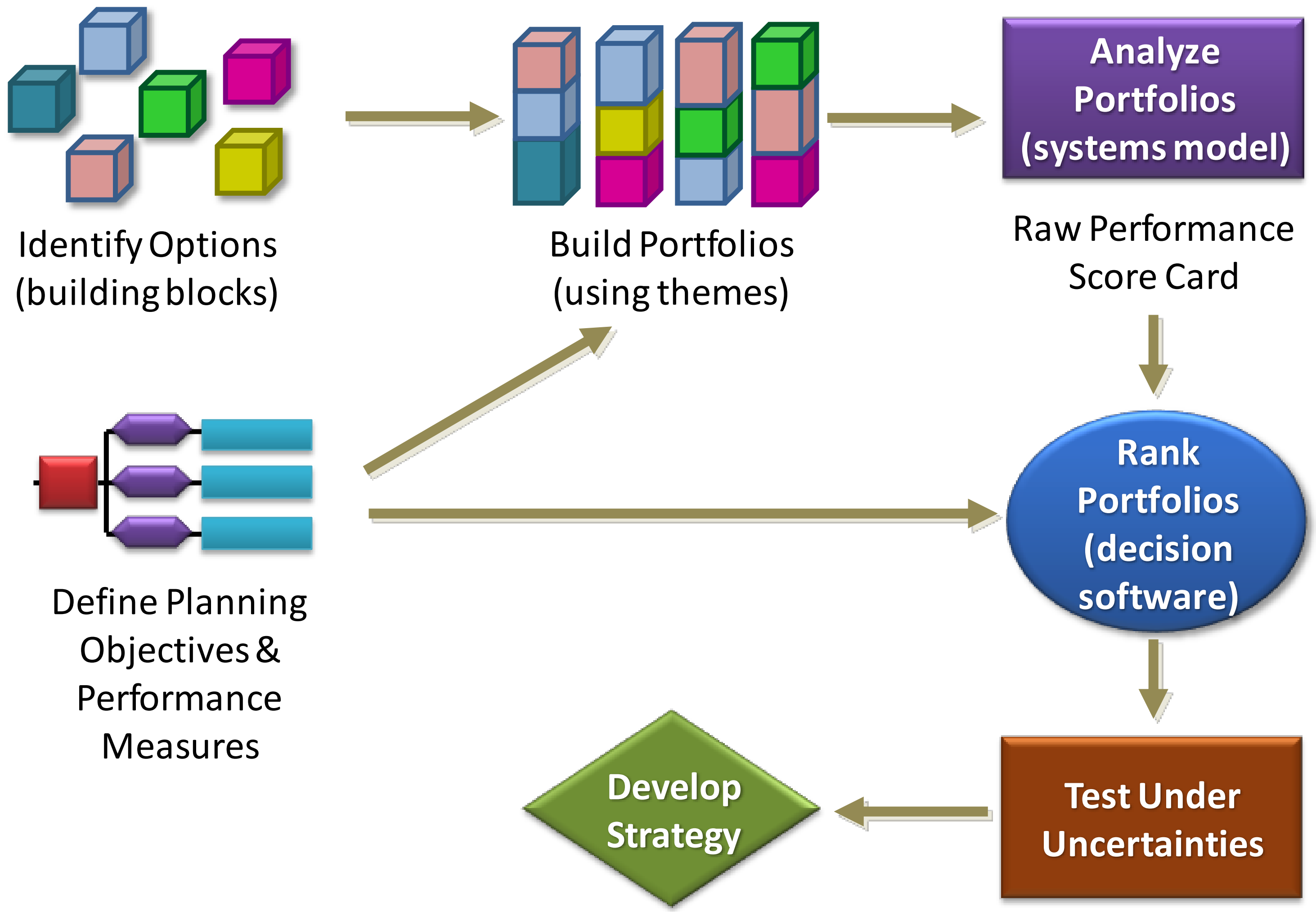
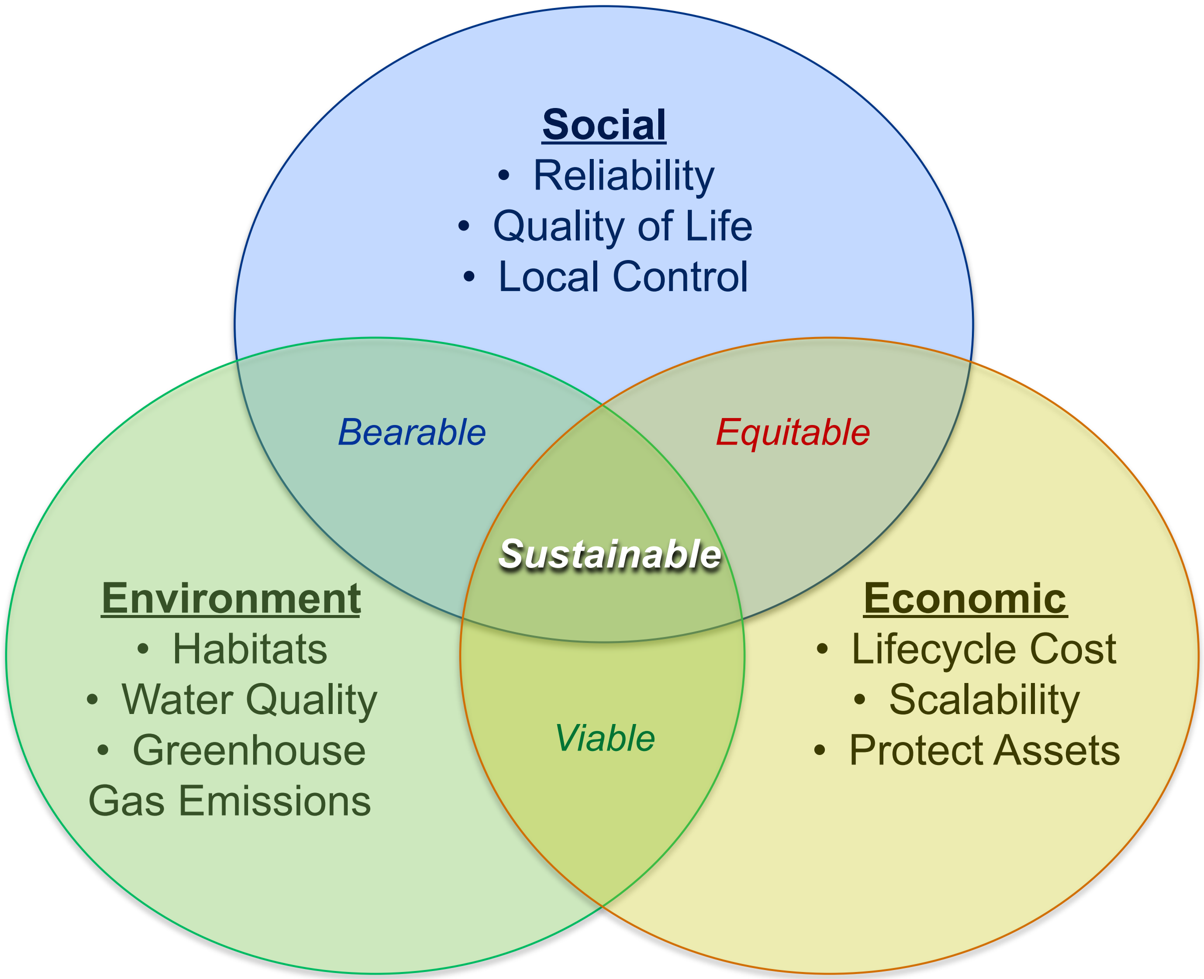
LRWRP Planning and Evaluation Process



LRWRP Objectives Centered Around Principles of Sustainability



LRWRP Examined Impacts of Climate Change

Impact by 2035	Climate Scenario 1 (GFLD)	Climate Scenario 2 (NCAR)
Local Temperature (change from historical average)	+5%	+3%
Local Rainfall (change from historical average)	+1%	+13%
Local Water Demands (increase from historical normal)	+3.8%	+0.5%
Local Surface Water (change from historical average)	-7%	+20%
Imported Water (change from historical *normal* year)	-14%	-8%
Imported Water (change from historical *wet* year)	-6%	-3%

Bad Outcome | Neutral Outcome | Good Outcome

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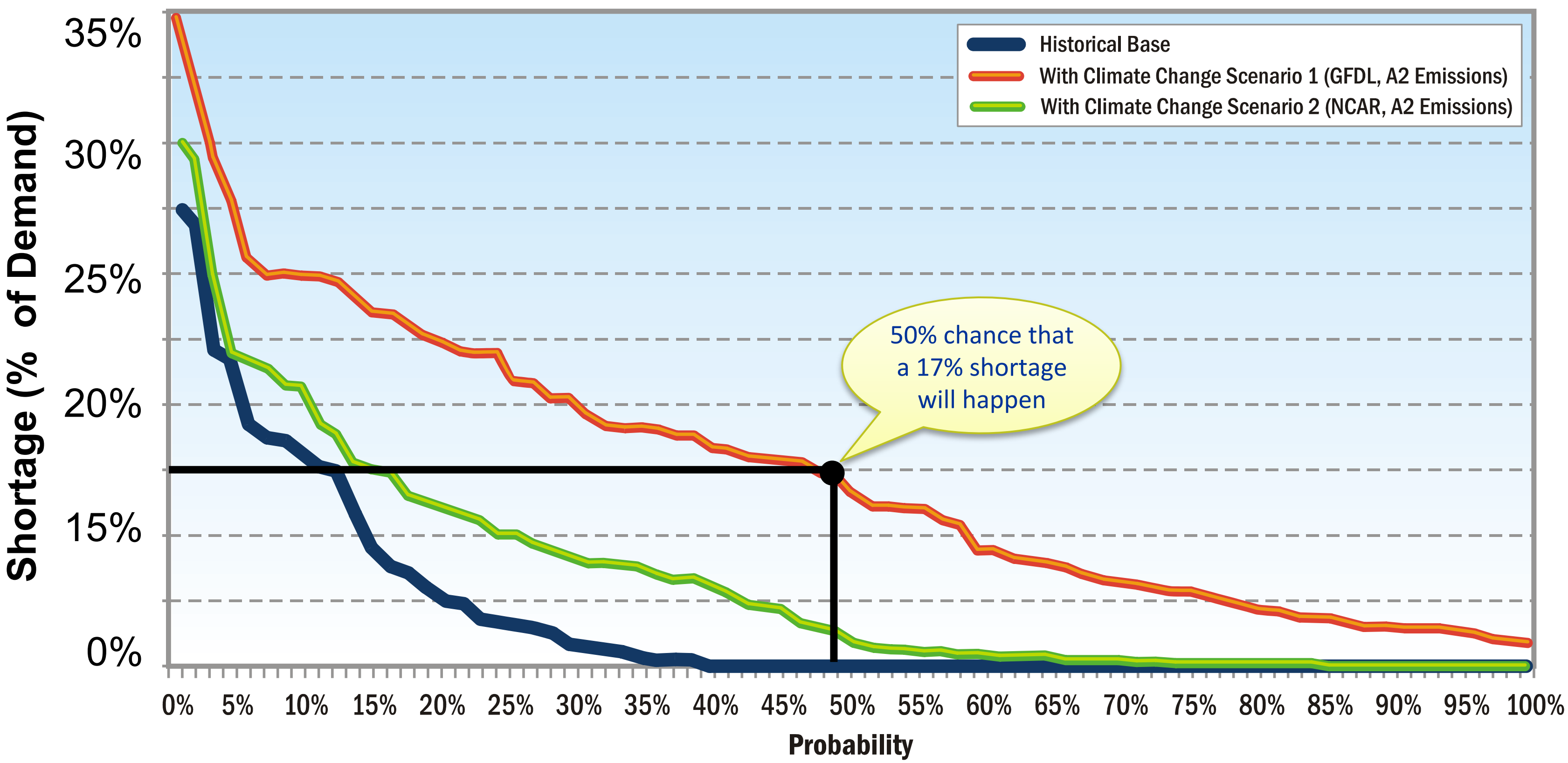
Gap Analysis (Difference Between Future Demands and Existing Supplies)



Note: Projected shortages for all probabilities are shown; therefore once the probability of zero shortage is reached, the line extends along the x-axis.

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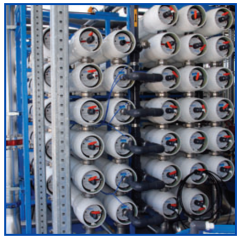
Range of Options Considered for LRWRP (AF = acre-feet)

Water Conservation
$200-$500 / AF

Groundwater
$1,000-$4,000 / AF

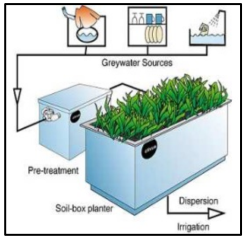
Imported Water
$1,800-$2,200 / AF



Recycled Water Indirect Potable Use
$2,100-$4,700 / AF

Recycled Water Non-Potable Reuse
$2,100-$9,000 / AF

Seawater Desalination
$3,000 / AF



Graywater Systems
$5,500-$15,000 / AF*

Rainwater Harvesting
$6,000-$20,000 / AF*

* Per device, these options are low cost

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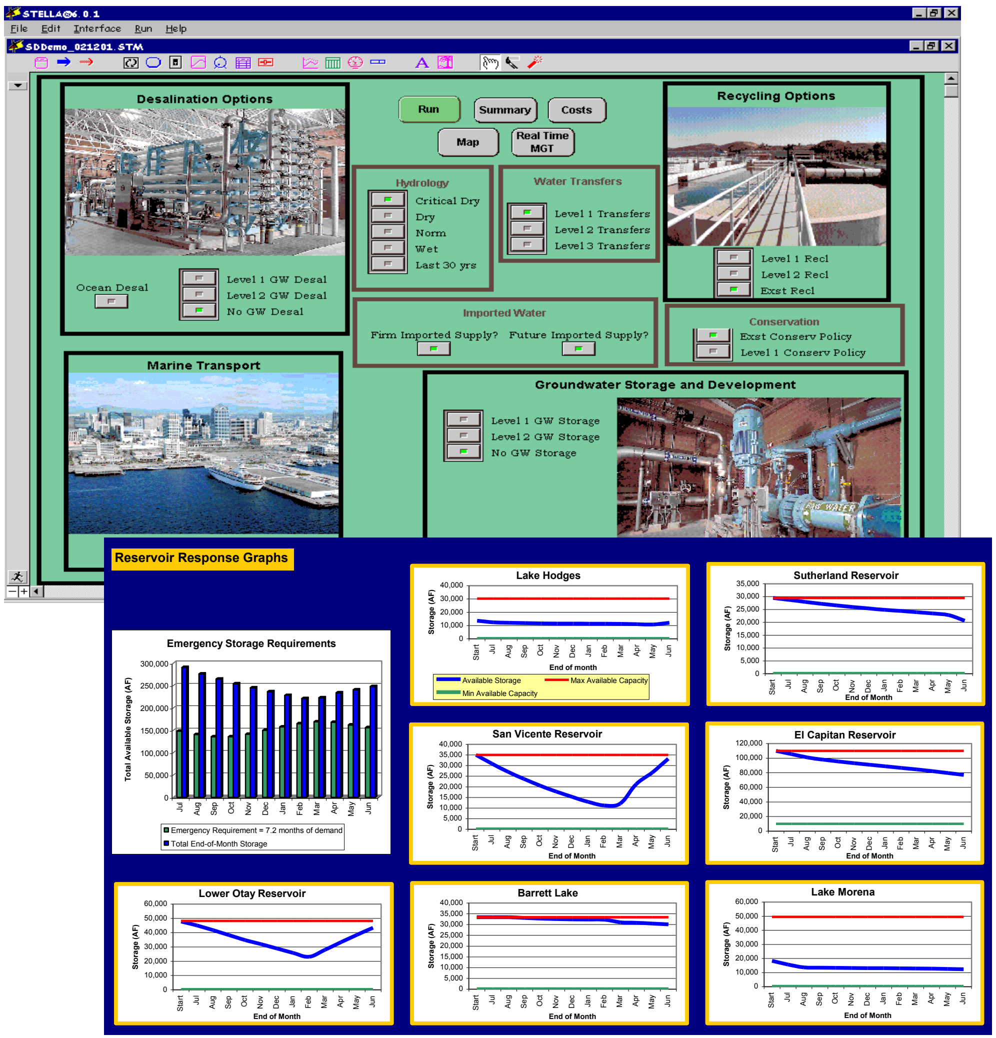
Definition of Portfolios

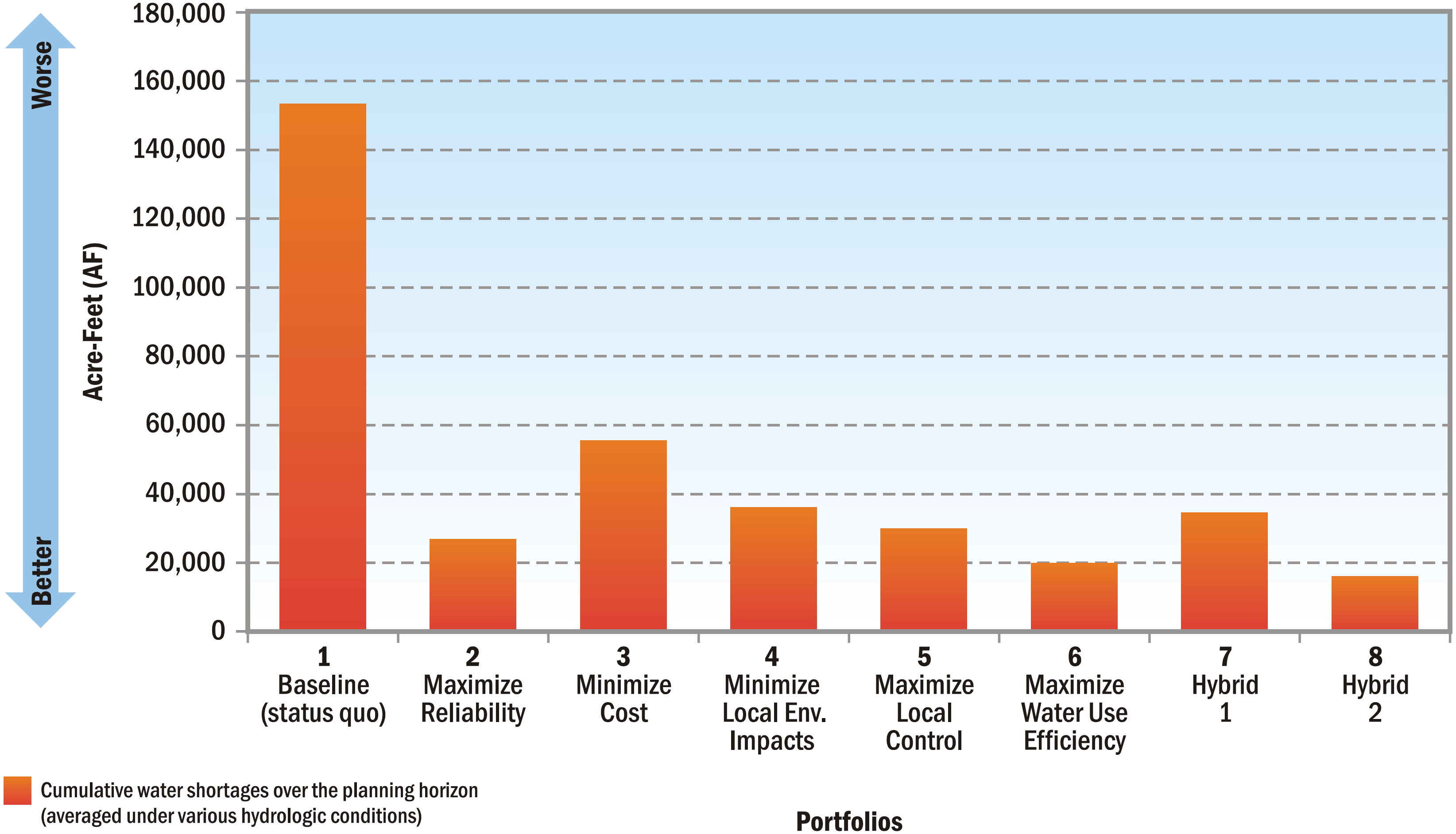
Portfolio Name	Portfolio Description
1. Baseline (Status Quo)	Heaviest reliance on imported water
2. Max. Reliability	Heaviest reliance on desalination and water purification
3. Min. Cost	Only includes options with lower unit costs than imported water
4. Min. Environmental Impacts	Includes options that have lowest greenhouse gas emissions and lowest impacts to receiving waters
5. Max. Local Control	Includes options that SDPUD have direct control over
6. Max. Water Efficiency	Heaviest reliance on conservation, reuse, and graywater
7. Hybrid 1	Builds off the Min Cost Portfolio by adding Phase 1 Indirect Potable Reuse project
8. Hybrid 2	Builds off the Max Water Use Efficiency portfolio by subtracting most expensive reuse and graywater projects

Systems Model (using STELLA software)

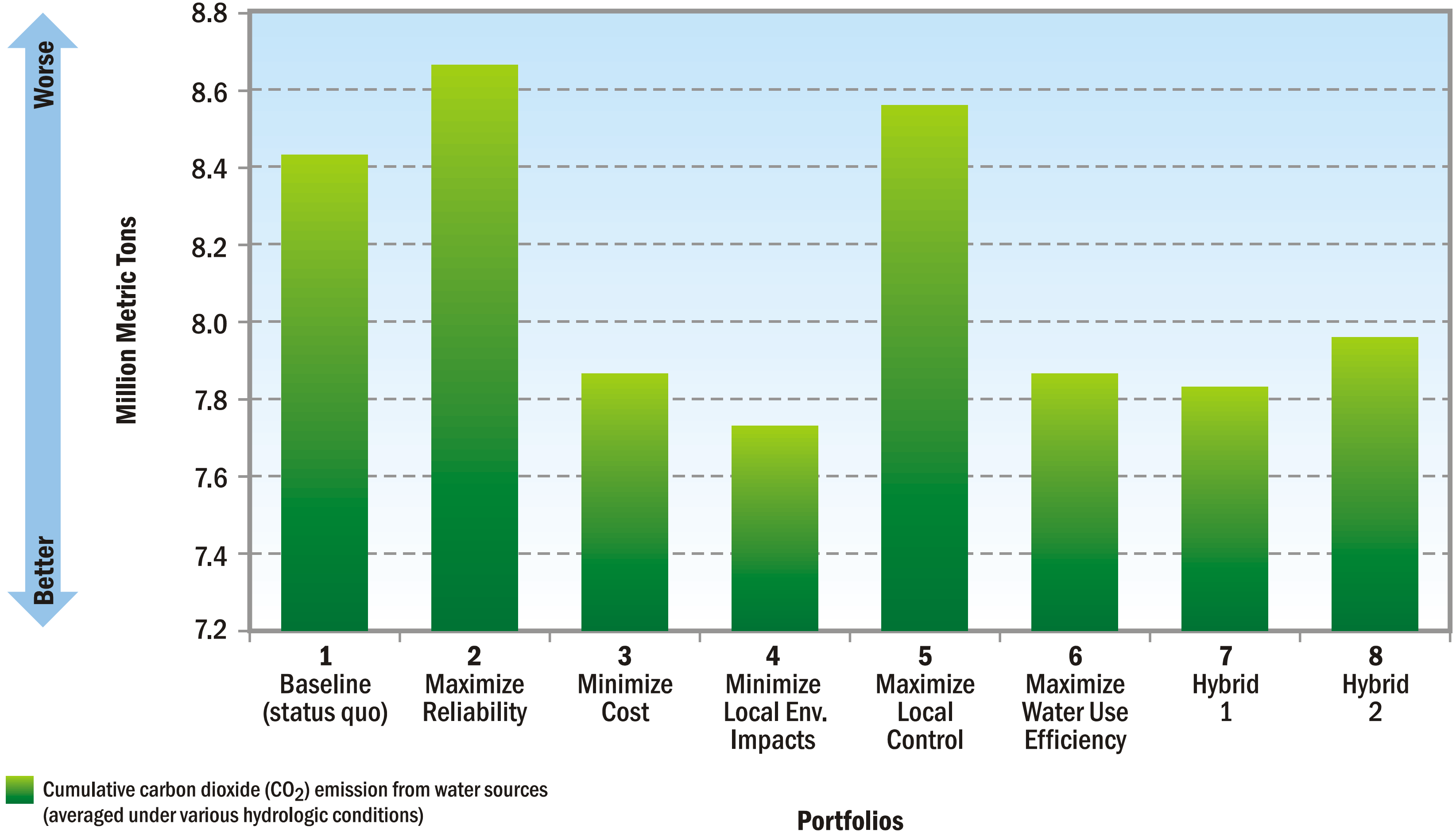


- Integrated water, wastewater and receiving water quality model
- Tracks water demands and supplies, including facility constraints, for multiple hydrologic sequences
- Simulates storage operations
- Estimates lifecycle costs
- Calculates water quality using mass balance
- Estimates energy requirements & GHG emissions

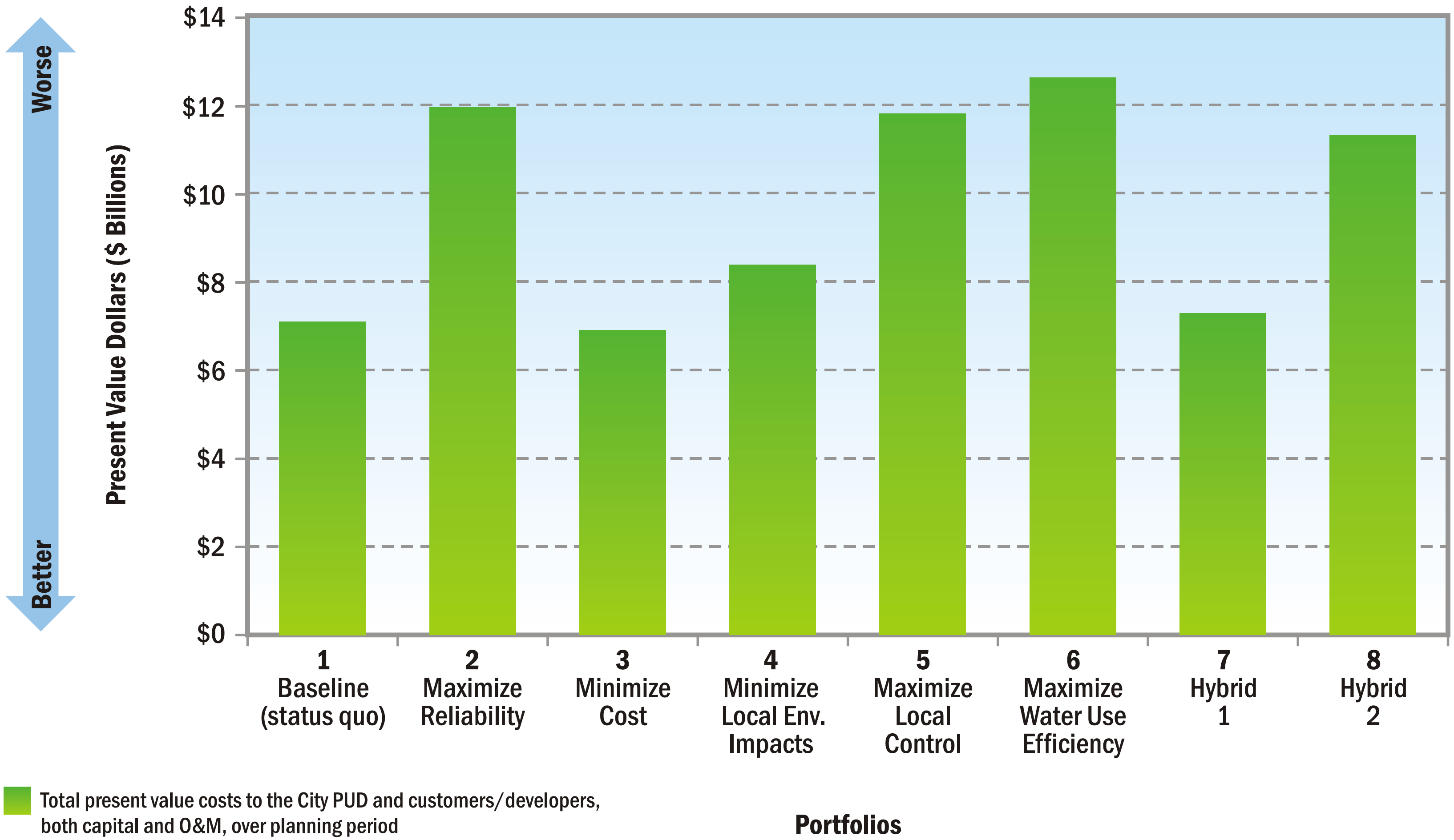
Systems Model Output: Future Water Shortages



Systems Model Output: Greenhouse Gas Emissions



Systems Model Output: Lifecycle Cost



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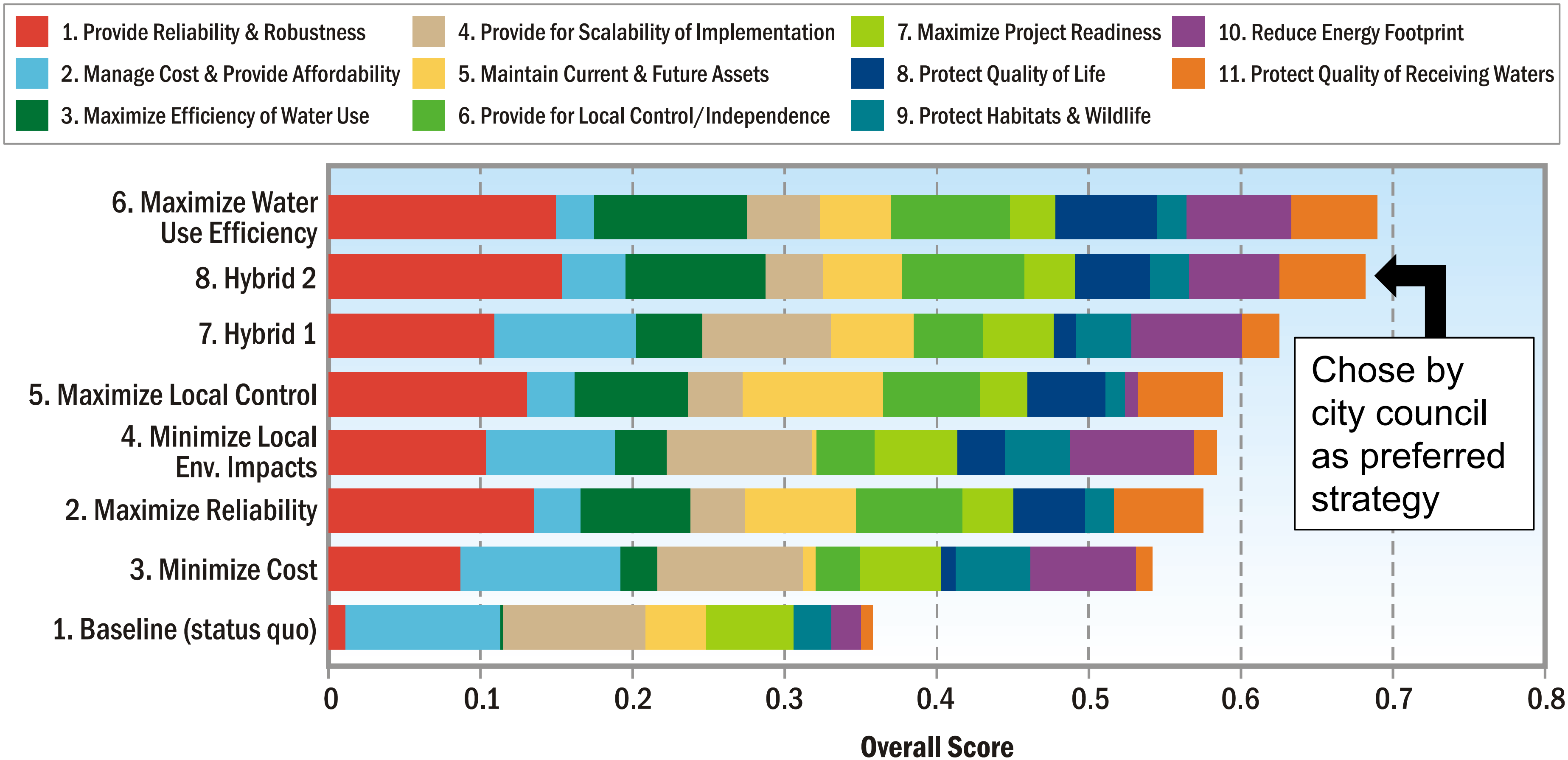
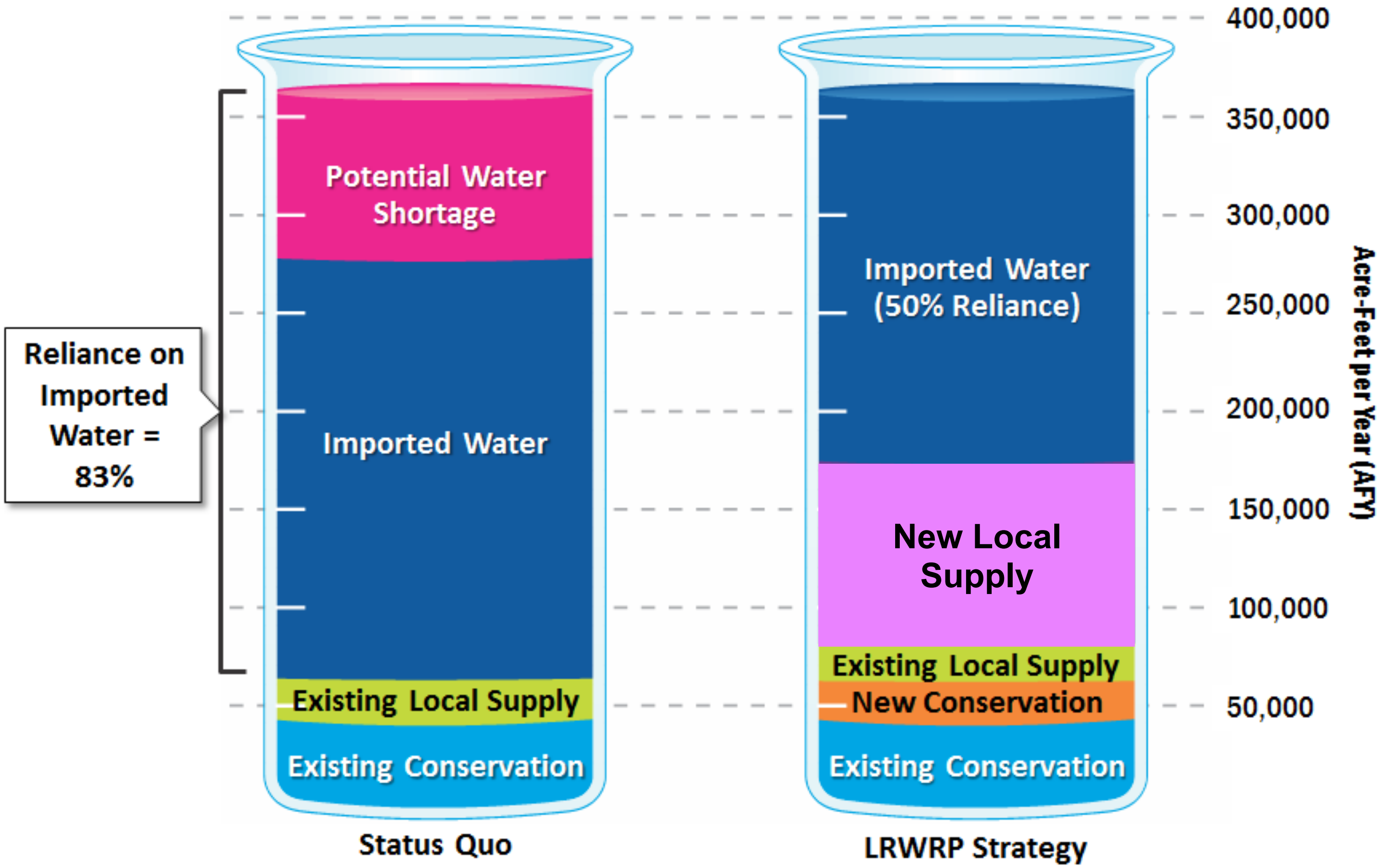
Use of Multi-criteria Software to Rank Alternatives



Preferred Strategy Reduces High Reliance on Imported Water



Preferred Strategy is Balance of All Three Sustainability Principles

- ✓ **Social**
  - Near perfect supply reliability, even under climate change
  - Maintains high quality of life
  - Gives city significantly more local control over resources
- ✓ **Economic**
  - Affordable—not cheapest or most expensive alternative—but when factoring the "value" of high reliability, it is best performing from a "total economic" perspective
  - Projects are scalable and build off of existing assets well
- ✓ **Environment**
  - High levels of water efficiency and reuse
  - Improves receiving water quality and salinity of water supply
  - Reduces greenhouse gases and energy footprint

Thank You

For more info:

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