Information Technologies to Support Water Conservation

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Overarching Goals

Situate urban water conservation in the current discussion about water planning and management strategies in Utah.

Talk about successes and developments in urban water conservation approaches that make it a viable option for providing significant future water supplies.
Overview

- Water management challenges
- Conservation’s “untapped” potential
- The conservation conundrum
- Demand management infrastructure
- Implications for investment strategies
Water Management Challenges
A Central Water Challenge

<table>
<thead>
<tr>
<th>Key Question:</th>
<th>Resource Constraints:</th>
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<tr>
<td>How can we best accommodate a growing population, promote a vibrant economy, and maintain a healthy natural environment in an era of resource constraints?</td>
<td>Two resources that are generally scarce, highly variable, and subject to a variety of risks:</td>
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<tr>
<td></td>
<td>• Western water resources</td>
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<td>• Public sector financing</td>
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Water utilities are at the crossroads of a changing water resource and financial environment - Christine Boyle

- Recent economic recession
- Increasing water shortages
- Declining per capita demand
- Aging infrastructure
- Tightened access to capital
- Climate change

“…the strongest financial solutions will be those that increase utilities’ capacity to adapt to change”

Source: C.E. Boyle, January 2014, JAWWA
Needed Water Infrastructure Investments

US 12th globally
*World Econ. Forum, Global Competitiveness Report 2014-2015*

Drinking water infrastructure graded D+

240,000 water main breaks/yr
*ASCE (2013)*

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**The Salt Lake Tribune**

**Cleanup from E. Salt Lake City water main break continues**

By Bob Mims The Salt Lake Tribune
Published October 13, 2014 7:59 am

East Salt Lake City's Foothill Boulevard was open to commuters Monday morning, but a section of 1700 South remained closed as crews continued repair work in the wake of Friday night's water main break and subsequent 2.5 million-gallon flood.

The break in the 48-inch water main — blamed on a failed fitting — sent a river flowing west on 1700 South to near 2500 East, from near its intersection with Foothill Boulevard. Varying amounts of flooding were reported in 34 homes as well as the Montessori Community School at 2416 E. 1700 South.
Water Management Strategies

Conservation

Optimization

Sequencing

Prioritization

Synergies

New Supplies

Water and Financial Efficiencies

R³ Existing Infrastructure

Repair
Replace
Redesign
Water Conservation’s “Untapped” Potential

Value Landscaping: Evaluating Landscapes for Environmental and Financial Sustainability
Urban Water Conservation

Why it Matters

- Rapidly growing percentage of Utah’s total water use
- Location – requires large physical transfers of water from outlying rural and natural areas
- It is less flexible than agricultural water use in times of shortage (can’t “fallow a subdivision”)
- Water use expectations and behaviors are being established in the urbanization process
- Physical conversion of moving water from ag. to urban use has long-term implications for future water demand:
  - water delivery and metering infrastructure
  - urban design and initial investments in landscaping
  - situational constraints on efficiency
Seattle, WA

Chart 3: Growth in Population and Water Consumption
Seattle Regional Water System: 1975-2010

Water Conservation Returns – Seattle

FIGURE 2  Demand forecasts with and without conservation

Source: Graphic courtesy of Bruce Flory, Seattle Public Utilities (2009)

Los Angeles

Context:

- Growing population and economy, and yet...
- ... they flattened water demand

Success due to:

- A budget-based rate structure
- Portfolio of innovative conservation incentives

San Antonio

Context:
- Growing population
- Endangered species
- Edwards Aquifer
- Drought
- *Reduced per capita water use 42% since 1994*

Success due to:
- Conservation pricing
- Education/Outreach
- Financial incentives

*Story*: http://carpediemwest.org/newvisions-smartchoices
Santa Fe

Context:
- 2002: demand = supply so no wiggle room
- Reduced per capita water use 40% in 10 years

Success due to:
- Aggressive conservation
- Financial incentives
- Recycling programs

Source: http://carpediemwest.org/newvisions-smartchoices
San Diego

Context:

• Had to move from imported to local water sources
• Reduced residential water use 30% over 7-year period

Success due to:

• Low-flow fixtures
• Low-irrigation landscaping
• Behavior change
• Conservation agreements with agriculture

Source: http://carpediemwest.org/newvisions-smartchoices
## Conservation Assessment

<table>
<thead>
<tr>
<th>Conservation successes</th>
<th>“Untapped” potential</th>
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<tbody>
<tr>
<td>Water use reductions</td>
<td>Outdoor water use efficiency</td>
</tr>
<tr>
<td>Awareness raised &amp; people responsive to drought</td>
<td>More widespread and durable reductions through changes in habits and norms</td>
</tr>
<tr>
<td>Voluntary conservation programs implemented</td>
<td>Greater use of markets and mandates (e.g. rates, codes)</td>
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<tr>
<td>Uniform building code has had big effect indoors</td>
<td>Finding outdoor equivalent of the building code</td>
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<tr>
<td>“Low-hanging fruit”</td>
<td>Needs greater investment</td>
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Conservation Conundrum

**co·nun·drum**

n.

1. A confusing and difficult problem or question.
## Conservation Conundrum

### Glass Half Full

- Efficiency will yield appreciable environmental and economic gains
- Utilities benefit from improved capacity utilization and life extension
- Customers benefit from avoided capital and operating costs

### Glass Half Empty

- Demand erosion presents utilities with a significant but surmountable financial challenge
- Rising infrastructure costs must be recovered from a shrinking sales base
- Water use responds to market forces and mandates

*Source: Beecher, 2010; Leurig, 2013; CERES*
Like the proverbial Water Works on the Monopoly board, water utilities were for well over a century low-risk and provided a steady, if unspectacular, return on investment. But every assumption that made water look like a sure bet is now in question: supplies are under stress, demand projections are questionable, and upward price pressures are intense. For investors and suppliers this will require a new way of thinking about water. -Sharlene Leurig

Recent Report:
“Conservation is critical to minimize risk and build financial resilience” (thinking long term)

- Allows utilities to cut operation and maintenance costs
- Helps defer expensive supply expansion projects (avoided costs)
- Helps reduce total demand, shave peak use, provide revenue stability

“...credit rating agencies have recognized conservation as a best practice in water utility policy... [and] necessary to deal with long-term risks associated with supply shortages and high costs of capital”

Source: C.E. Boyle, January 2014
Demand Management Infrastructure
If you don’t meter water, you can’t manage it.

Issue in many ag-to-urban transition areas

Example: Weber Basin Water Conservancy District

WBWCD meter installation project for pressurized secondary irrigation systems
WBWCD METER TRANSITION:

- Approximately 16,500 direct retail connections
- Approximately 50,000-60,000 total secondary connections in the district’s service area
Trend – Advanced Metering Analytics

Evolution of AMR to AMA

AMR – Automated Meter Reading

- Mobile Meter Reading
- Provides Efficient Reading with Monthly Billing Data

AMI – Advanced Metering Infrastructure

- Fixed Network Meter Reading
- Provides Raw Daily or Hourly Data

AMA – Advanced Metering Analytics

- Fixed Network with Powerful Analytics Software
- Provides Actionable Proactive Intelligence

How is Technology Changing the Water Utility Industry?

- Dan Merritt & Kristie Anderson, Badger Meter
Software applications to analyze and manage urban landscape water use

Example: USU’s WaterMAPS™
Basic Approach: definingappropriateness of urban landscape irrigation relative to plant water needs
Basic Approach: 
Identifying Capacity to Conserve

Landscape Irrigation Ratio (LIR)

Landscape Water Use \( \text{estimated} \) 
[gallons extracted from municipal or water provider meter/billing data]

LIR = 

Landscape Water Need \( \text{estimated} \) 
[calculated from landscaped area (derived from classification of airborne remotely-sensed multispectral imagery) and local evapotranspiration (\( ET_0 \)) modified by relevant landscape correction factors for turf vs. trees and shrubs]

\( \text{(per unit of landscaped area)} \)

LIR less than 1 = Efficient 
Between 1 and 2 = Acceptable 
Between 2 and 3 = Inefficient 
Greater than 3 = Excessive

WaterMAPS™
Seasonal LIR Calculations

- Time Period: 4/1 - 10/31, 2013
- Locations analyzed: 1369
- Mean LIR: 2.01

Quantifies Conservation Potential
Analysis using hourly data

- People generally do not water during the middle of the day
- People who overwater do so at night
- Caution about only using “visual cues” to enforce waste restrictions
Analysis of seasonal patterns

- Can be used to better design water policies and deliver conservation programming

### Monthly LIR at this location

<table>
<thead>
<tr>
<th>Month</th>
<th>LIR</th>
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<tbody>
<tr>
<td>May</td>
<td>1.41</td>
</tr>
<tr>
<td>June</td>
<td>1.48</td>
</tr>
<tr>
<td>July</td>
<td>2.81</td>
</tr>
<tr>
<td>Aug</td>
<td>2.13</td>
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<tr>
<td>Sept</td>
<td>1.84</td>
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<tr>
<td>Oct</td>
<td>1.93</td>
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Example: Individual Water Use Reports:
(WBWWCD Meter Transition Project)
Made possible by investments in new sources of data
(4) Irrigation Systems

Design
Maintenance
Operation
Springtime Sprinkler Tune-Up Checklist

1. Check the Soil
   Use a shovel to make sure the soil is thawed to a depth of at least 12".

2. Check the Controller
   Clean, check settings and replace the battery back-up.

3. Check for Obstructions
   Remove dirt and debris from sprinkler heads.

4. Check for Wear & Tear
   Replace broken or worn nozzles, valves, pipes, and other components.

5. Check the Valves
   Inspect valves closely to ensure they are functioning properly and there is no leakage.

6. Check for Surge
   Open valve slowly when restoring water to avoid system damage from a water pressure surge.

7. Check Water Pressure
   Make sure the water pressure is within the suggested operating range, typically 40-65 PSI.

A checklist to get your automatic sprinkler system up and running again following its winter hibernation.
Increasing irrigation system efficiency increases conservation potential.

- **2012 average LIR = 1.26** (average savings = 56,583 gal)
- **2013 average LIR = 1.06** (average savings = 11,780 gal)

- **2012 average LIR = 1.89** (average savings = 129,703 gal)
- **2013 average LIR = 1.59** (average savings = 75,973 gal)

- **2012 average LIR = 2.52** (average savings = 166,213 gal)
- **2013 average LIR = 2.12** (average savings = 108,069 gal)
Given current financial and ecological constraints, utilities will have to embrace a new form of infrastructure if they intend to provide reliable, reasonably priced water services. ...It includes the many improvements, practices, and devices that conserve water and retain stormwater onsite. ...this new infrastructure is often distributed across many properties, some of them privately owned...[and] serves the same purposes as conventional infrastructure...”

Recent Report:
Bond Financing Distributed Water Systems: How to Make Better Use of Our Most Liquid Market for Financing Water Infrastructure,” S. Leurig (Ceres) and J. Brown (Univ. TX School of Law), Sept. 2014
Investment Strategies

strategy
(străt′ ē-jē) n.
1. Plan of action designed to achieve a particular goal.

Every Drop Counts.
Traditional focus was on supply provision
New focus must put demand in the picture
Water Systems Broadly Conceived

Hydro-ecological components

Human components

Highly integrated or “coupled”
Supply-driven perspective
Engineered approach
Centralized systems
Reliant on “grey infrastructure”
“Hard Path”

Demand management emphasis
Behavioral approach
Decentralized systems
Reliant on “green infrastructure”
“Soft Path”
Bottom Line

- Opportunities to shape and sustain our future
- Be serious about water demand management
- Backed by a portfolio of strategic investments in “water conservation infrastructure”
- Propelled by commitment to using water wisely
- Dedicated to making Utah a leader (again) in water management in the West


References


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