EAST BAY MUNICIPAL UTILITY DISTRICT

Water-Energy Nexus:

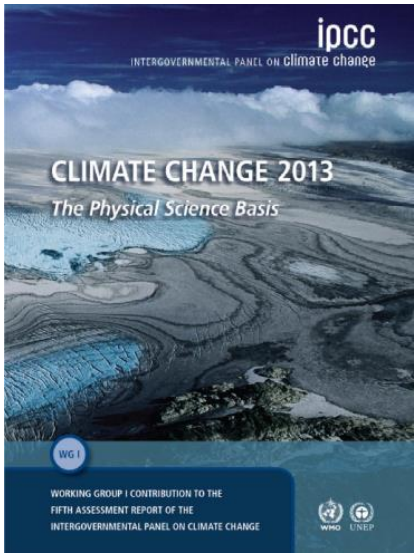
Strategies and Initiatives

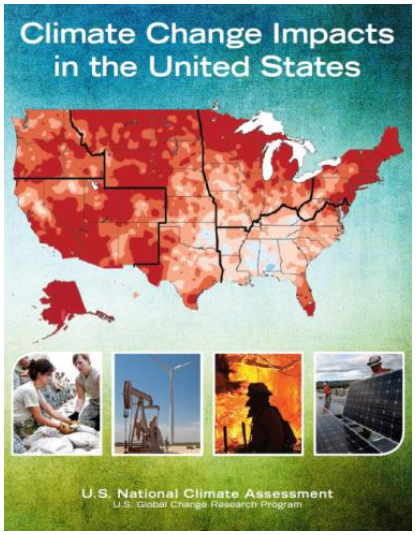
BayREN Water-Energy Nexus Forum

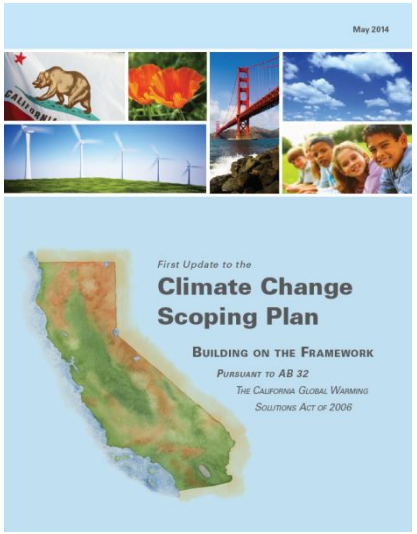
July 29, 2014

Climate Assessments

- Projected Climate Change Impacts
  - Water Resources
  - Water Quality
  - Energy
- California AB32 – Global Warming Solutions Act



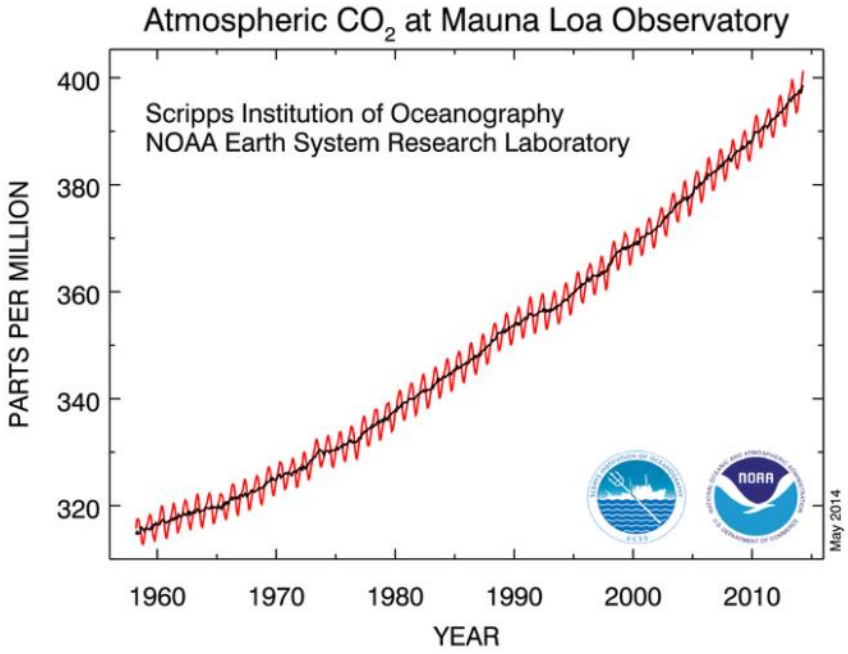




Atmospheric CO_2 Since 1950's

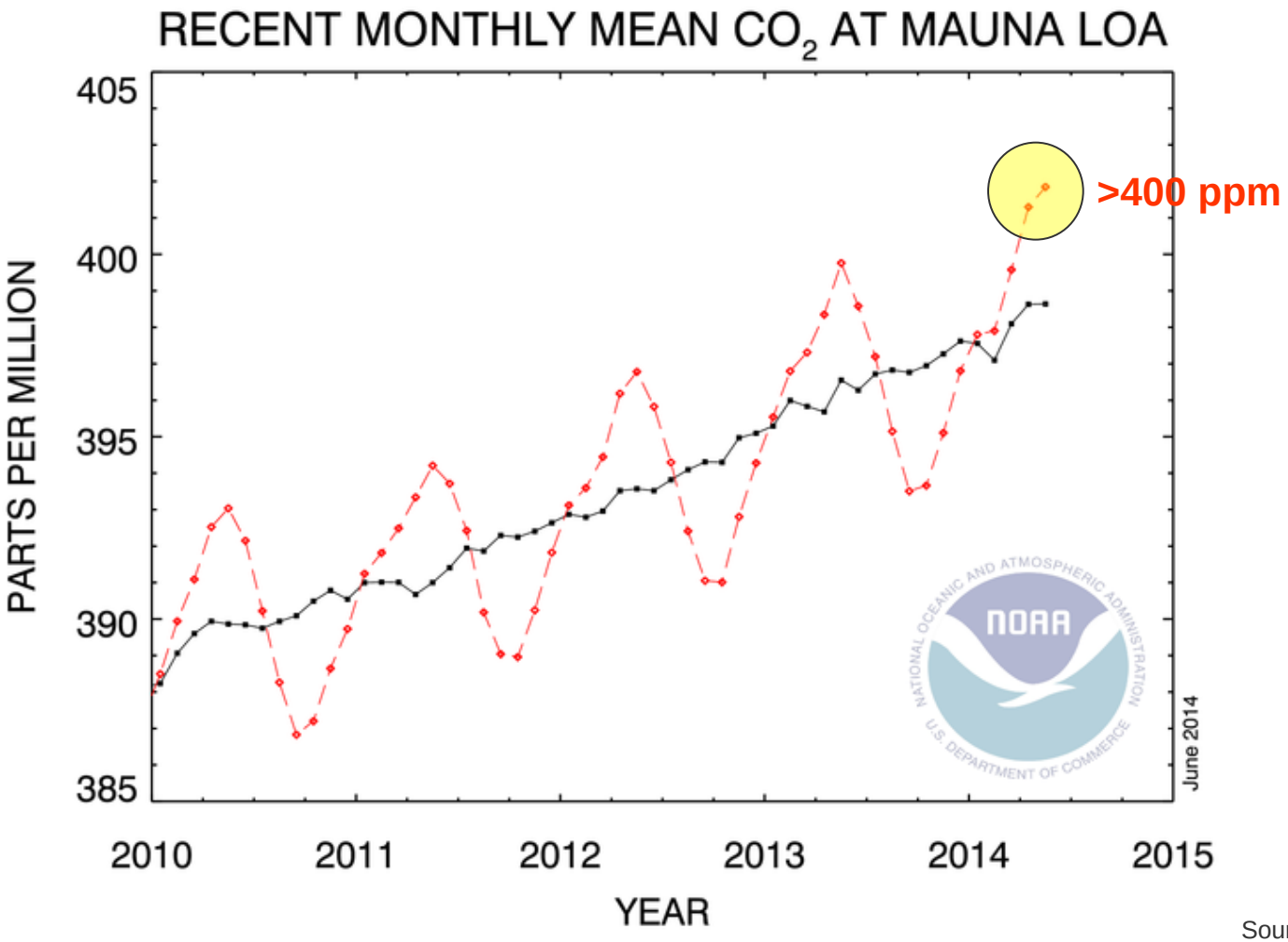
As atmospheric GHG concentrations rise

- Average global temperature will rise
- Sea level will rise
- Precipitation patterns will change



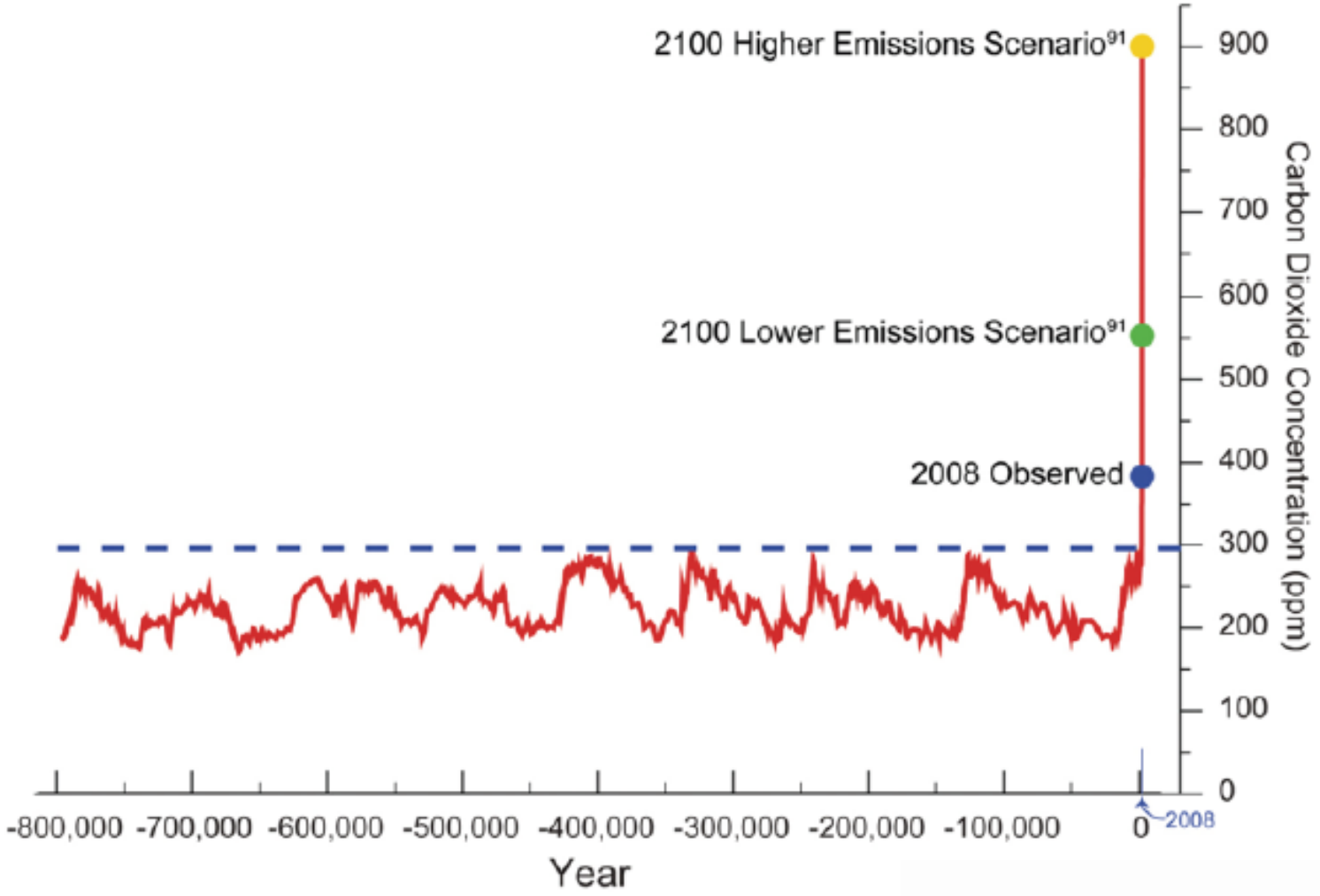
Source: NOAA

CO_2 Increase Not Slowing Down



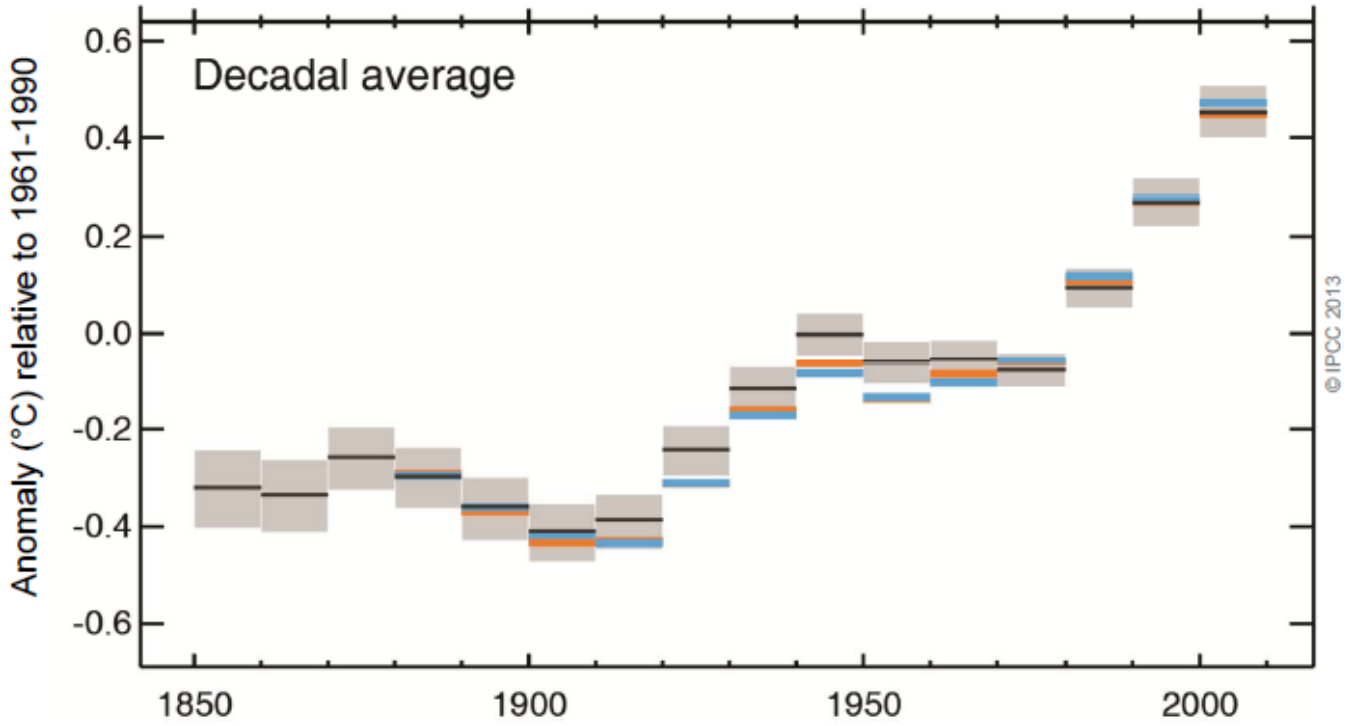
Source: NOAA

Atmospheric CO_2 over the last 800,000 years



Source: US Global Change Research Program

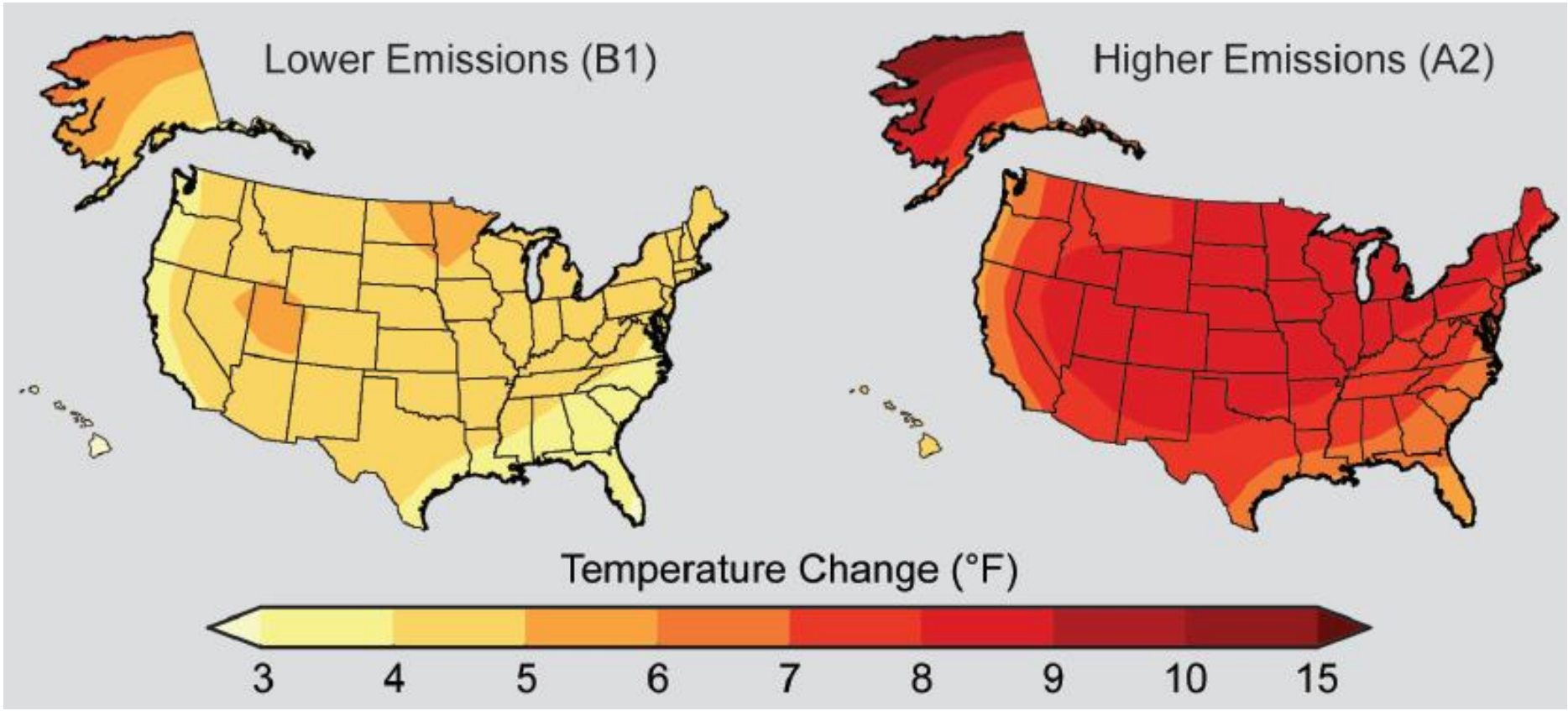
Observed Temperature Change



- Each of the **last three decades has been successively warmer** at the Earth's surface than any preceding decade since 1850
- In the Northern Hemisphere, **1983 to 2012** was likely the **warmest 30-year period in the last 1400 years**
- **Rate of increase** since 1970 (compared to 1880) **2.5 times higher** (increase from 0.2°F to 0.5°F per decade)

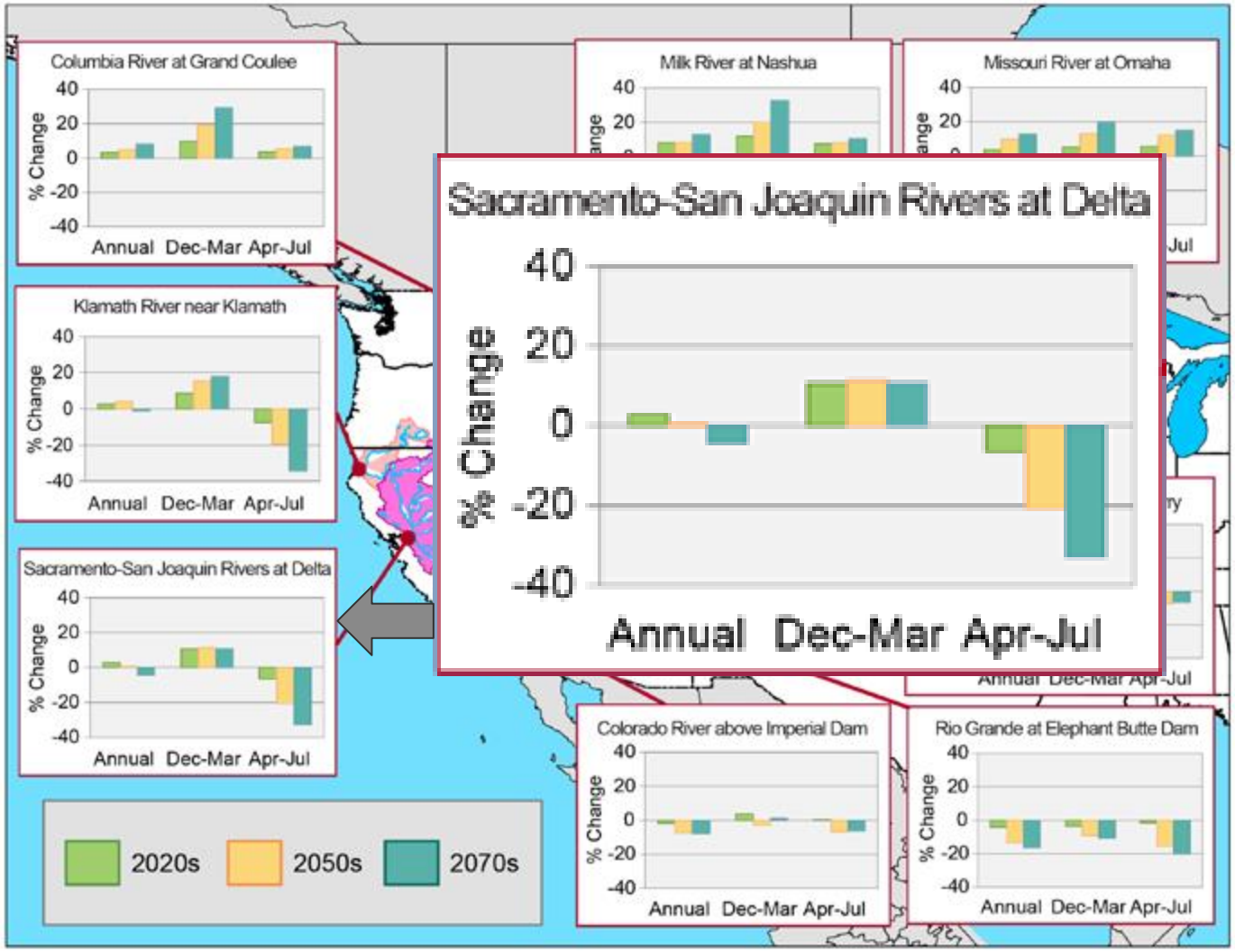
Source: IPCC AR5

Projected Temperature Change



Source: IPCC AR5 and 2014 National Climate Assessment

Projected Runoff



Source: 2014 National Climate Assessment

EBMUD Energy Strategy

- Minimize energy use
- Minimize energy costs
- Diversify our energy supplies
- Educate our employees and customers

District Power Purchases

- 148,000 MWh in FY2013
- Purchased from
  - PG&E
  - SMUD
  - WAPA
- Self-Supply

Sector	%
Water Treatment	11%
Distribution Pumping	44%
Admin/Raw Water Pumping	11%
Wastewater	34%

Water and Energy Use

- Each year water-related energy use in California consumes
  - 19% of the state's electricity (48,000 GWh)
  - 30% of its natural gas
  - 88 million gallons of diesel fuel
- Of the 19% electricity use
  - 4% used by water utilities
  - 1% used by wastewater utilities
  - 14% used by end users
- Energy use during droughts increases as other supplies are utilized

Energy Use in Perspective

60 watt light bulb for 8 hours = Walking for 82 days

Dell GX280 for 8 hours = Walking for 246 days

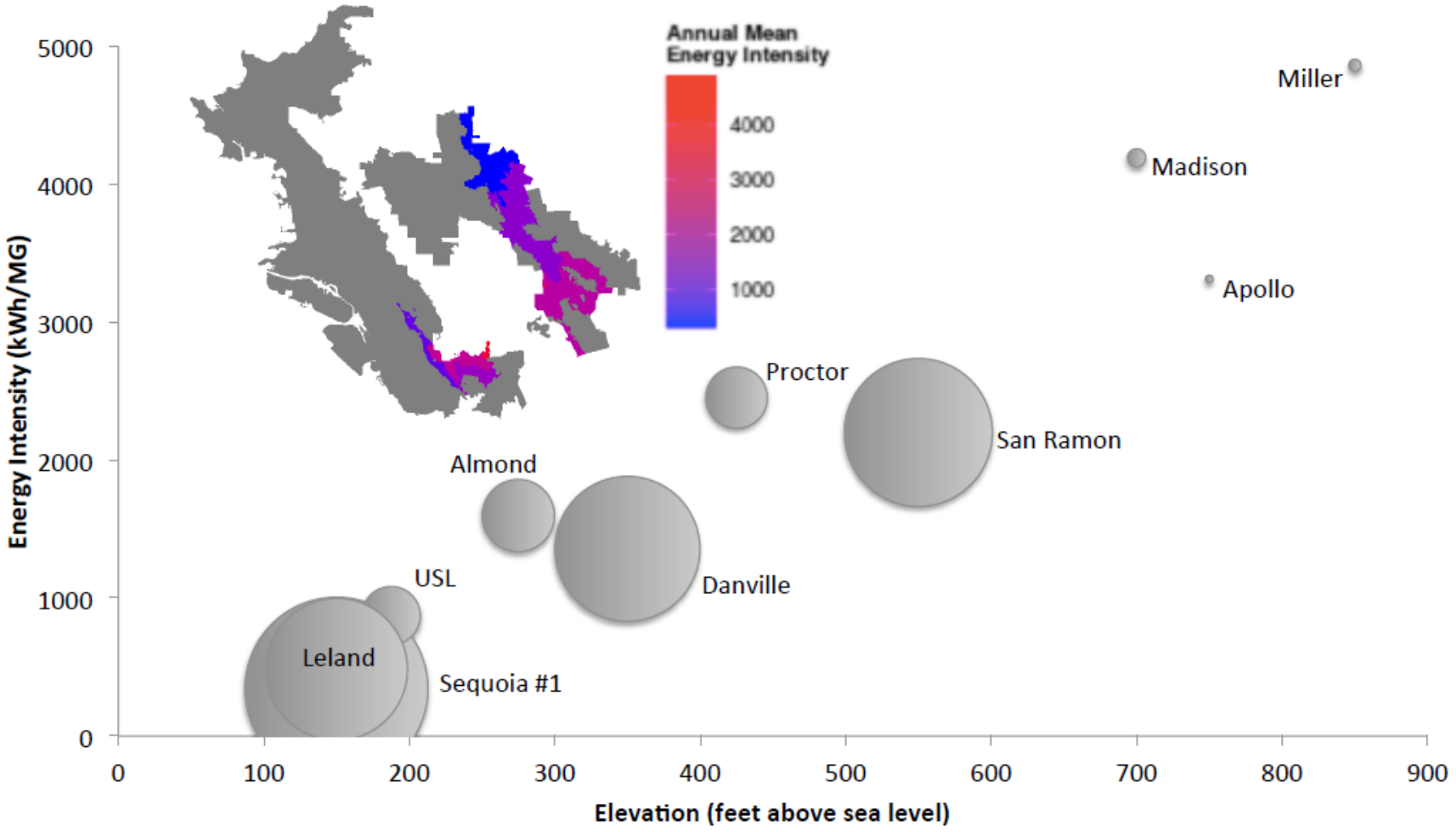
Electricity use for water in CA = Walking for 12.5 billion years

UC Davis Study Project Goals

- Estimate energy intensity (EI) of water
- No one-size-fits all EI number that can be given a gallon of water
- Need to consider seasonal and spatial effects on energy

UC DAVIS
CENTER FOR WATER-ENERGY EFFICIENCY

Spatial Variation in Energy Intensity



Size of the bubbles = relative water consumption by zone

Benefits

- Developed characterization of when and where energy is being used
- Map of energy intensity enables intelligently targeted conservation efforts and infrastructure upgrades
- Set realistic targets for energy and water conservation
- Enable energy efficiency programs through water conservation

Less Water = Less Energy

- Promote water conservation
- Demand Management
  - Home surveys and rebates
  - Education and information
  - New service regulations
  - Research on technology

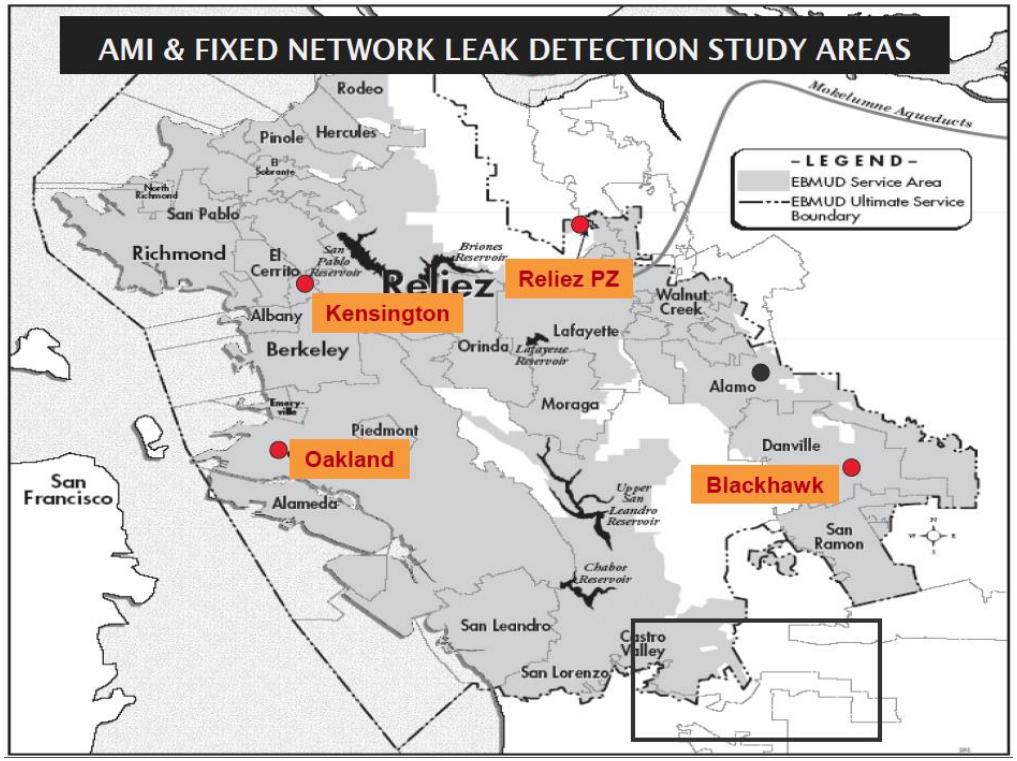
Steamer Field Study
Cost Comparison

Steamer Type	Boilerless Steamer (single compartments)	Boiler-Based Steamer (single compartments)
Annual Energy	$912	$4,822
Annual Water	$33	$979
Total Costs	$945	$5,801
Savings	**$4,856**	

Based on monitoring 12 steamers with an average daily use of 6.5 hours
360 days/yr operation at $0.13/kWh & $5.00/100 cu.ft. water/sewer

A Multi-Scalar Approach

- Infrastructure-wide
  - SCADA system data
  - Asset data
  - Energy data
- Four Pressure Zones
  - Water meter data
  - Energy meter data



Advanced Metering Infrastructure Projects

Website Features	Blackhawk 	Reliez 
Historical Use	Previous 10-years	NA
Water Use Data	Yearly, monthly, daily, hourly	
Data Units	Billing units, cubic feet, gallons, dollars	
Customized Alerts	Potential leaks, daily water budget	
Notifications	Email, telephone, postcards	
Customer Reports	Graphical and Excel	
Admin. Reports	Aggregate consumption, leakage, demand profiles	

Blackhawk: Aggregate Hourly Consumption Profile

EBMUD

SIMON SAVES

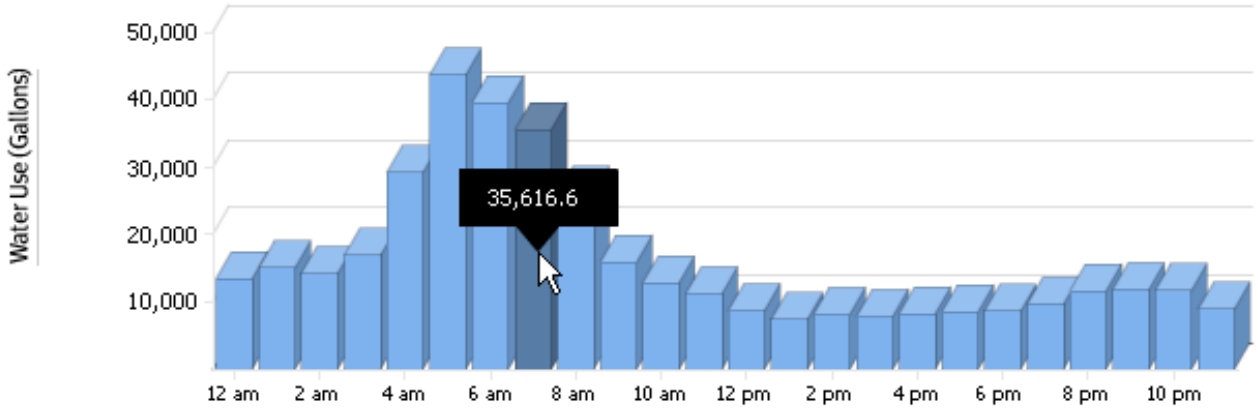
Welcome, admin | Logout

Admin Controls | MANAGE ADMINS | USER LOOKUP | REPORTS | SYSTEM MESSAGES

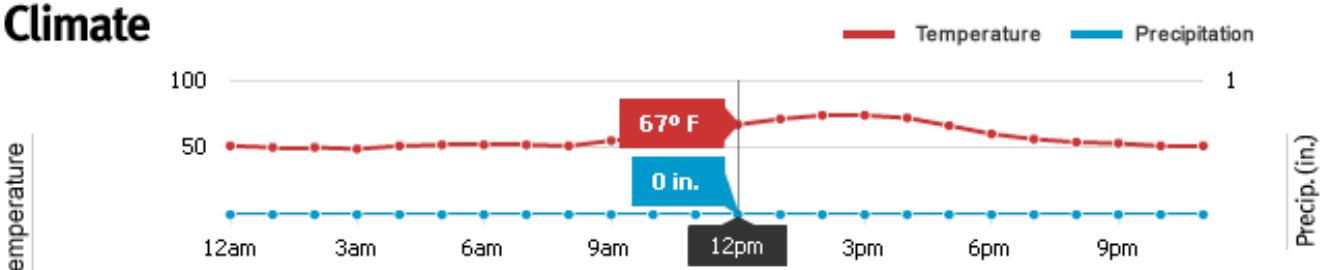
Reports › Water Usage

Hourly Water Usage

Hourly usage for 10/10/2009



Climate



QuickView

Yearly | Monthly | Daily | Hourly

Meter Read Report

- Monthly Reads
- Daily Reads
- Hourly Reads

Select Month | 2009

DOWNLOAD

Consumption Report

Enter timeframe

Filter: Usage is greater than

Gallons

DOWNLOAD

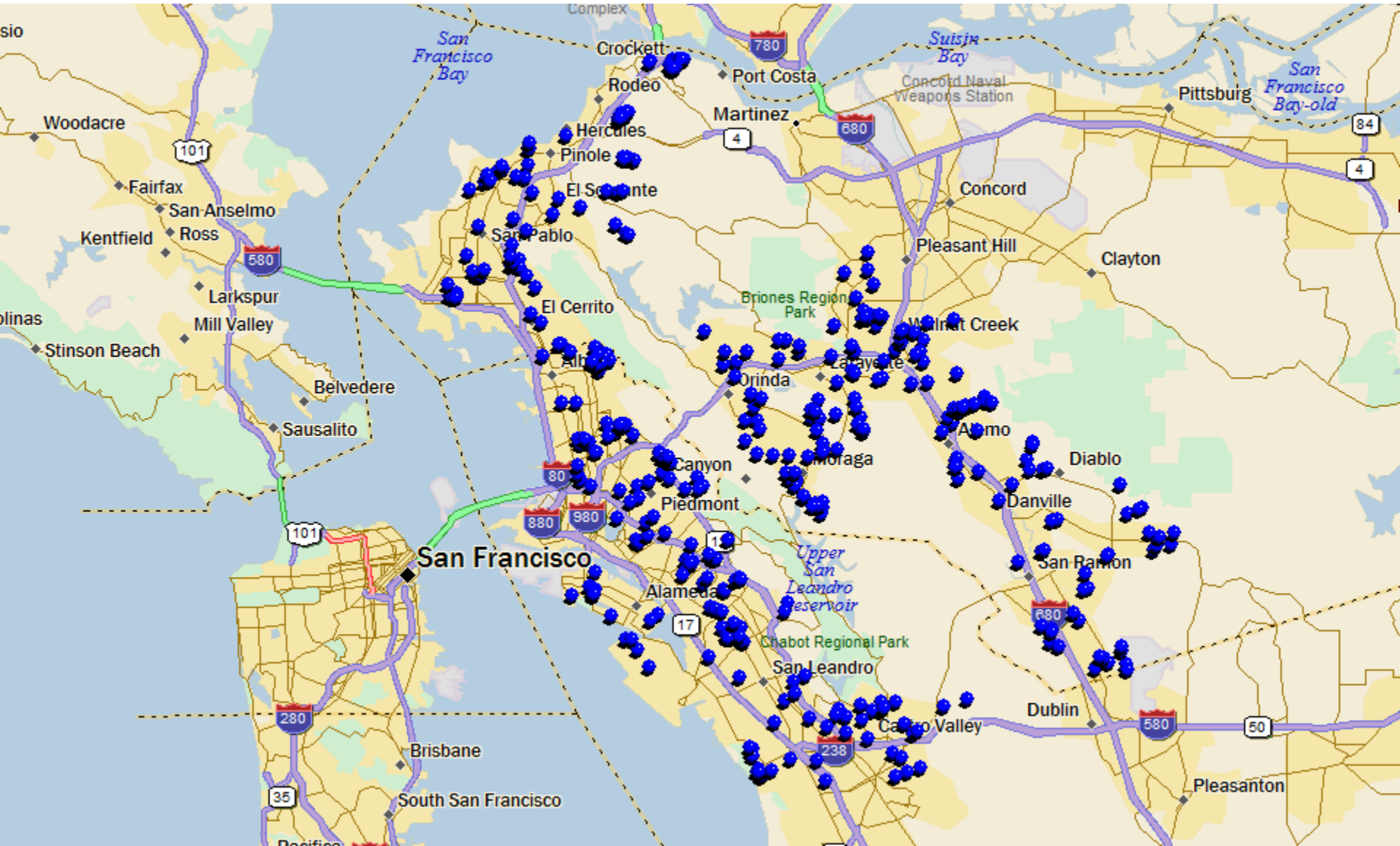
Blackhawk: Automated Reading and Billing Statistics

>35,000 billing reads October 2011- June 2013

>18 million hourly reads that customer have access to for 2013

>100 million hours of consumption data available to conservation staff since 2009

Unmeasured Flow Study

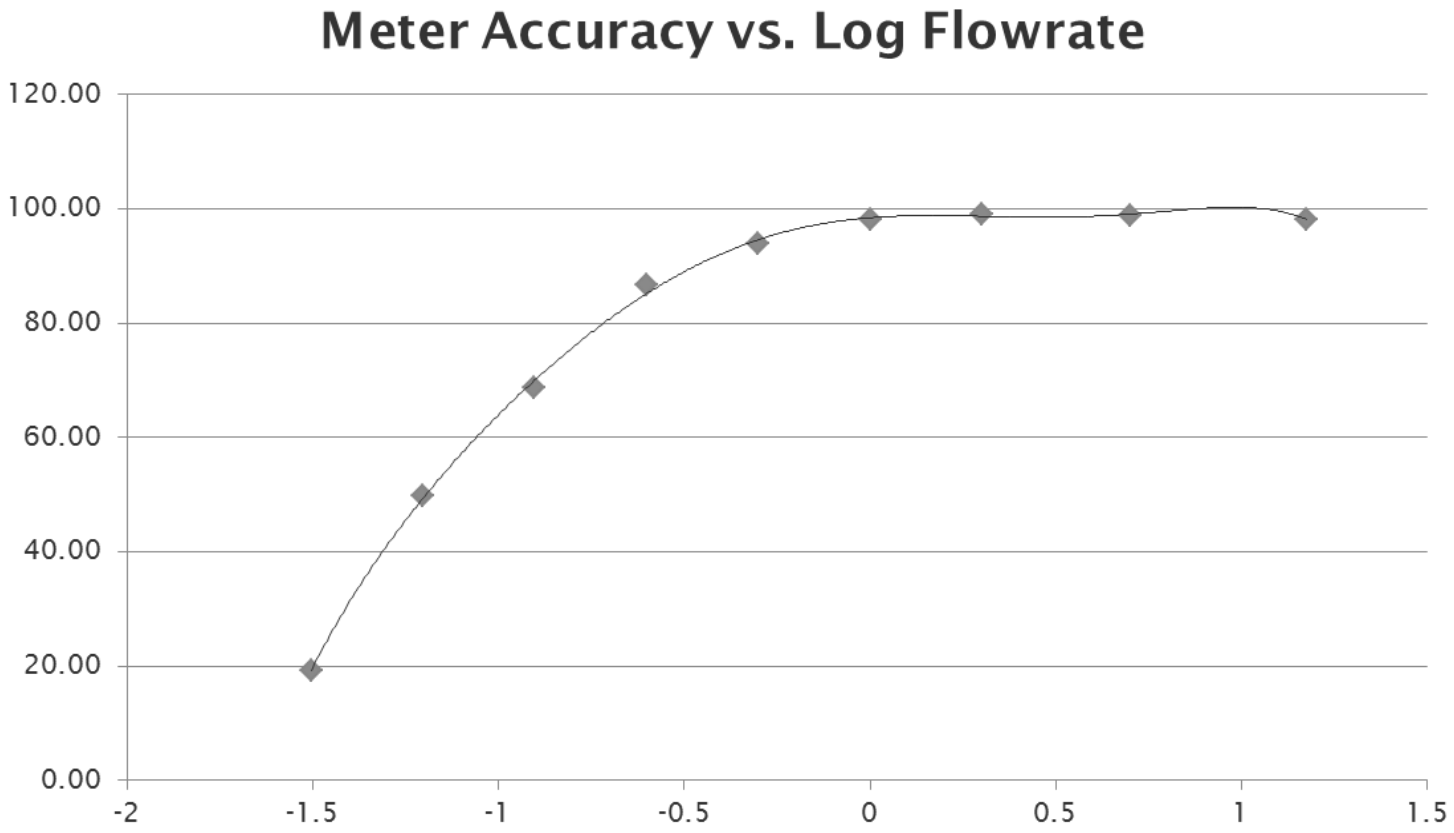


Unmeasured Flow Study

- Replaced approximately 500 meters with Sensus Iperl Mag Meters
- Over 200 pulled meters tested down to 1/32nd gpm
- Iperl Meters remain accurate at 1/37 gpm
- Meter Resolution is 0.001 CF or about 1 ounce of water
- Datalogging at 1 minute intervals
- 60 million meter reads!

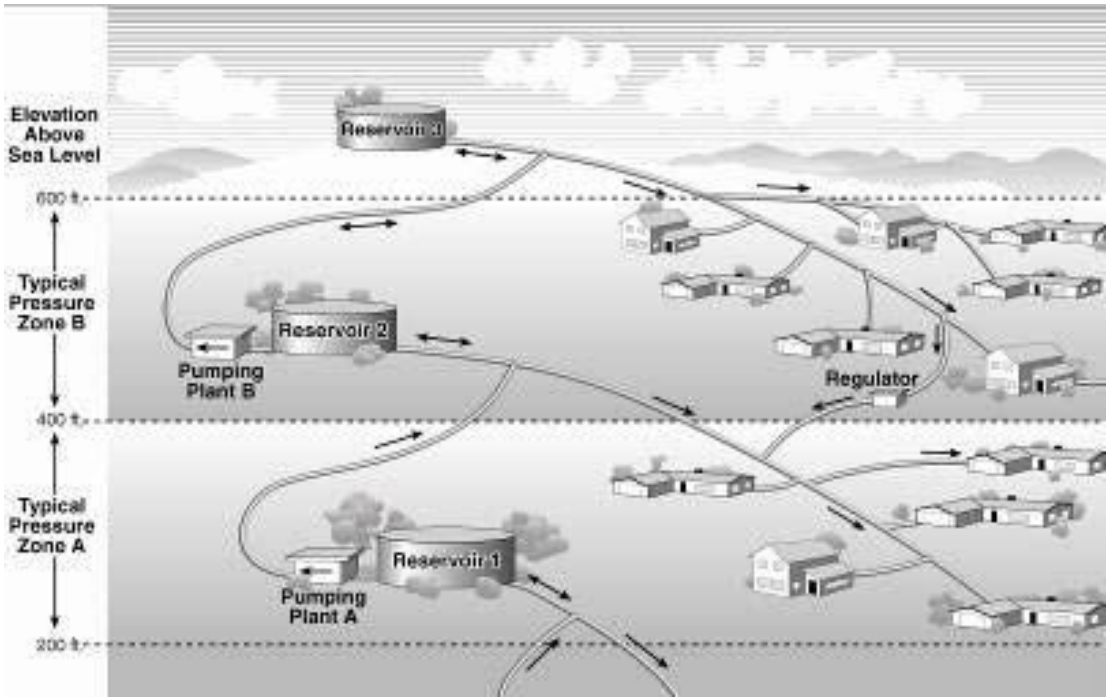
Unmeasured Flow Study Preliminary Results

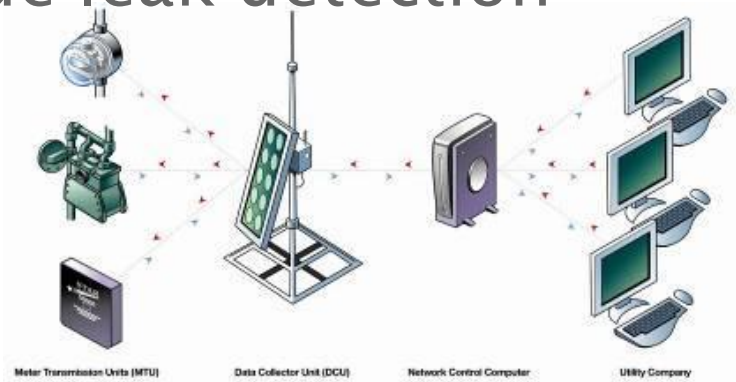
Flowrate	15	5	2	1	1/2	1/4	1/8	1/16	1/32
% Accuracy	98.2	98.9	99.2	98.1	93.9	86.8	68.7	49.9	19.2

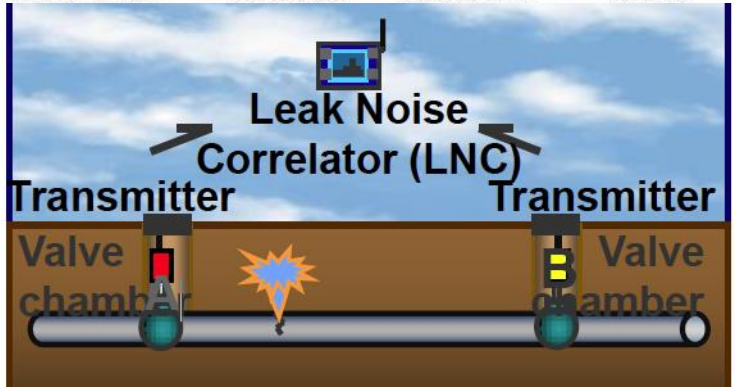


Water Balance – Leak Detection

Concept: Real-time, spatially derived water balances to enhance system wide leak detection

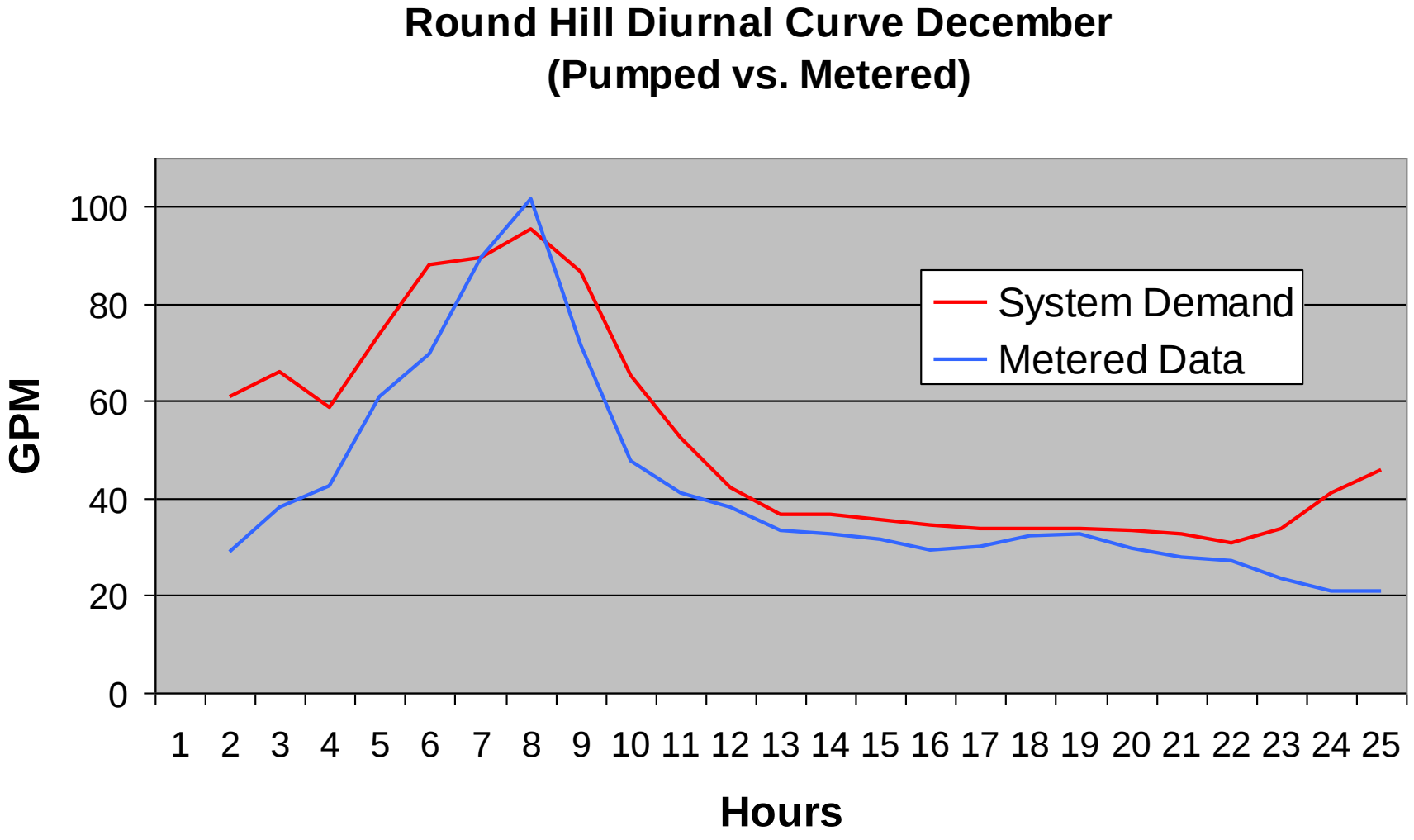






***Impact:* Accelerate leak detection to reduce water loss an minimize potential pipe damage and service interruption.**

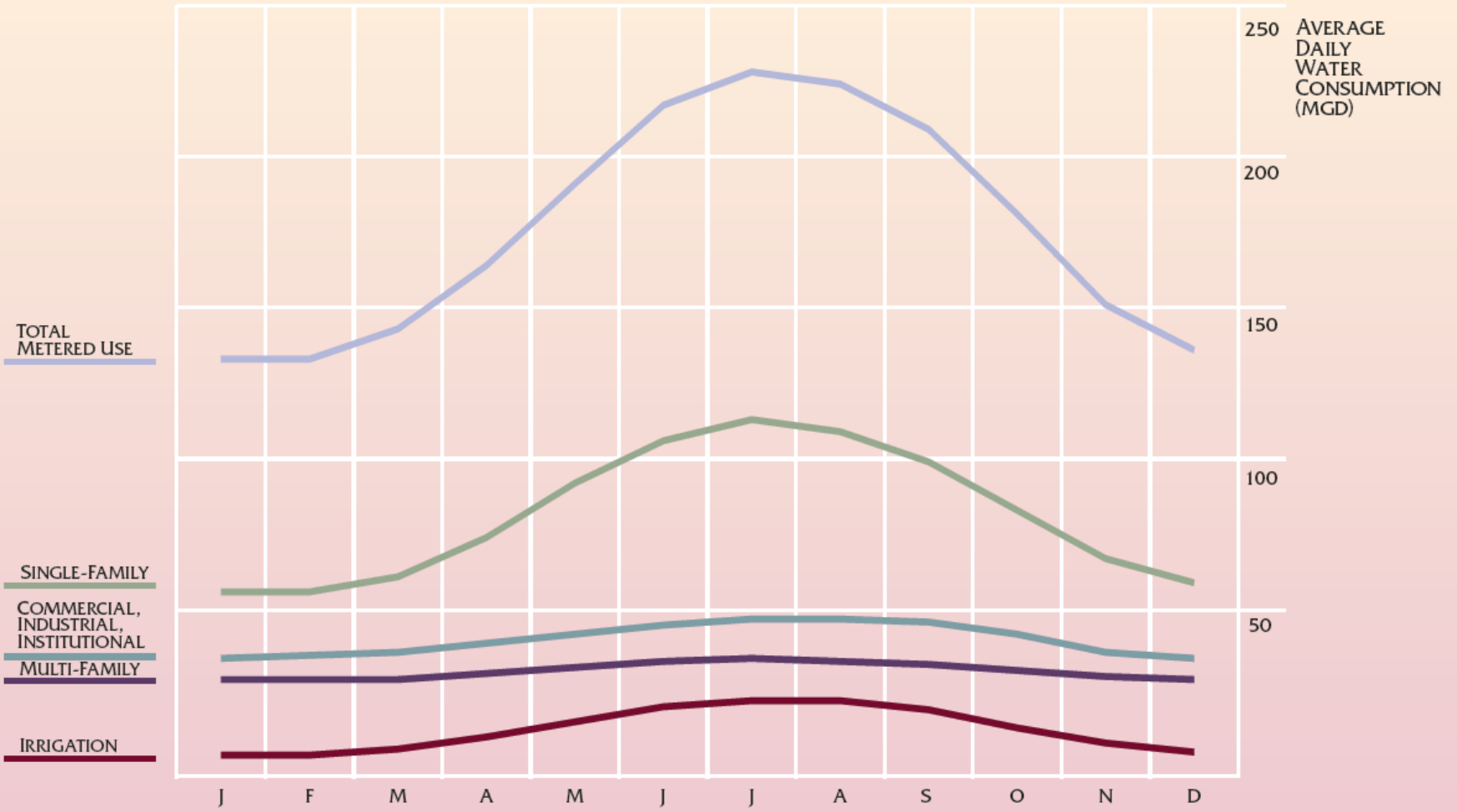
Pressure Zone Balancing



Seasonal Use by Customer Category

FIGURE 6-4

MONTHLY WATER USE BY CUSTOMER CATEGORY



NOTES:
1. Based on Calendar Year 1975-2010 consumption data.
2. Total metered use includes water, fire and hydrant use by all customer categories, including petroleum.

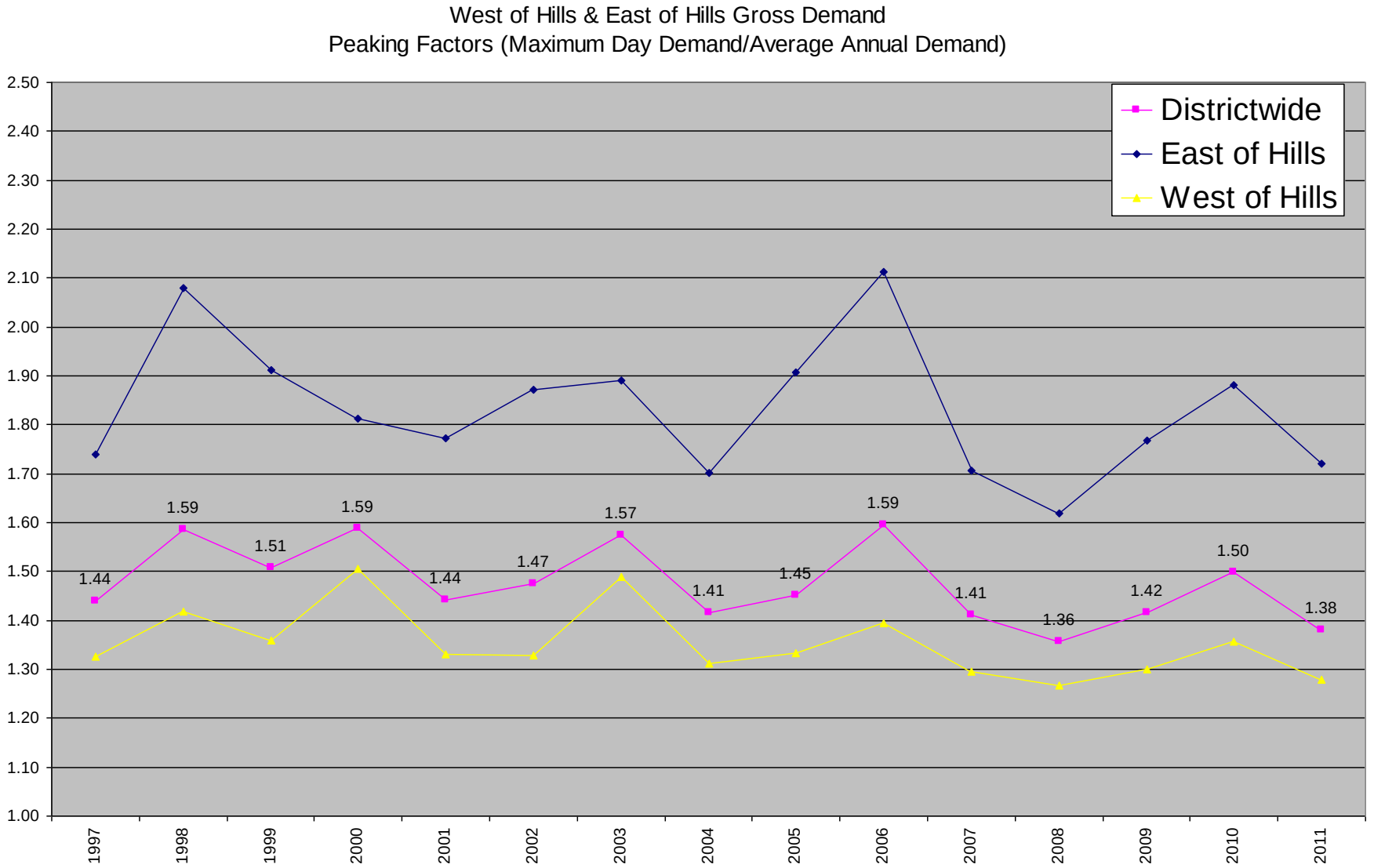
How do we size new facilities?

- Statistical analysis of historical peaking factors (peak day/average annual) to determine 1 in 20 year return period (maximum day demand)
- Apply peaking factor to projected future demands from 2040 Demand Study
- Apply Engineering Standard Practice sizing criteria
  - Pumping Plants: 1.5 X Maximum Day Demand
  - Reservoirs: 1.0 X Maximum Day Demand
  - Water Treatment Plants: 1.0 X Maximum Day Demand
  - Pipelines not straightforward (based on level of service) but are influenced by Maximum Day Demand

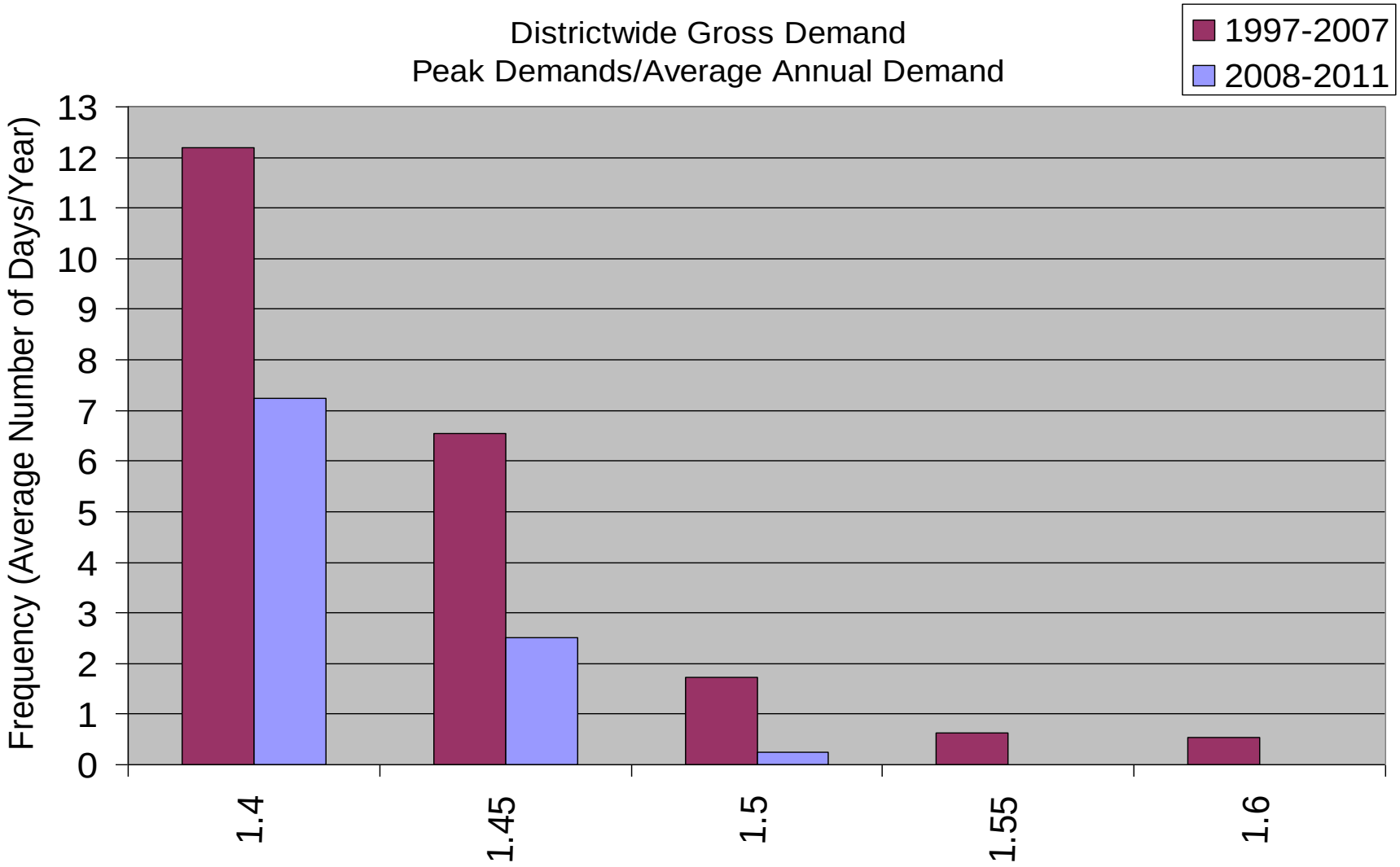
Water Conservation: Why does it matter?

- 44 MGD Districtwide Average Annual Conservation
- 1.59 Districtwide Maximum Day Demand Peaking Factor
- 70 MG Storage, 70 MGD Water Treatment Plant, 105 MGD Pumping Plant, and ??? Pipeline Capacity
- Expand Sobrante WTP Capacity by 25 mgd (55 mgd to 80 mgd)
  - Capital Cost Estimate (2007) = $72.6M (~$2.9M/MGD)
- New Wildcat PP at 32 mgd
  - Capital Cost Estimate (2007) = $9.9M (~$3.1M/MGD)
- New Highland Reservoir at 2.7 MG
  - Contract* Cost (2010) $5.7M (~$2.1/MG)

Historical Maximum Day Demand Peaking Factors

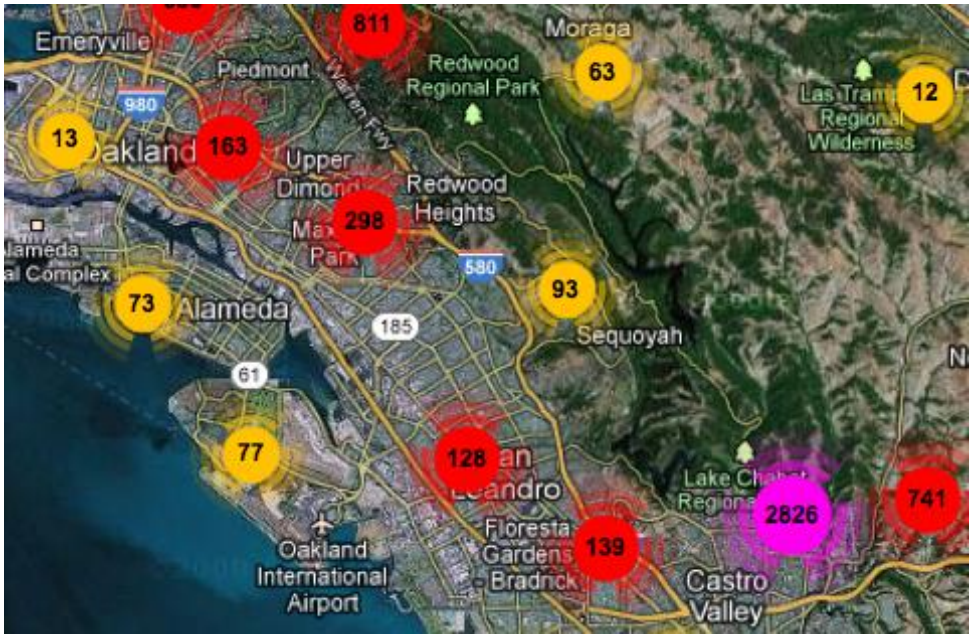


Frequency of High Demand Day Factors



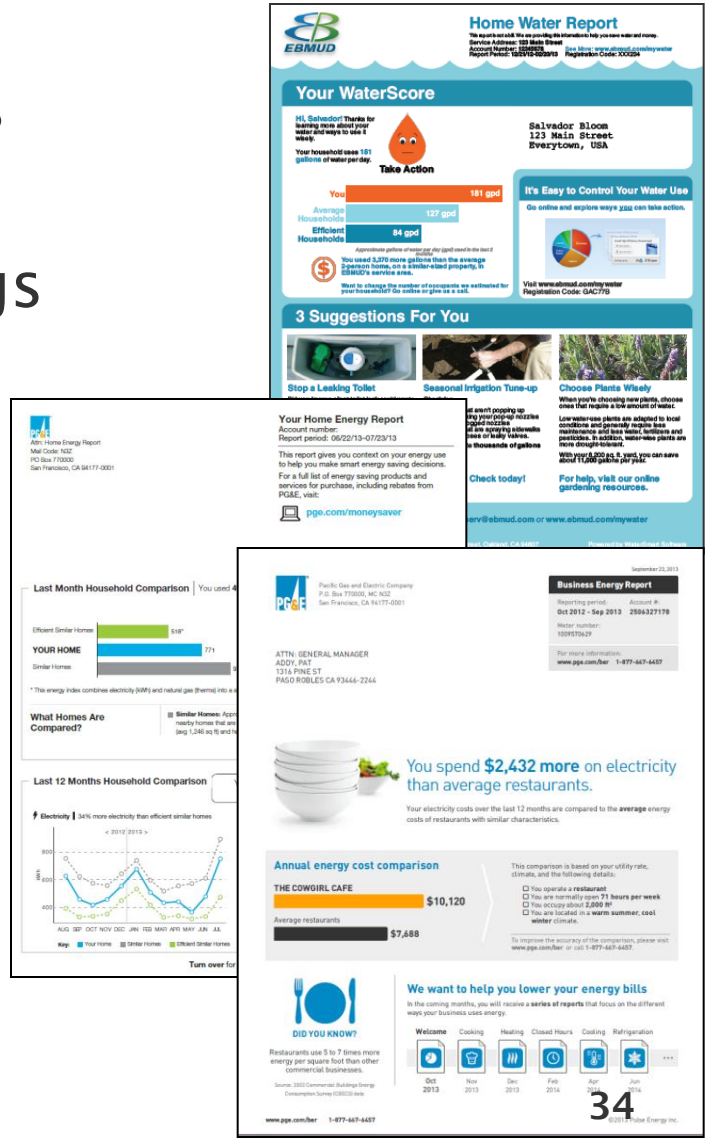
Home Water Report Pilot Study Participants

City	No. of Participants	Control Group	Total
Castro Valley, CA	8,000	-	8,000
Oakland, CA	-	3,500	3,500
Random	1,500	1,500	3,000
Total	**9,500**	**4,000**	**14,500**



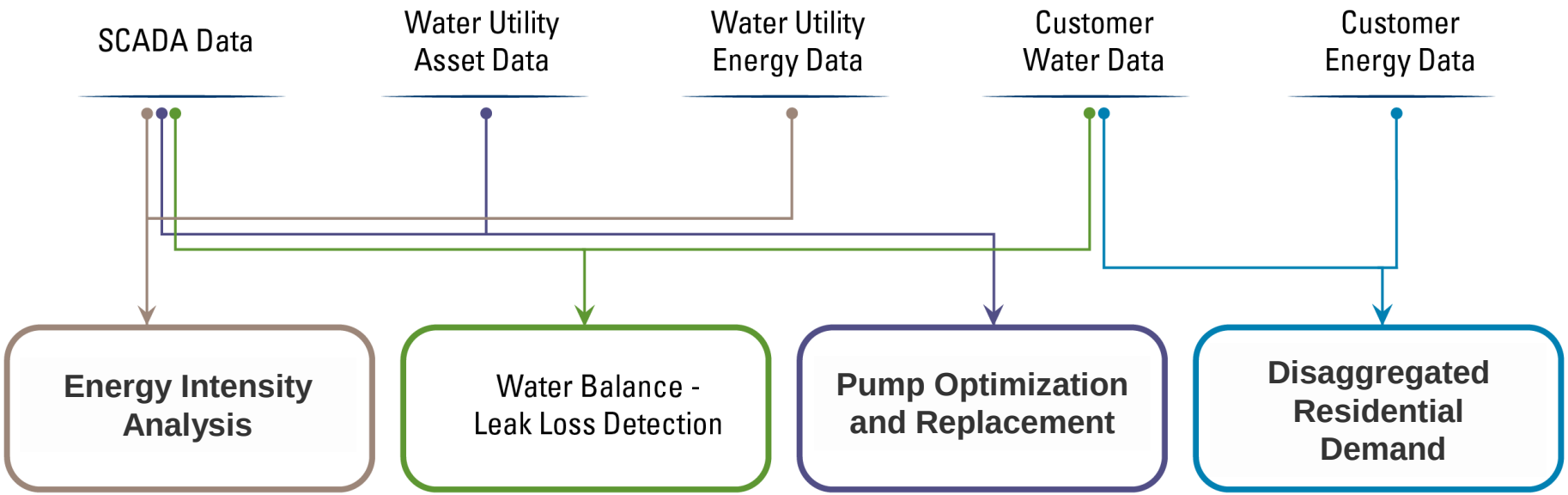
EBMUD-PG&E Joint Water-Energy Report Pilot Proposal

- Evaluate parcel-level energy savings achieved through water reports
- Estimate system-level energy savings achieved through water reports (embedded energy)
- Develop template for combined water-energy report
- Test combined report format with focus group
- PG&E funding through *Emerging Technologies* program w/potential for future resource programs



Foundational Data Analytics

Concept: Integrating existing data and enhanced analytics to design and demonstrate cloud computing



Impact: **Deeper energy & water savings, better monitoring & performance verification, and new revenue streams**

W-E Challenges & Opportunites

EBMUD

Challenges

- Need additional water and energy use data
- Need new methodologies to address efficiency gains and GHG/carbon credits and avoid double counting
- Differential in water and energy costs and ROI

Opportunities

- Advance utility, market and consumer awareness
- Improve and expand on W/E data collection and metrics
- Analyze and promote incentive funding for cold and hot water efficiency programs that save energy
- Expand public-private efficiency partnerships