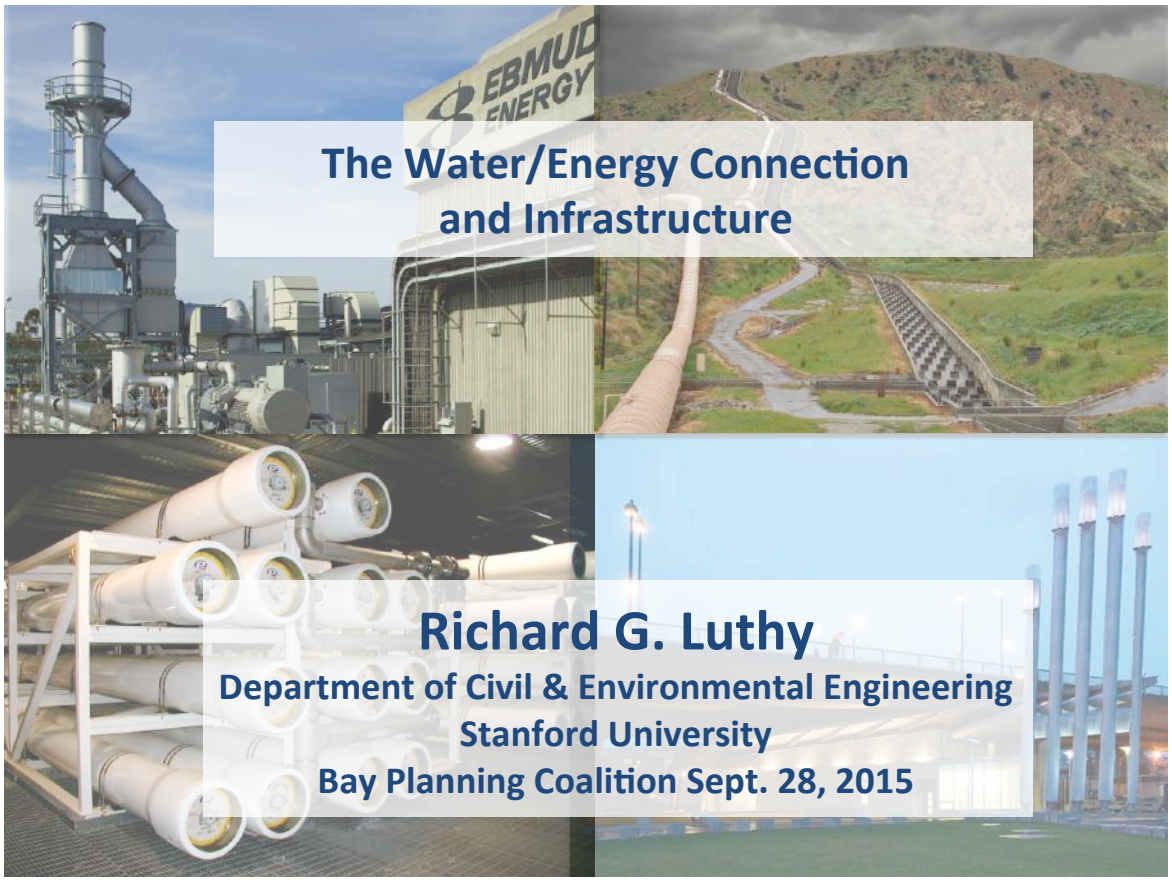


The Water/Energy Connection and Infrastructure

Richard G. Luthy
Department of Civil & Environmental Engineering
Stanford University
Bay Planning Coalition Sept. 28, 2015

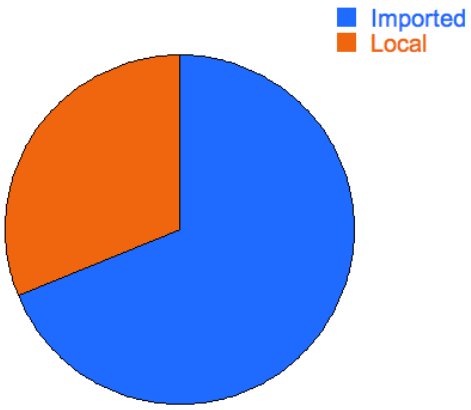
Some thoughts…

ReNUWIt
Re-inventing the Nation's URBAN WATER INFRASTRUCTURE

- Energy is critical to climate change mitigation
- But… energy must be balanced w/ public health, resiliency, etc.
- Scarcity increases energy intensity
- Decentralized systems & new technologies offer
  - Energy savings
  - Less trenching and piping for reuse
  - Better quality water
- Demonstrations needed –
  - Utilities and cities can lead the way

SF Bay Area

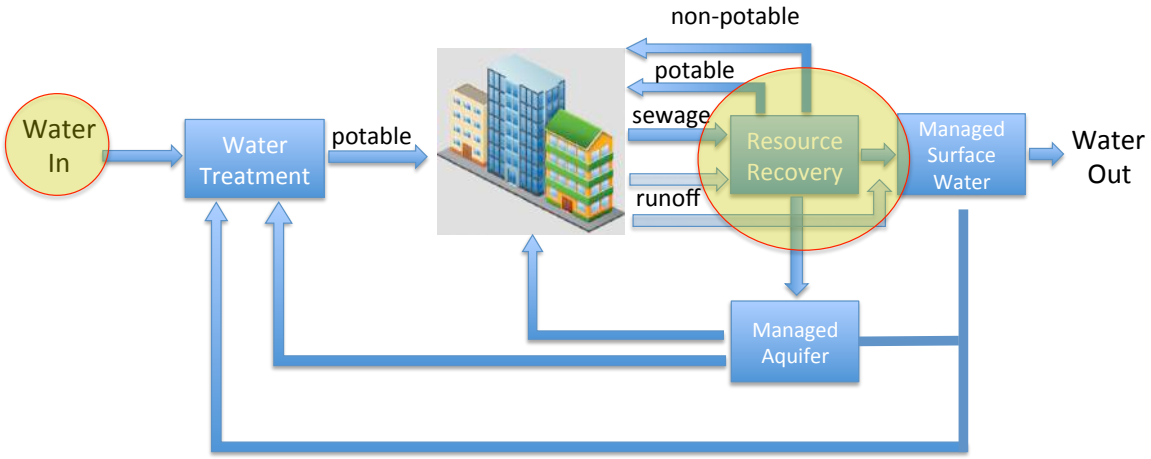
2016 Water Portfolio



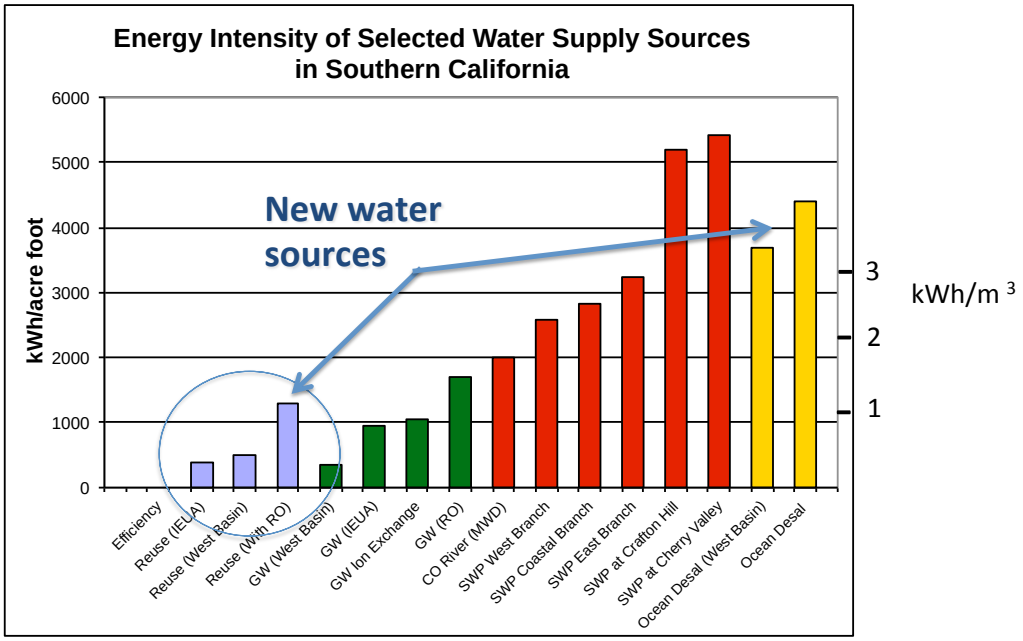
Total = 1.3 billion gallons/day

2050 Water Portfolio

New Water Sources

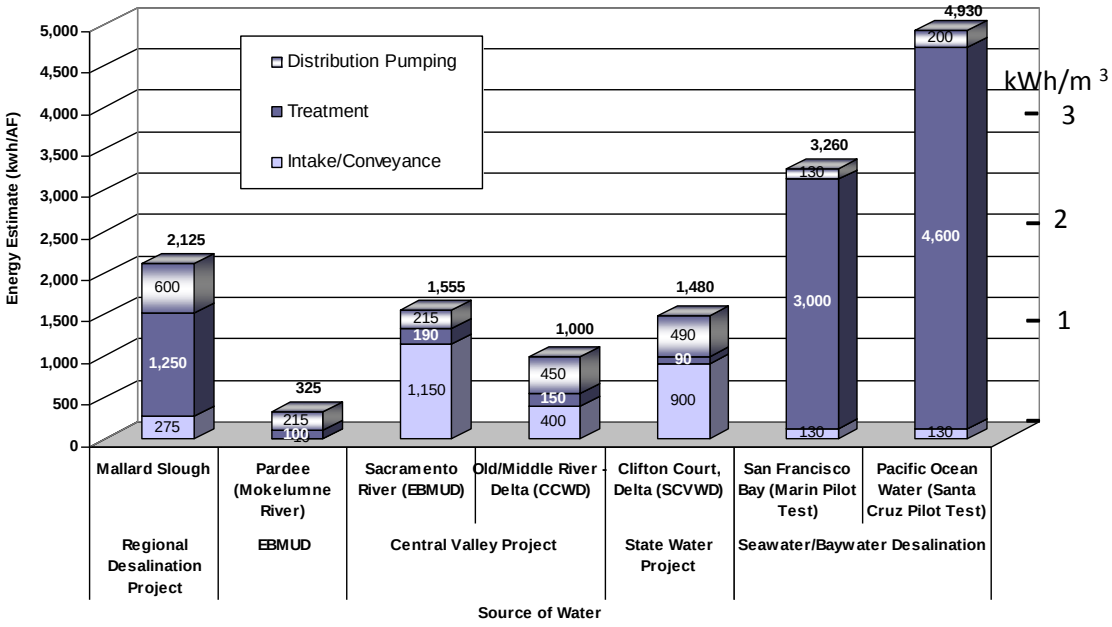


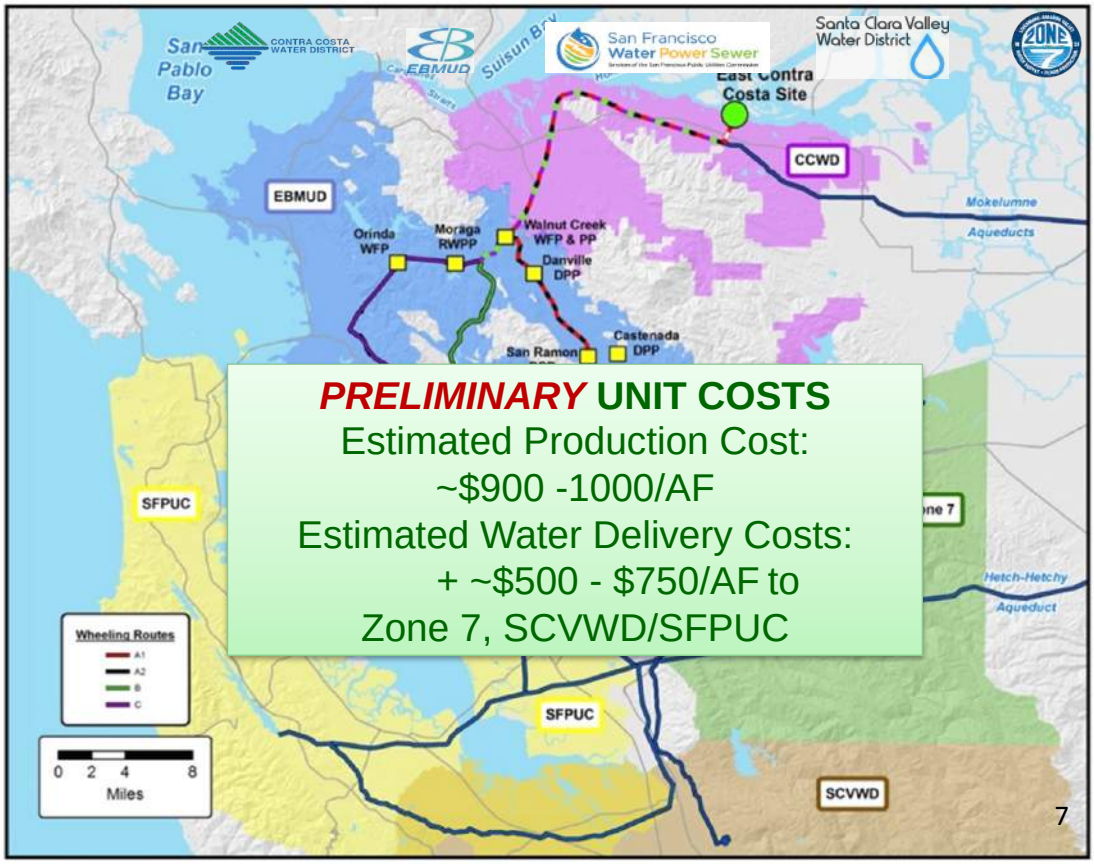
Energy for Water Supply
So. Calif.– note the range



NRDC (2004)

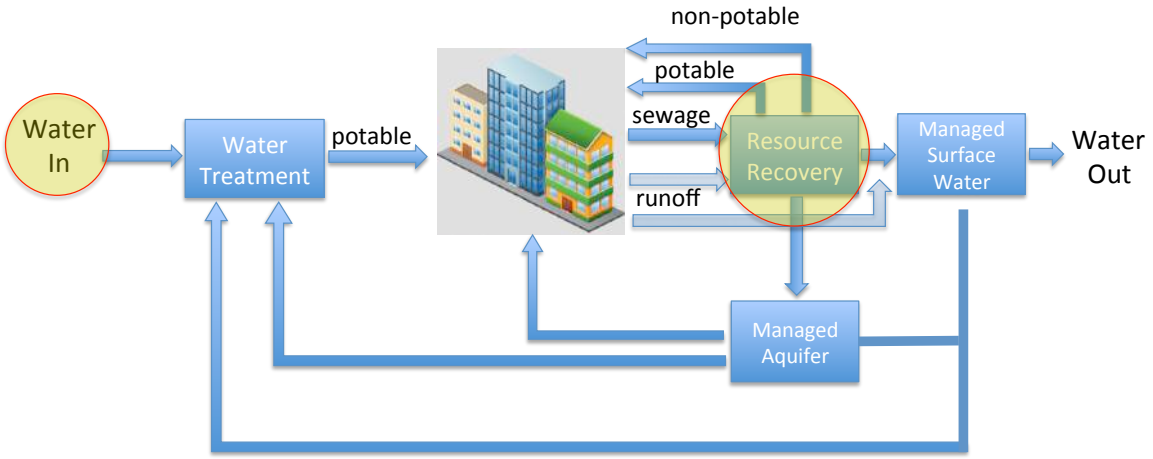
Energy Comparison of Bay Area Water Supply Options





Wastewater Treatment

ReNUWIt
Re-inventing the Nation's URBAN WATER INFRASTRUCTURE



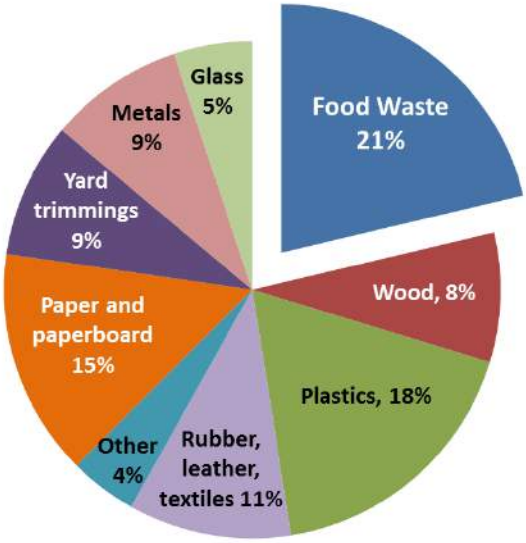
Synergies of Using a WWTP
(significant excess capacity)

EBMUD (Ben Horenstein)

Food Waste

- Largest category of municipal solid waste to landfills
  - Less than 4% currently diverted, mainly for composting
- Diversion from landfill conserves space and reduces GHG emissions
  - Organic material breaks down in a landfill and releases methane gas, which is a potent GHG
  - WWTP may often be closer to food waste sources than landfill – fewer truck miles

Municipal Solid Waste Sent to Landfill (EPA, 2011)

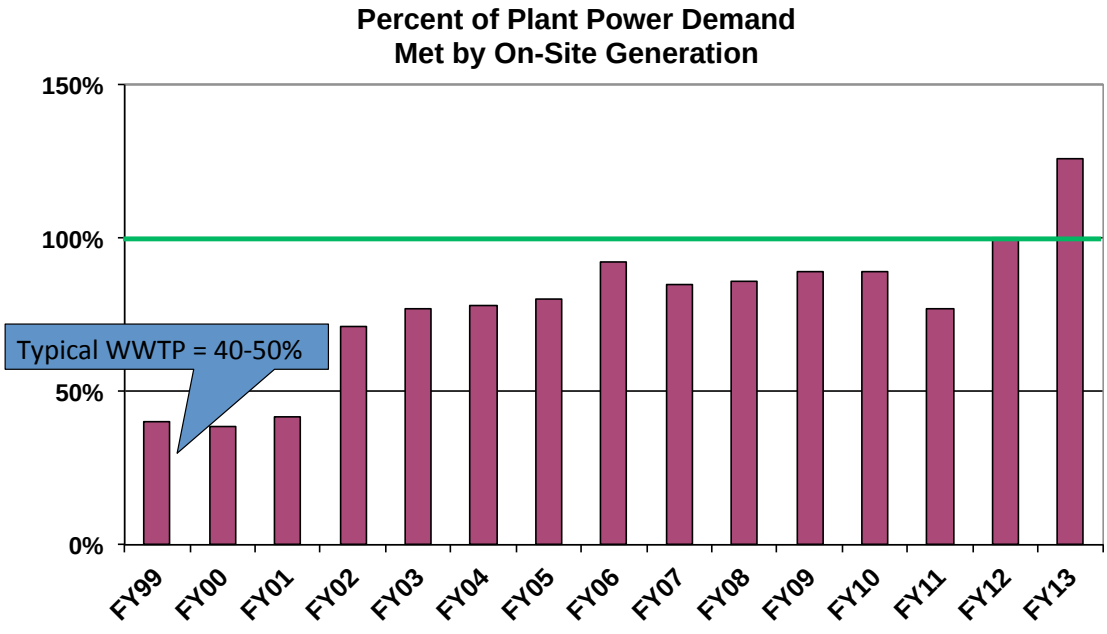


EBMUD (Ben Horenstein)

Energy Positive in Oakland

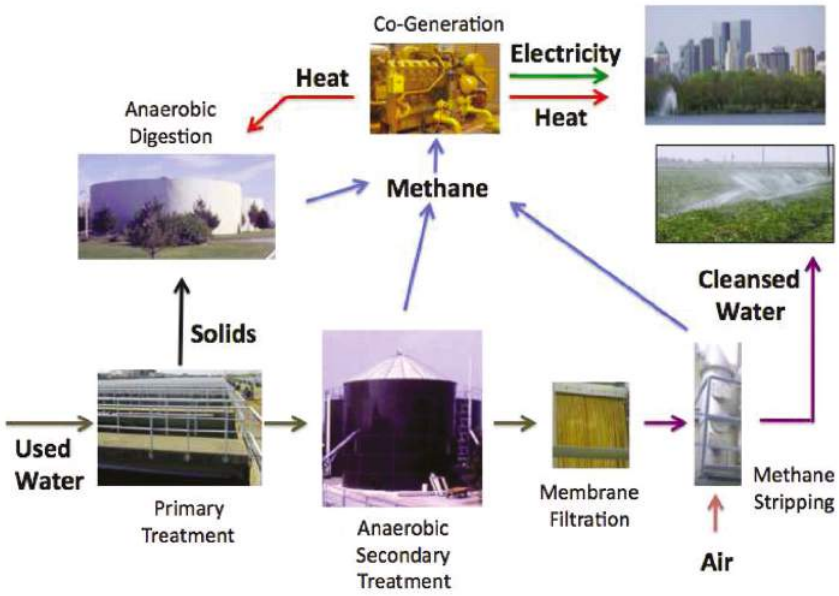
EBMUD (Ben Horenstein)

EBMUD Operates the 1st Net Energy Producing WWTP in North America



EBMUD (Ben Horenstein)

Anaerobic Opportunities (a new model)



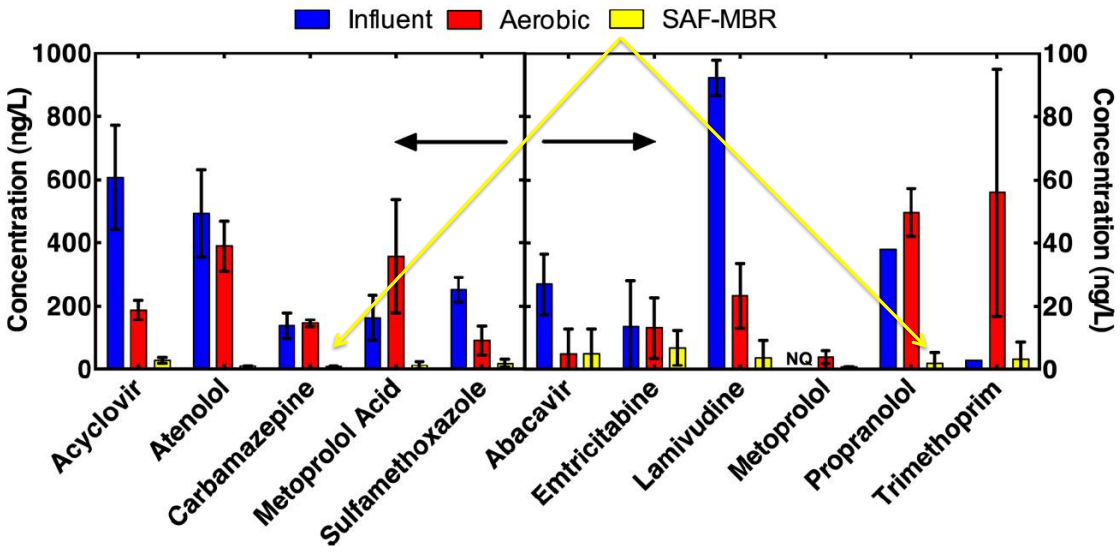
McCarty et al. (2011)

Anaerobic Opportunities (a new model)

Wastewater and Waste Organics → **High Value Products**

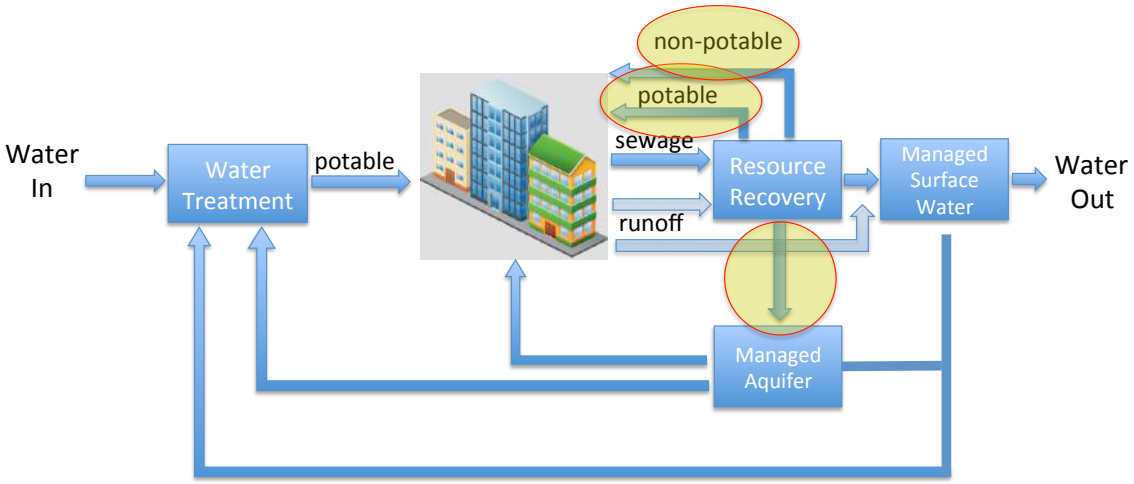
Resource Recovery Research Center, Stanford University

Superior removal of pharmaceuticals:
new anaerobic system vs aerobic system



McCurry et al., *Environ. Sci. & Technol. Letter*, 1:459, 2014

Water Reuse



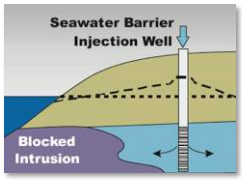
Centralized Reuse

Irrigation (Title 22)

Cooling Towers

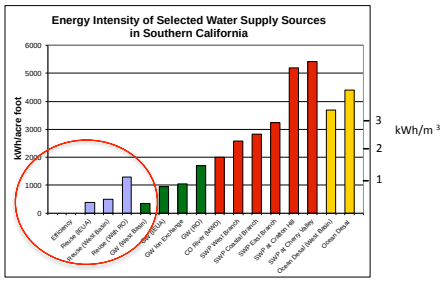
Edward C. Little
Water Recycling Facility

Low-Pressure Boilers (RO)



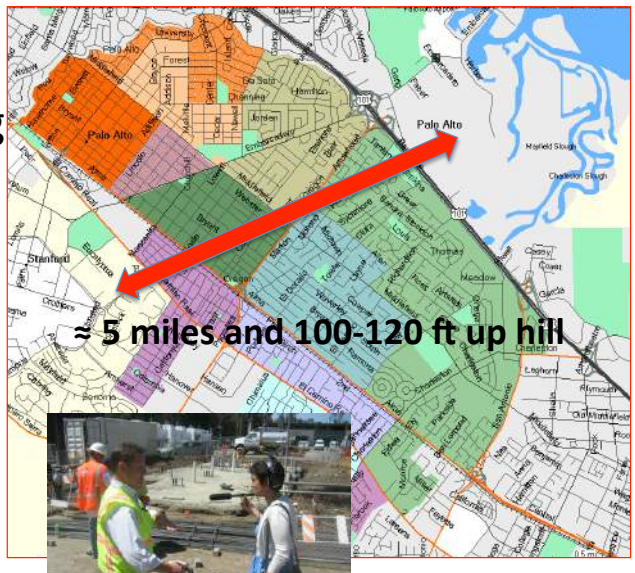
Groundwater Recharge (RO)

High-Pressure Boilers (RO)



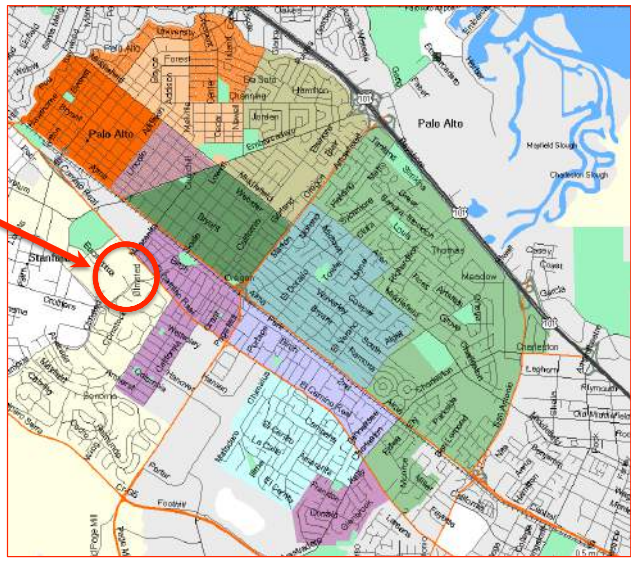
Decentralized reuse

- No cross-town trenching & pumping water back up hill
- Save energy by avoiding pumping
- Energy generation
- Reclaim the water where it's generated and needed
- Less salt
- Better quality with new technology



Decentralized water reclamation

- Stanford wastewater at Serra Street approx. **360 ppm salt**
- Palo Alto recycled water approx. **770 ppm salt**
- Stanford wastewater best for irrigation & long-term salt management

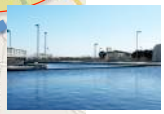


De-centralized Reuse

ReNUWIt
Re-inventing the Nation's URBAN WATER INFRASTRUCTURE

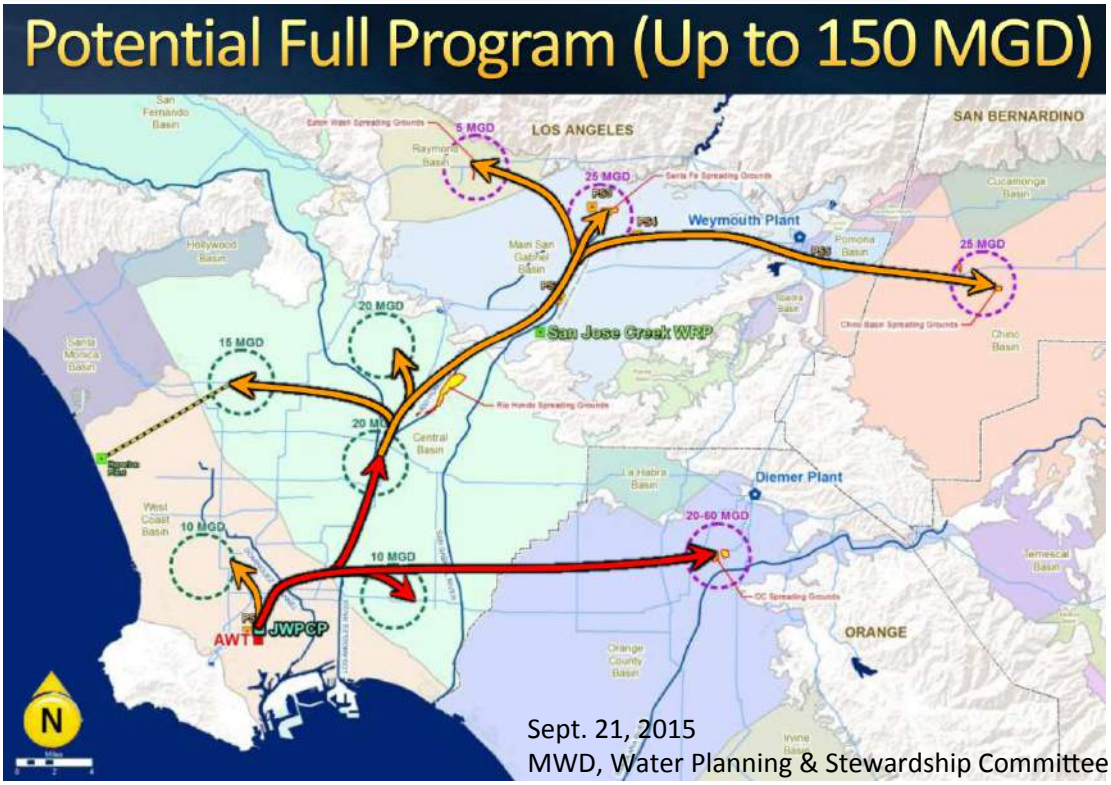
"In order to get recycled water to Morgan Hill, you would have to pump it up hill.
If we could develop a facility locally, that could be cheaper because we wouldn't have as large distribution costs"

Gordon Siebert, Council Member, Morgan Hill; former chair of the Joint Powers South County Regional Wastewater Authority

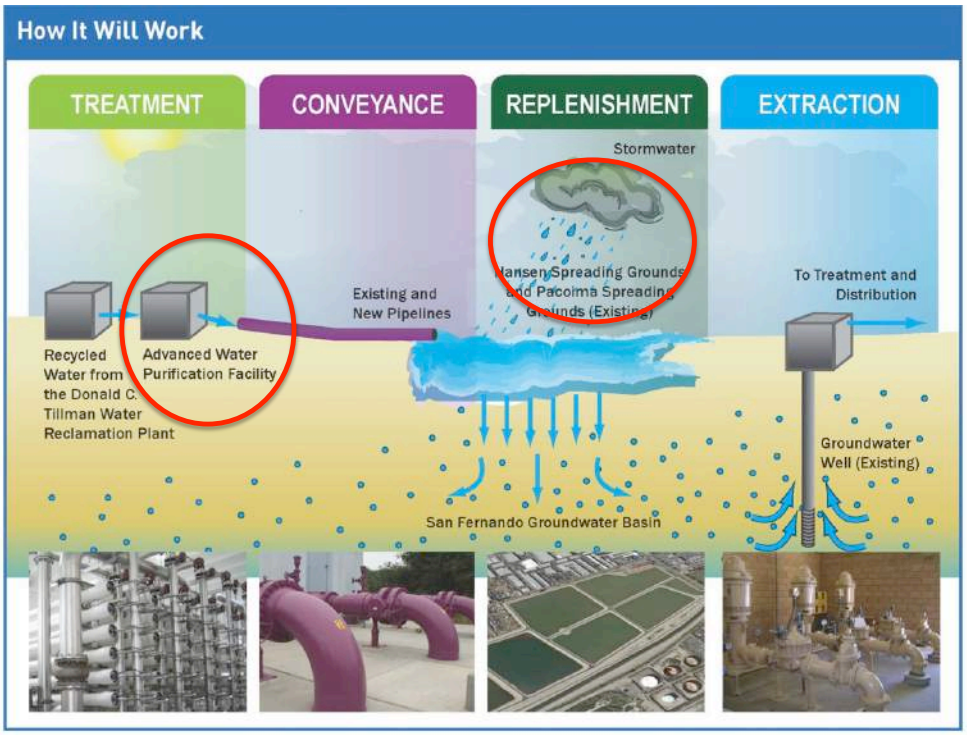


South County Regional Wastewater Authority
Joint Powers Authority (Morgan Hill & Gilroy)

MWD– potential water recycle plan



Coupled recycled water & stormwater recharge



Source: LADWP

Final Thoughts

- Scarcity often increases energy intensity
- Conservation saves energy, especially hot water
- Decentralized systems & new technologies offer
  - Energy recovery (zero-energy water reuse)
  - Less trenching and piping for reuse
  - Better quality water
- Demonstration needed –
  - Utilities and cities can lead the way