UNDER THE PATRONAGE OF THE EGYPTIAN PRIME MINISTER

11TH WATER DESALINATION CONFERENCE IN THE ARAB COUNTRIES

UNDER THE THEME: NATIONALIZATION OF DESALINATION INDUSTRY IN THE ARAB WORLD

WATER REUSE HISTORY IN THE USA

Hany Said, CEO

Pacific Aqua Technologies, USA

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CALIFORNIA FACTS

Population - 39,849,872

- Our current estimate for California's population is nearly 39.5 million. At the last official United States census carried out in 2010, the population of California was declared at 37,253,956 which made the state the most populous in the country. It is currently the 17th fastest growing state with a yearly growth rate of .90%.

How much water does California use each year?

The U.S. Geological Survey estimates between 1985-2010, 42 million acre-feet per year, or about 38 billion gallons per day.

- CALIFORNIA uses MORE WATER than any other state
- EACH CALIFORNIAN uses an average of 181 GALLONS of water EACH DAY
- MORE WATER is used each day for IRRIGATION than any other water use category

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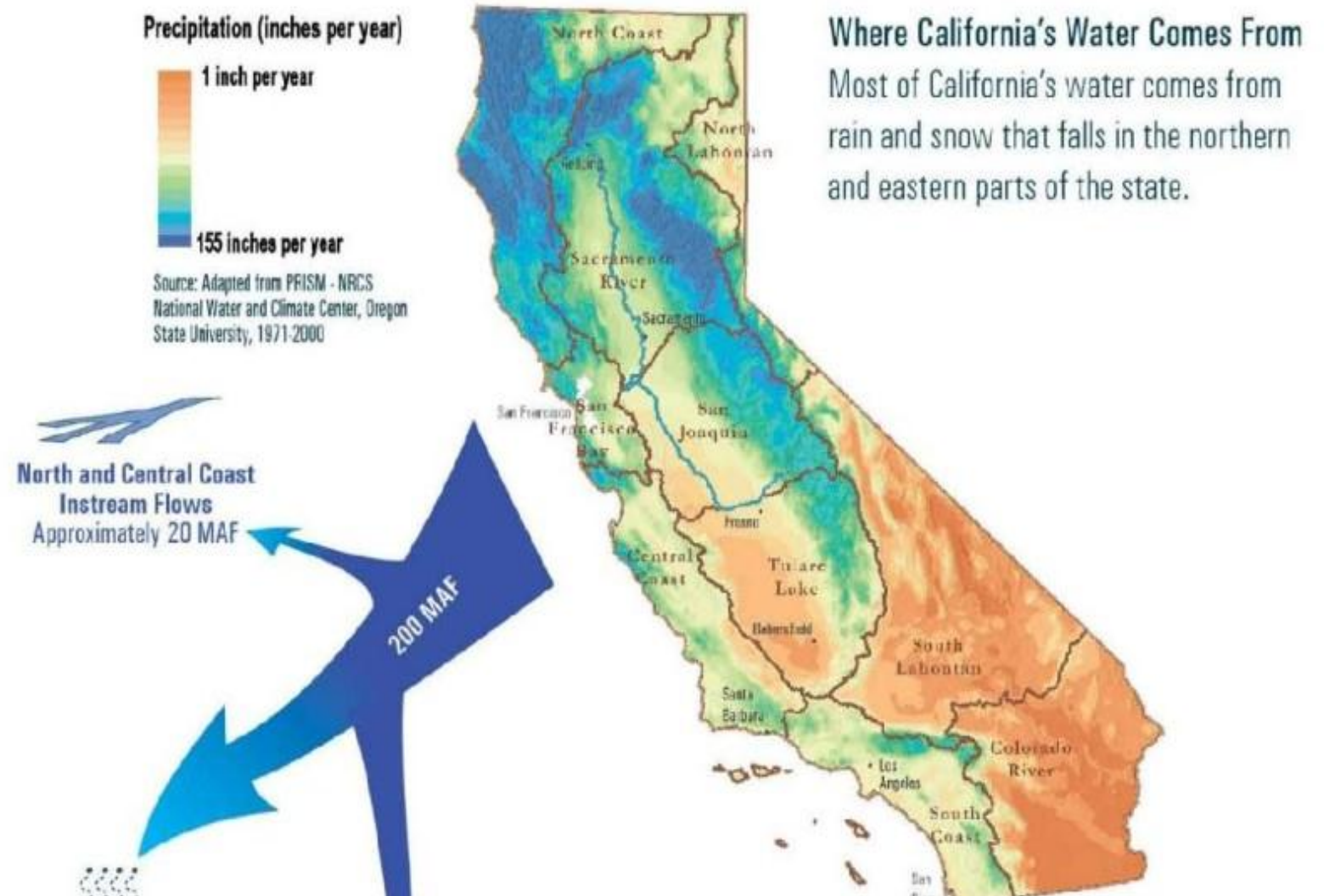
CALIFORNIA FACTS

Where does California's water come from?



CALIFORNIA FACTS

The Watersheds Supplying California's Drinking Water

Total land area (acres)	156,623,659
Land in public management	67%
Land in private ownership	33%
Land used for agriculture	5%
Land in urban/suburban development	2%

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WATER FACTORY 21–ORANGE COUNTY WD

- Began operation in 1976
- 20 million m^3/yr
- Flocculation, re-carbonation, multi-media filtration, RO, activated carbon, and disinfection
- Groundwater injection to prevent seawater intrusion

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GROUNDWATER RECHARGE: DRAFT CALIFORNIA REGULATION

- Issued August 2, 2002
- Surface Spreading / Subsurface Injection
- Specifies Controls for
  - Pathogenic organisms
  - Nitrogen compounds
  - Regulated contaminants and physical characteristics
  - Nonregulated contaminants
- Maximum Average Recycled Water Contribution

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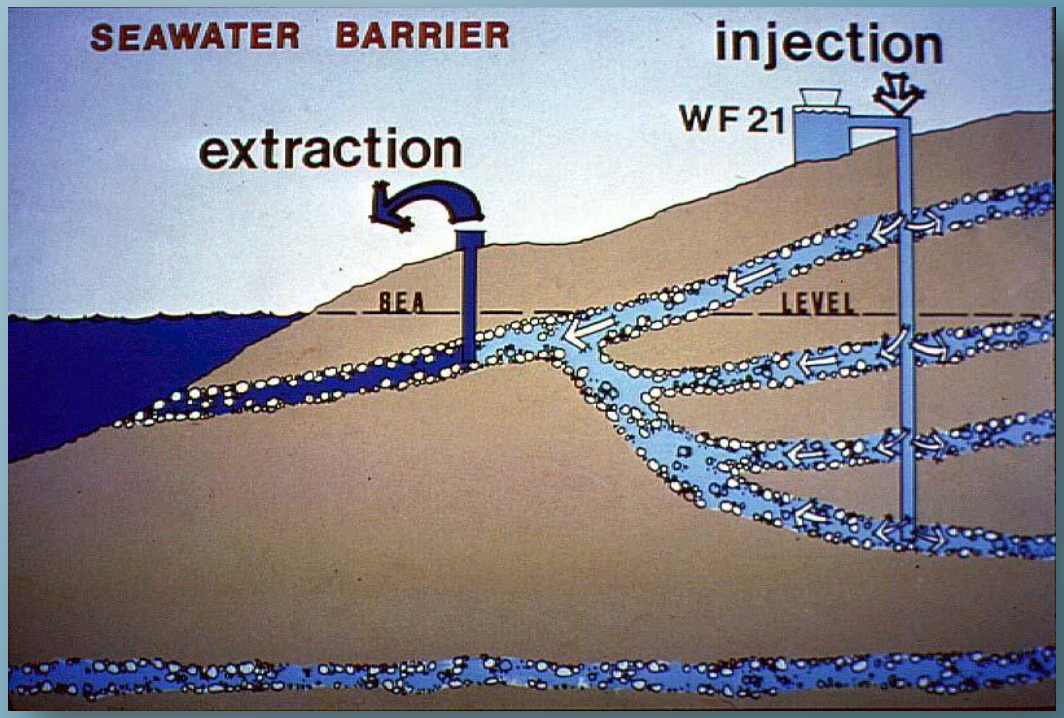
Groundwater Recharge

- Groundwater Replenishment*
- Salt Water Intrusion
- Subsidence Control



* Many projects throughout the U.S. (e.g. FL, AZ, CA, CO, etc.).

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WHAT IS WASTEWATER REUSE?

Terminology

- Water reuse
  - The beneficial use of treated wastewater for agriculture, industry, etc.
- Water reclamation
  - Reclamation involves all processes used to treat wastewater so that it can be beneficially reused
- Water recycling
  - Recycling generally means reuse of wastewater back in the same cycle where it is generated.

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WHAT IS WASTEWATER REUSE?

Categories of Water Reuse

- Indirect Reuse
  - Reuse of wastewater within the context of natural water systems (rivers, aquifers, etc.). The ultimate indirect reuse is through the global hydrologic cycle
  - Other terms: Indirect potable reuse
- Direct Reuse
  - The direct beneficial reuse of treated wastewater for agriculture, industry, etc.
  - Direct potable reuse: the reuse of reclaimed water for potable uses

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DRIVING FACTORS FOR WATER REUSE

- Water Availability
- Water Consumption
- Water Quality

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BENEFITS OF WATER REUSE

- Important element of integrated water resources utilization and management
- Treated effluent is used as a water resource for many possible beneficial purposes
- For many Arab coastal cities, wastewater would not be discharged to the sea thus reducing pollution to the marine environment and not creating public health issues

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PUBLIC HEALTH AND WATER QUALITY CONSIDERATIONS

- Physical water quality considerations
  - Turbidity, color, etc.
- Chemical water quality considerations
  - Chemical constituents including solids, metals, nitrogen, phosphorus, etc.
- Biological water quality considerations
  - Pathogens including bacteria, helminths, virus, etc.
- Emerging water quality considerations
  - Pharmaceuticals, hormonal products, personal care products, other EDC's.

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WATER REUSE DESIGN CRITERIA

- Water quality requirements
- Monitoring requirements
- Treatment process requirements
- Treatment reliability requirements
- Operational requirements
- Cross-connection control provisions
- Use area controls

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REGULATORY WATER REUSE CRITERIA

- International Guidelines (WHO Guidelines)
- Country Guidelines and Requirements (U.S):
  - Federal Water Reuse Requirements
  - U.S. EPA guidelines
  - State agency requirements and guidelines
  - Local (county and municipal) requirements
  - Other Guidelines

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U.S. EPA REGULATORY GUIDELINES

- Disinfected tertiary effluents
  - Typical uses: urban, crop irrigation, recreational
  - BOD = 10 mg/L; E.C. = none, etc.
- Disinfected secondary effluents
  - Typical uses: restricted access irrigation, landscape uses, construction, wetlands, etc.
  - BOD = 30 mg/L; TSS = 30mg/L; E.C. = 200/100 mL; etc.

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SOME US WATER REUSE CRITERIA

California Department of Health:

- Water Recycling
- Groundwater Recharge

" …the water resources of the State (must) be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised…"

- Reuse goal: 1,900 million cubic meters annually by 2020

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California Nonpotable Urban Uses Criteria

Type of reuse	Treatment required	Total coliform limits
Flushing sanitary sewers	Secondary	None specified
Irrigation of restricted access landscape areas, nursery stock, & sod farms; landscape impoundments; cooling water (no mist); nonstructural firefighting; soil compaction; etc.	Secondary Disinfection	23/100 mL
Restricted recreational impoundments	Secondary Disinfection	2.2/100 mL
Irrigation of open access landscape areas; nonrestricted recreational impoundments; toilet & urinal flushing; process water; decorative fountains; commercial laundries and car washes; structural fire fighting; etc.	Secondary Coagulation, Filtration, and Disinfection	2.2/100 mL

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CALIFORNIA WATER RECYCLING CRITERIA

- Media Filtration
  - 5 gpm/sqft. maximum (2 gpm/sqft. for traveling bridge automatic backwash filters)
  - $\leq$ 2 NTU average daily turbidity
  - $\leq$ 5 NTU 95% of time in any 24-hour period
  - 10 NTU maximum
  - Coagulation required unless secondary effluent 5 NTU or less
- Membranes
  - $\leq$ 0.2 NTU 95 % of time in any 24-hour period
  - 0.5 NTU maximum

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CALIFORNIA WATER RECYCLING CRITERIA - DISINFECTED TERTIARY RECLAIMED WATER

- CT $\geq$ 450 mg-min/L
- 90 minutes modal contact time (minimum)
  or $\geq$ 5 logs virus removal
- $\leq$ 2.2 total coliform/100 mL (7-day median)
- No more than one sample $\geq$ 23 total coliform/100 mL in any 30-day period
- $\leq$ 240 total coliform/100 mL (maximum)

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UV DISINFECTION GUIDELINES

- UV dose ≥ 140 mW•s/cm2
- Lamp output = 70 % of nominal (new) UV lamp output
- 70 % transmittance through quartz sleeves
- Wastewater transmittance ≥ 55 %
- Minimum of three UV banks in series

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EXAMPLES OF REUSE AND RECYCLING OPERATIONS IN THE U.S.

- State of California, U.S.

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LA COUNTY SANITATION DISTRICTS

- 10 Water Reclamation Plants
- Quality of effluent varies from undisinfected secondary to coagulated, filtered, disinfected tertiary.
- Total Water Reclamation capacity = 332 million m^3/yr
- Recycle approximately 35% of their 735 m^3/yr wastewater flow
- Customers pay between 30% to 100% of O&M cost ($3 to $10 / 100 m^3)

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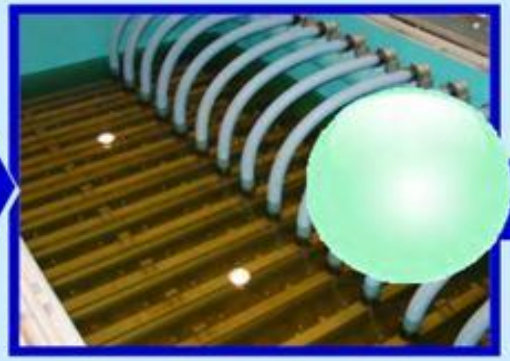
NEWater Production Process

Treated
Used Water



Microfiltration /
Ultrafiltration

Reverse Osmosis

NEWater

Ultra-Violet

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WEST BASIN WATER RECYCLING PLANT

- Produces 5 different qualities of recycled water
  - Tertiary for industrial & irrigation
  - Nitrified for cooling towers
  - Softened RO for ground water recharge
  - Pure RO for low pressure boiler feed
  - Ultra-pure RO for high-pressure boiler
- Capacity = 80 million m^3/yr
- Customers include refineries, Goodyear Blimp home, Toyota HQ, Home Depot Nat'l Training Center, Mobil Refineries

THE HOME DEPOT®

TOYOTA

Mobil

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CARSON REGIONAL WATER RECYCLING PLANT

- Capacity = 19,000 m^3/d water recycling plant
- Microfiltration, RO, and Nitrification systems
- Effluent used as industrial process water at an oil refinery

Customers:

- ExxonMobil
- BP

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IRWD* MICHELSON RECLAMATION PLANT

- Reuse area = 125 Hectare
- Trails = 18 km
- Ponds = 30 Hectares
- 36 Tons of Nitrogen Removed from Watershed
- Operates year around

* Irvine Ranch Water District

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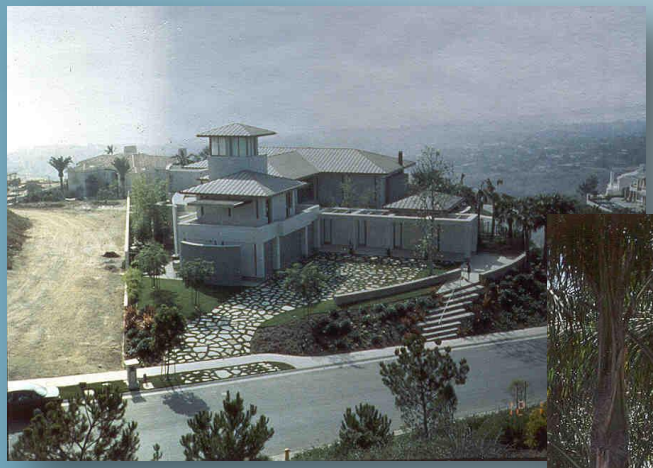
IRWD LANDSCAPE RECLAIMED WATER USES

Single Family Estates



Reclaimed Water Streetscape

Reclaimed Park

Reclaimed Landscape

Reclaimed Golf Course

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U.S. EPA'S GUIDELINES FOR INDIRECT POTABLE REUSE OF MUNICIPAL WASTEWATER

Type or Reuse	Treatment	Reclaimed water quality
Groundwater recharge by spreading into potable aquifers	Site-specific Secondary and disinfection (minimum) May also need filtration and/or advanced wastewater treatment	Site-specific Meet drinking water standards after percolation through vadose zone.
Groundwater recharge by injection into potable aquifers	Secondary Filtration Disinfection Advanced wastewater treatment	Includes, but not limited to, the following: pH = 6.5 to 8.5 < 2 NTU No detectable fecal coli/100 mL > 1 mg/L Cl residual Meet drinking water standards
Augmentation of surface supplies	Secondary Filtration Disinfection Advanced wastewater treatment	Includes, but not limited to, the following: pH = 6.5 to 8.5 < 2 NTU No detectable fecal coli/100 mL > 1 mg/L Cl residual Meet drinking water standards

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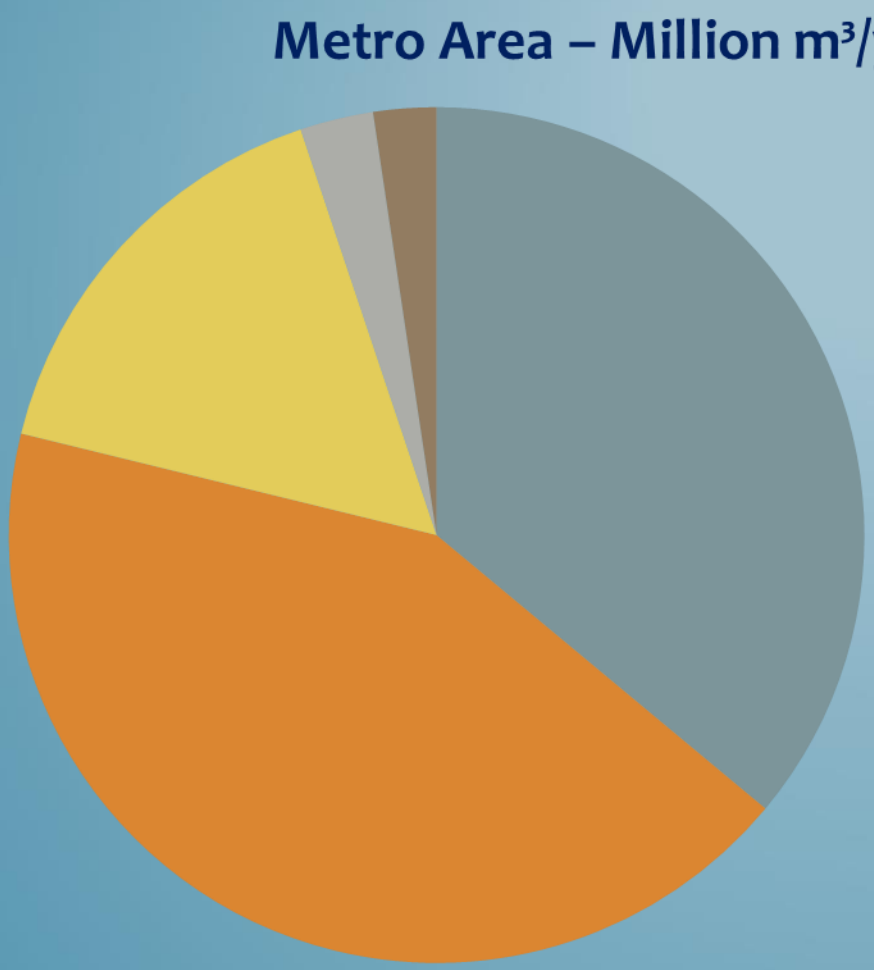
WASTEWATER REUSE IN THE U.S.



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OTHER EXAMPLES OF REUSE AND RECYCLING OPERATIONS

- Singapore PUB “NeWater” Project
- Singapore; a small island in SE Asia, depends on heavily on imported water.
- The “NeWater” project was started to recycle and reuse wastewater –
- Currently, about 15% of the island demand is met using highly treated wastewater
- Wastewater is treated using biological treatment followed by Microfiltration, RO, and UV disinfection.
- Water is used mostly by industrial users (e.g. circuit manufacturing).

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PROUD EGYPTIAN

IDA MEMBER

NATIVE CALIFORNIAN AND ONE THAT BEEN DIRECTLY INVOLVE IN THE CALIFORNIA REUSE WATER PROJECTS

WOULD LIKE TO SEE WATER REUSE BE ADAPTED IN EGYPT

EGYPT COULD BE THE LEADER IN WATER REUSE IN THE MIDDLE EAST WITHIN THE NEXT FIVE YEARS

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