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A Balanced Approach to Water Conservation: Removing Barriers and Maximizing Benefits

Sponsored by:

Water Research Foundation

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Outline

- Conceptual Framework for Water Use Efficiency
- Institutions, Incentives, and Water Efficiency
- Planning Models and Methods
  - Short Term Financial Models
    - Adapting the Traditional Utility Finance Model to Include Conservation Pricing and WUE Programs
  - Long Term Resource Planning
    - Benefit-Cost Models – Program Planning and Tracking
    - Avoided Cost Models – Conservation Program Benefits
    - Integrated Planning Models – Risk, Uncertainty, and Planning Portfolios
- Case Studies of Utility Conservation Implementation
- Decision Support Matrix and Research Needs

Confusion over Conservation

- "Conservation" can mean:
  - mandatory curtailment during water supply shortage,
  - any decrease in human water consumption, or
  - water that is stored for later consumption.
- "Conservation programs" can denote
  - a public relations campaign,
  - provision of efficient plumbing devices,
  - on-site water use surveys, or
  - retrofit on resale legislation or landscape ordinances.
- This Project: Conservation as Water Use Efficiency
  - Devices/practices whose benefits exceed costs

Role of Conservation

- Short Term Drought Response
  - In response to shortage, customers can reduce consumption (customer shortage cost is the avoided benefit of water use)
  - Utility drought management—information programs, restrictions, drought pricing—is a planning problem!
- Long Term WUE Investment
  - Benefit Cost Analysis—What is the potential for WUE investment?
  - Avoided Cost Analysis—What is the benefit of WUE?
  - Integrated Planning—How should WUE fit into the portfolio of water resources?

Conceptual Framework

Source: WaterRF 4175- A Balanced Approach to Conservation: Removing Barriers and Maximizing Benefits, 2010.

Conservation and Institutional Structure

- How does institutional structure relate to water conservation planning and implementation?
- Who should do what?

How Institutional Structure Affects the Conservation Challenges and Opportunities

	Challenges	**Opportunities**
Size	Small systems and industry fragmentation	Linking conservation to capacity development
Scope	Wholesale and retail water system operations	Aligning incentives and strategies to optimize solutions
Ownership	Differing incentives of public and private systems	Cost avoidance and methods for addressing cost recovery
Oversight	Uneven role of oversight bodies in encouraging conservation	Increased uniformity of oversight expectations and enforcement
Rights	Variations in water law and water availability	Refinement of governance of withdrawal and use

Rational for a Regional Approach

- Due to the misalignment between who pays program costs and who receives its benefits…
- There is a strong rationale for a regional approach to implementing cost-effective levels of water conservation.

Mechanics of Implementing Regional Conservation

- Accounting Controls
- Tracking Planned Programs
- Monitoring Performance
- Evaluating Results
- Incorporating the above into plans

Adapting the Traditional Utility Finance Model to Include WUE Programs

- **Revenue Forecasting** – Incorporation of ongoing efficiency, efficiency pricing, and drought pricing
- **Revenue Requirements** – Broader definition to include:

  1) renewal and rehabilitation of water infrastructure,

  2) distribution efficiency and water use efficiency programs,

  3) affordability programs, and

  4) investments to protect and preserve local watersheds.
- **Cost Allocations –** Cost allocation of joint costs of WUE and stewardship.

Adapting the Traditional Utility Finance Model to Include WUE Programs

- **Rate Design** –To more fully reflect the true forward-looking resource costs of service delivery and enable funding of sustainability programs consistent with a water resource stewardship role.
- **Financial Planning for Drought Management -** Planning for shortages and drought as a matter of standard practice rather than as a response to crisis. Financial plans that anticipate reductions in the availability of water supplies, increased customer outreach expenses, and drought pricing for revenue management.

Useful Planning Models

- Short Term Financial and Drought Planning
  - Rate Models - Sales and Revenue
  - Drought Management—Minimizing Shortage Costs
- Long Term Resource Planning
  - Avoided Cost Model – Benefits of WUE
  - WUE Benefit Cost Model
  - Least Cost Planning
    - Balancing Supply Costs with Customer Shortage Costs
    - Relationship Between Avoided Costs and Shortage Costs
  - Analysis of Water Resource Portfolios

Short Term Planning

- Needs to address short-term Drought Contingency Planning
  - Conservation induced by Price
  - Conservation not induced by Price
- How much can/will customers reduce consumption during a shortage event?

Example: WaterRF Drought Response Tool

- An **empirical** planning tool for planning for Drought Response
  - 4 Drought Stages
  - 4 Customer Demand Reduction Targets
  - Revenue Management and Rate Design are key
- Addresses **both** price-induced and non-price-induced water conservation.

What do we know about water conservation?

- Price-induced Customer Conservation
  - Lots
  - More than 138 studies of price's effect on water demand
  - Specific recommendations for residential water demand
  - Short-term vs. long-term responses
- Non-Price Induced Customer Conservation
  - It depends
  - It varies

Price-Induced Water Conservation

- Recommendation for short-term Price Elasticities:
  - Single Family Summer: -.20
    - Thus, a 100 percent increase in rates would result in a 20 percent decrease in summer water demand
  - Single Family Non-Summer: -.12
- Basis:
  - *Do Residential Water Demand Side Management Policies Measure Up? An Analysis of Eight California Water Agencies* Renwick and Green, Journal of Environmental Economics and Management, 2000.
  - Study empirically examines a recent drought
  - Elasticity could be higher **IF** there is a strong media campaign

Non-Price-Induced Water Conservation

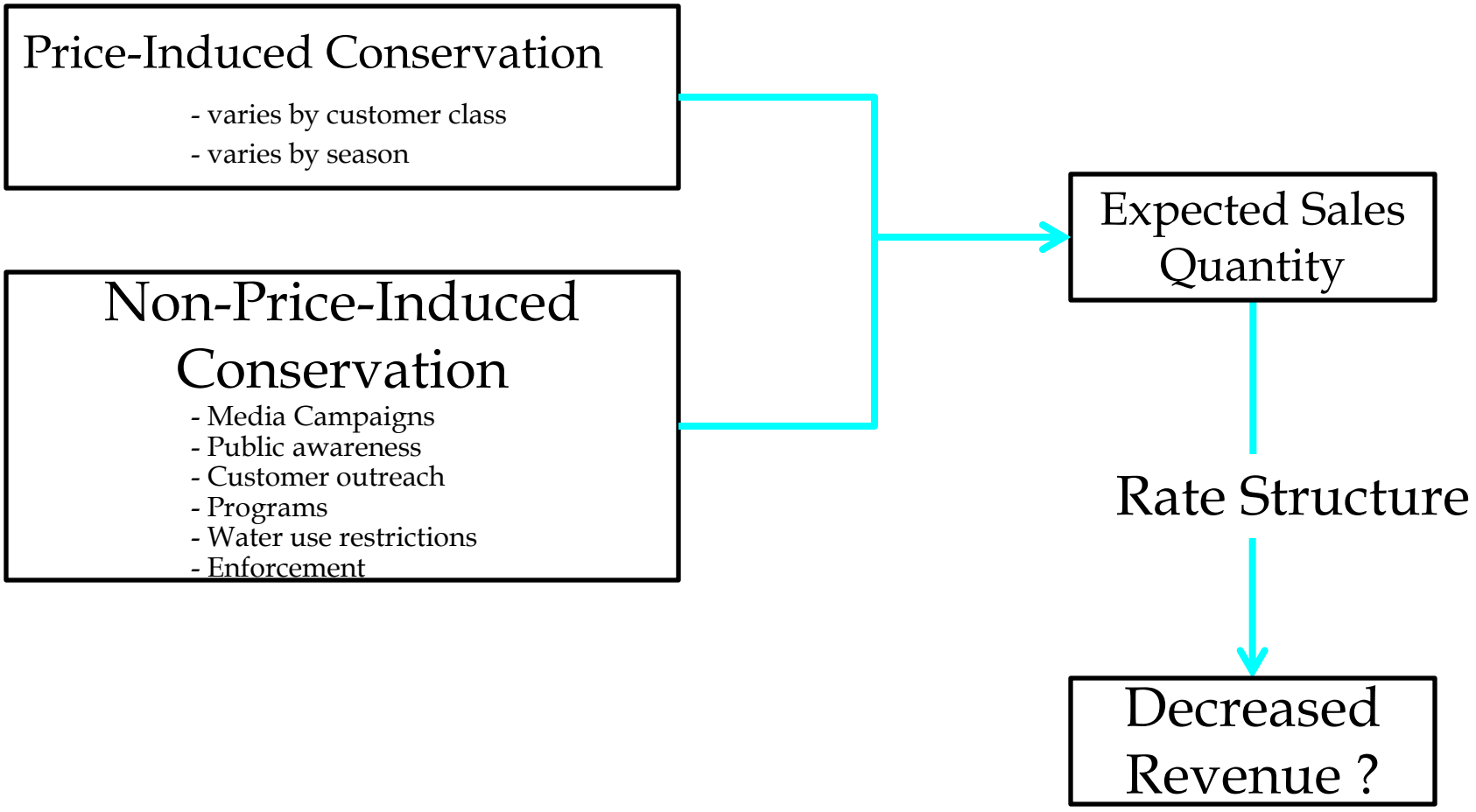
During drought, many things happen at once

- Drought pricing adjustments
- Public relations efforts that affect water use behaviors
- Public awareness
- Level of programmatic activity/enforcement by agencies
- Water use restrictions

During drought, there are limitations to customers' ability to cut back.

- Some water not "discretionary" (e.g., sanitary use)
- Some water exempt from restrictions (fire, erosion control)
- Some water used indoors (restrictions focus on outdoor use)

Drought Response Model Design

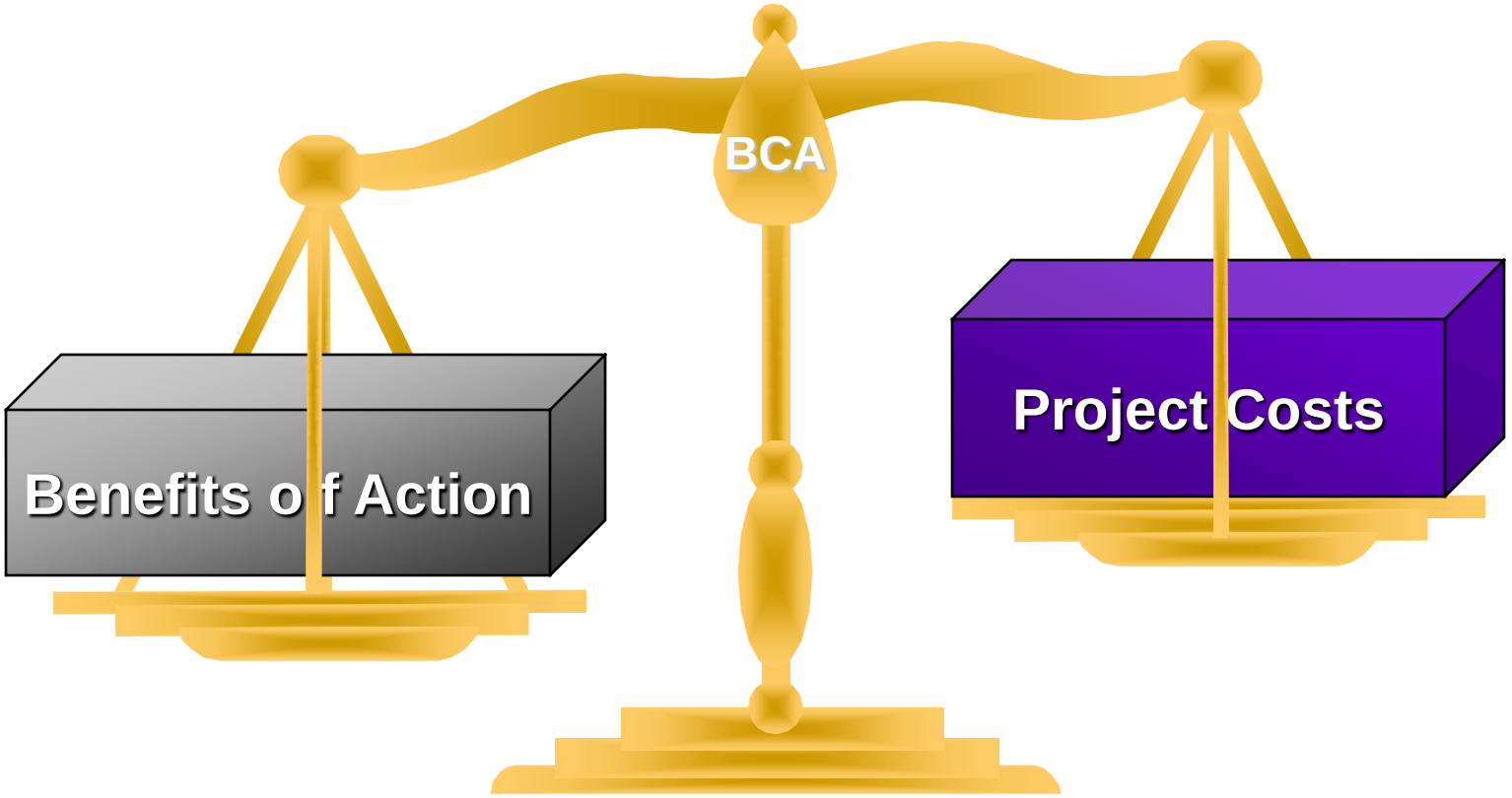


Long Term Resource Planning

- Benefit-Cost Models – Program Planning and Tracking
- Avoided Cost Models – Conservation Program Benefits
- Integrated Planning Models
  - Risk, Uncertainty, and Resource Portfolios
  - Interactions Between Conservation and Supply Options

Why do WUE?

Is water efficiency worth it?



Maximizing the Benefits of WUE

Water efficiency projects provide benefits.

If you understand the values produced by the effects of WUE, then better projects can be designed.

Benefits of Action = f (WUE Impacts)

Benefits of WUE can be defined in terms of the costs avoided

Analytic Framework for Long-Term WUE Investments

Avoided Cost Analysis

- The cost of alternatives can be compared to a benchmark to estimate "avoided cost" (or "net benefit")
- The benchmark often reflects the cost associated with the typical or conventional means of producing the desired benefit

Integrated planning

- Avoided-cost analysis helps place supply-side and demand-side options on a level playing field for comparison.
- Thus, avoided cost analysis plays a role in integrated resource planning and total water management.
- As in energy, the concept of avoided cost can promote consideration of conservation as a legitimate resource option.

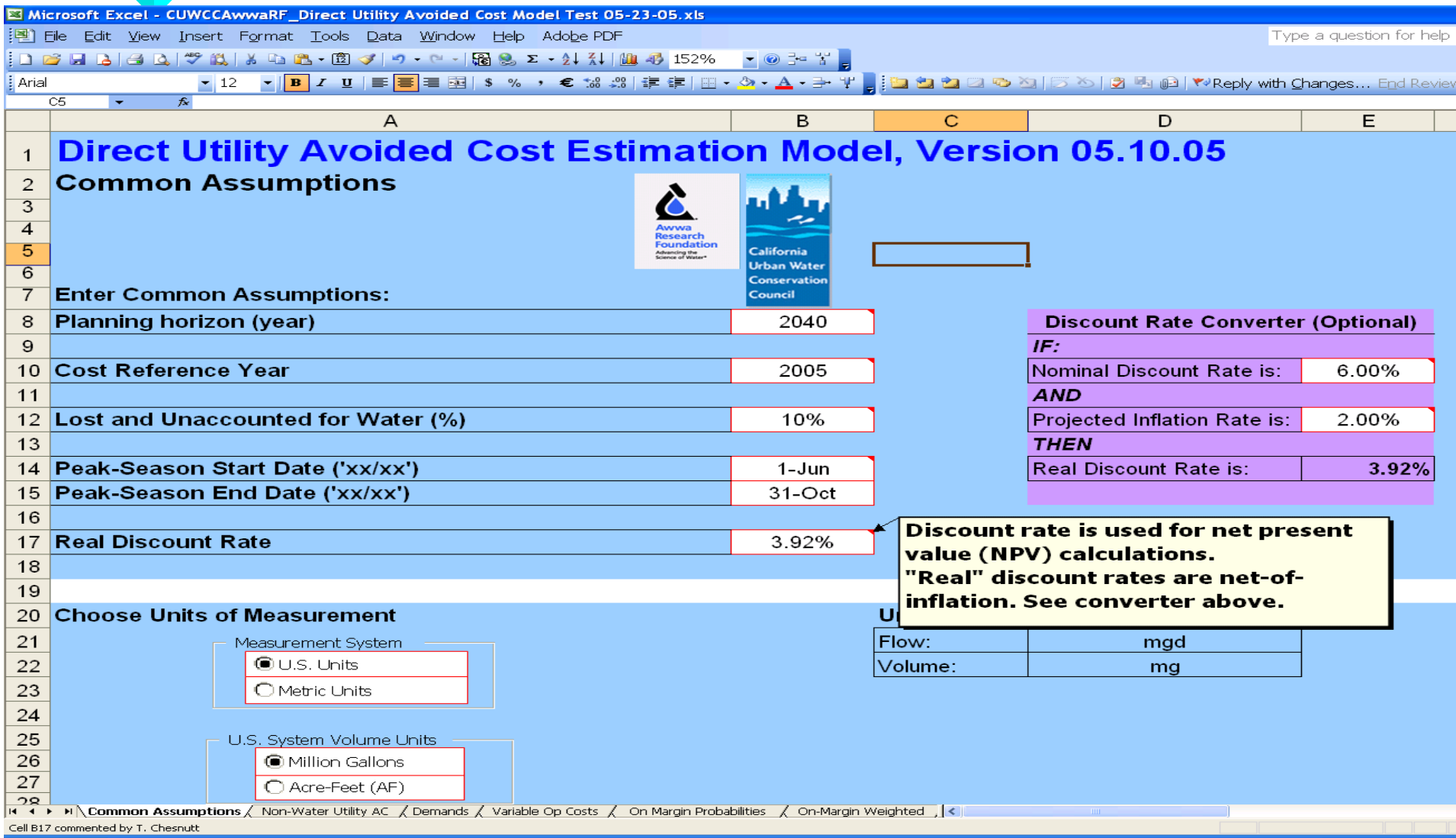
Relevance of Avoided Costs

- Avoided cost concepts can be useful to water utilities
  - Making cost consequences of alternatives explicit
  - Minimizing long term costs of providing the benefits of water supply
- Avoided costs include:
  - the costs of foregone opportunities and
  - the costs of avoided environmental degradation
- Guidance and precedence exists for their methods and use

The Water RF/CUWCC Direct Utility Avoided Cost Model

- Provides solid defensible estimates of avoidable costs from a utility perspective. (=potential Efficiency benefit)
- Allows costs to vary
  - By time of year (peak season)
  - By conveyance path (pumping zones, treatment or source differentials)
- Can handle costs avoided due to deferral *or* downsizing
- Also estimates bill impacts for different customer groups.

Avoided Cost Model

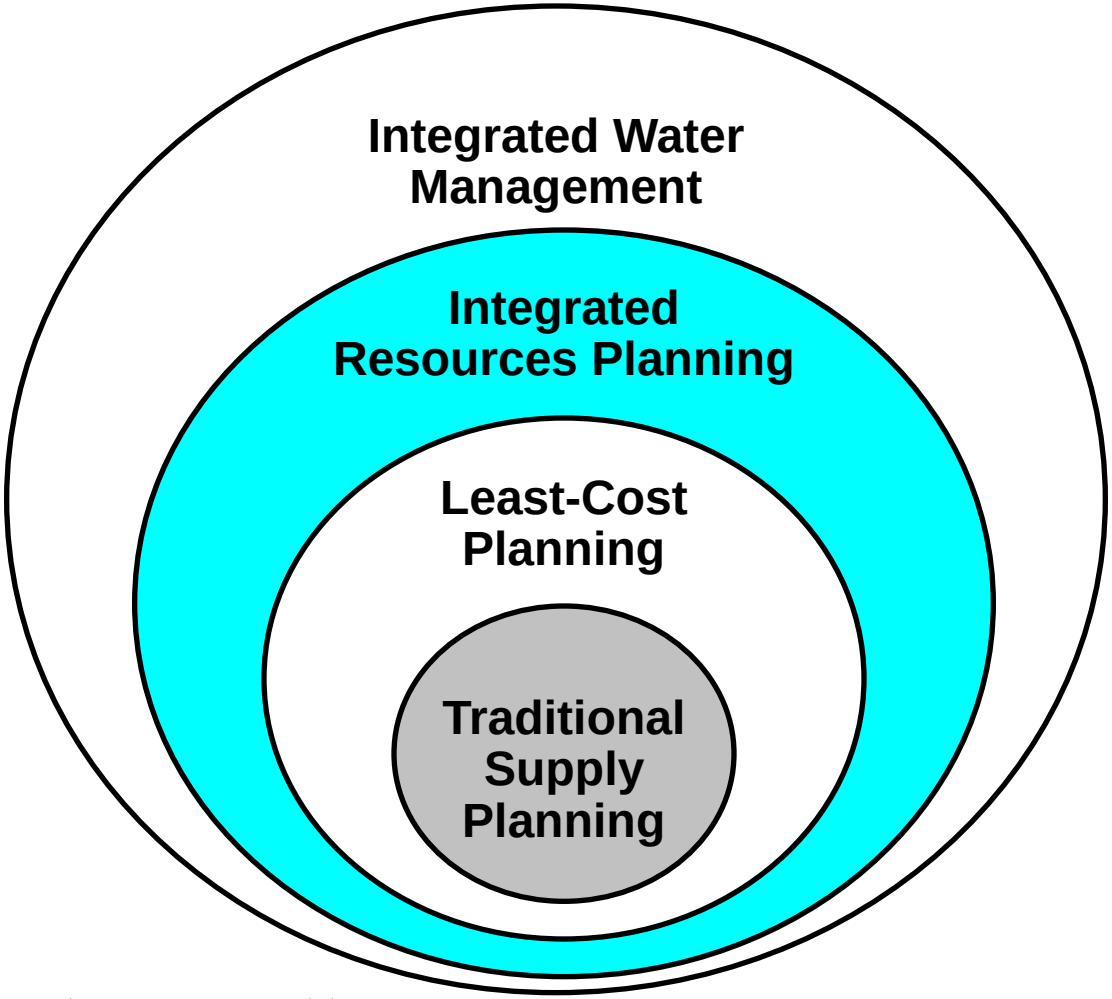


Integrated Water Management

- What characterizes IWM?
  - Equal consideration to supply- and demand-side alternatives (demand can be manipulated),
  - Explicit treatment of uncertainty,
  - Integrates short and long-run planning,
  - Acknowledges a broader concept of cost,
  - Addresses sustainability,
  - Involves all institutions with a stake, and
  - Emphasizes ongoing, open, and participatory decision-making process.

Source: Source: Chesnutt, T.W. and C. N. McSpadden, *Putting the Pieces Together: Decision Support for Integrated Resources Planning Using IRPSIM*, A report for the Metropolitan Water District of Southern California, April 1994.

Integrated Planning



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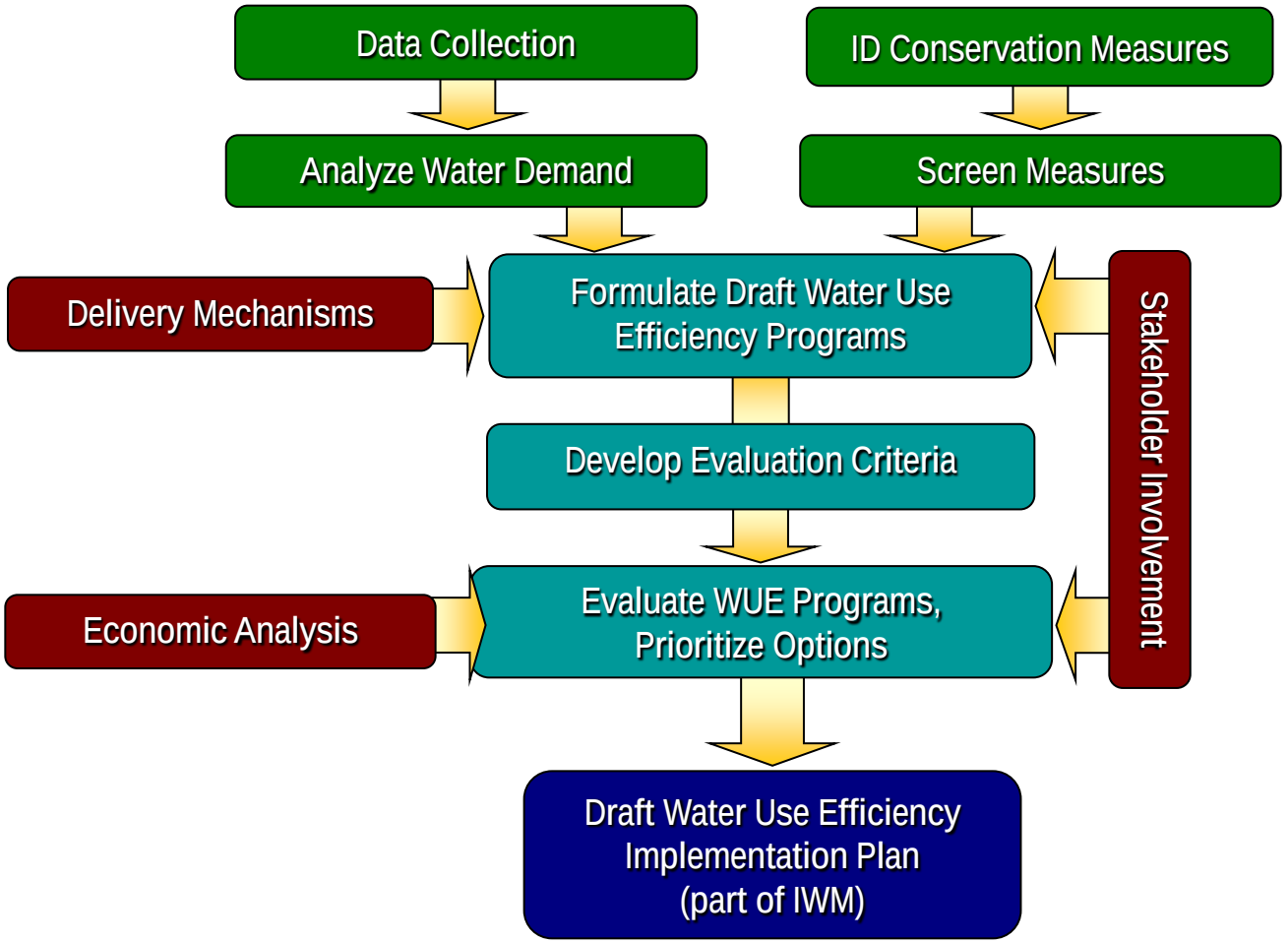
Example: Water Use Efficiency Plan



Utility Case Studies

1. Short Term Drought Management- Padre Dam Water District
2. Financial Planning For Sustainability Under Uncertainty – Atlanta GA
3. Long Term WUE – West Basin MWD's Conservation Master Plan

Decision Framework

- Water RF A Balanced Approach to Water Conservation Decision Framework
- A spreadsheet-based planning tool
- Walks a generalist through:
  - key decision-points,
  - stages of planning, and
  - hyperlinked models and information sources
- Screen captures follow

Decision Framework

Decision Framework Navigation

1. Start ← You are here
2. Long-Run Water Use Efficiency
3. Water-Saving Technologies
4. Delivery Mechanisms
5. Water-Conserving Behaviors
6. Delivery Mechanisms B
7. Information and Education
8. Analytic Resources
9. Shortage Management
10. End

Clickable Arrows are Green

Water Research Foundation: A Balanced Approach to Water Conservation Decision Framework

No — Are you experiencing or do you anticipate problems with water supply
- availability
- reliability?
- sustainability

Yes →

No — Are your water supply production and/or purchase costs high?

Yes →

CONSIDER ACTIONS TO ENCOURAGE LONG-RUN WATER USE EFFICIENCY (WUE)

Sheet 2. Long-Run Water Use Efficiency

N — Would you like to offer your customers additional options to control their water bills?

Yes →

No — Does your utility wish to invest to produce increased environmental benefits?

Yes →

No — Are you facing legal or regulatory requirements to reduce per capita usage?

Yes →

1. Start | 2. Long-Run WaterUseEfficiency | 3. Water-Saving Technologies | 4. Delivery Mechanisms | 5. Water-Conserving Behaviors | 6. Delivery Mec

Research Needs

- Empirical Evaluation of Long-Term WUE Program Outcomes
- Process Evaluation of Conservation Program Implementation
- Empirical Evaluation of Expected Changes in Consumption due to Rates
- Forecasting Initial and Ultimate Customer Response to Water Use Restrictions
- Affordability and WUE for Low Income Customers
- Conservation and Sustainability Planning

Report Contains

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- Planning Models and Methods
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