Agricultural Water Use Efficiency

Technical Analysis

California Water Plan
April 14, 2005
Year 4 Review Components

- Agricultural Water Use Efficiency
- Urban Water Use Efficiency
- Desalination
- Recycling

Investment Levels for Water Plan

Look Back at Past Activities
Projection of Potential
Synthesis
Who’s Using the Information

- CALFED ROD Year 4 WUE Checkup
- Common Assumptions for Surface Storage Investigations
- Water Plan Bulletin 160 update
CALFED Year 4 Review
Public Input

✓ Outline of Approach and Scope Presented to BDPAC
  WUE Subcommittee, Sept 2003

✓ Draft Results Presented to WUE Subcommittee, June
  2004

✓ Technical Workshop for RDI Component, July 2004

✓ Technical Workshop on Approach and Draft Results,
  August 2004
Agricultural WUE Approach

I. Define geographic scope of analysis

II. Input information
   - water use
   - land use
   - field level irrigation systems characterization
   - district level systems characterization

III. Use target investments to achieve water quantity, water quality and in-stream flow and timing
Geographic Scope

- Statewide
- 56 Planning Areas (PA’s) are highest resolution
- 23 Analysis Areas - PA’s with similar land and water use
- CALFED Solution Area
Investment Levels

- 2. $15 million/yr through 2030
- 3. CALFED ROD $30 million/yr through 2030
- 4 - 6. $50, $100, $150 million/yr through 2030
Allocation of Prop 50

- Across CALFED Program Objectives
  - In-stream flows
  - Water quality
  - Water supply reliability
- Based on Targeted Benefits in each Analysis Area
Data and Modeling Approach
Analysis Steps

Raw Data

Ag Demand Data from Water Plan

Irrigation Methods from Water Plan

Cropping Data from Water Plan

Cost Data

Manipulate Data

Supplier Data:
- Inflow from river
- Outflow to fields and flows

Field Level Data:
- Inflow from supplier, GW
- Outflow to crops and flows

Align Irrigation Methods by Analysis Area

Consolidate to Modeling Crop Categories

Supplier and Field Level

Apply Assumptions & Process

Calibration & Modeling

Results
District Cost Estimates

Data, Assumptions, and Methods
District Cost Estimates

- Proven Technologies
- Estimate costs for discrete categories of improvements
- Assess current conditions by Analysis Areas
- For each Projection Level, assign improvements that
  - Meet target investment
  - Are needed to support on-farm improvements
District Improvement Categories

- Delivery flexibility – labor, central control, regulating reservoirs
- Canal lining and seepage recovery
- Regulating reservoirs with automation
- Interceptors
- Pressurized pipe
On-Farm Cost Estimates

Data, Assumptions, and Methods
On-Farm WUE Activities

- Proven technologies (return systems, drip, LEPA)
- Low, Medium and High management levels
- By crop category
- Connection between on-farm improvements and district flexibility
On-Farm WUE Cost Estimates

- Update of 1994 study
- Feasible irrigation systems by crop type
- Efficiencies and flow estimates based on field assessments by Cal Poly and DWR
- System costs estimated by Ag. Engineers
  - Capital components
  - Labor, O&M
  - Management
- Result is feasible set of systems/management by crop
Irrigation System Annual Cost and SAE
Orchard Crops

Seasonal Application Efficiency

$/acre/year

0.0  0.40  0.50  0.60  0.70  0.80  0.90  1.00

250.0
220.0
200.0
180.0
160.0
150.0
120.0
100.0
80.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0

Field Irrigation Potential
RDI Method

Existing and New Drip Acres of:
- Almonds & Pistachios
- Citrus
- Prunes
- Peaches
- Apples, Pears and Olives
- Grapes and walnuts are not included

Assume 2”/Ac of ET reduction

Implementation Rate of 27 years

Volume of ET Reduction due to RDI
Results
## On-Farm Costs and Flow Reductions

<table>
<thead>
<tr>
<th>Investment Level</th>
<th>Annual Cost (M$/yr)</th>
<th>Present Value of Annual Cost (M$)</th>
<th>One-Time Capital Conversion Cost (M$)</th>
<th>Reduction in Recov. Flow (taf)</th>
<th>Reduction in Irrecov. Flow (taf)</th>
<th>Potential ET Svgs from RDI (taf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$41.49</td>
<td>164.7</td>
<td>26.2</td>
<td>142.6</td>
</tr>
<tr>
<td>2</td>
<td>$7.50</td>
<td>$103.24</td>
<td>$42.00</td>
<td>570.4</td>
<td>93.9</td>
<td>142.6</td>
</tr>
<tr>
<td>3</td>
<td>$15.00</td>
<td>$206.47</td>
<td>$40.19</td>
<td>891.7</td>
<td>144.6</td>
<td>142.6</td>
</tr>
<tr>
<td>4</td>
<td>$25.00</td>
<td>$344.12</td>
<td>$40.34</td>
<td>1220.3</td>
<td>199.6</td>
<td>142.6</td>
</tr>
<tr>
<td>5</td>
<td>$50.00</td>
<td>$688.24</td>
<td>$43.90</td>
<td>1747.1</td>
<td>292.7</td>
<td>142.6</td>
</tr>
<tr>
<td>6</td>
<td>$75.00</td>
<td>$1,032.36</td>
<td>$51.58</td>
<td>2041.1</td>
<td>354.5</td>
<td>142.6</td>
</tr>
</tbody>
</table>
## District Costs and Flow Reductions

<table>
<thead>
<tr>
<th>Investment Level</th>
<th>Annual Cost (M$/yr)</th>
<th>Present Value of Annual Cost (M$)</th>
<th>Reduction in Recov. Flow (taf)</th>
<th>Reduction in Irrecov. Flow (taf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$2.91</td>
<td>$40.10</td>
<td>3.0</td>
<td>1.1</td>
</tr>
<tr>
<td>2</td>
<td>$7.50</td>
<td>$103.24</td>
<td>21.7</td>
<td>12.8</td>
</tr>
<tr>
<td>3</td>
<td>$15.00</td>
<td>$206.47</td>
<td>63.2</td>
<td>50.6</td>
</tr>
<tr>
<td>4</td>
<td>$25.00</td>
<td>$344.12</td>
<td>110.1</td>
<td>99.4</td>
</tr>
<tr>
<td>5</td>
<td>$50.00</td>
<td>$688.24</td>
<td>165.0</td>
<td>199.1</td>
</tr>
<tr>
<td>6</td>
<td>$75.0</td>
<td>$1,032.4</td>
<td>180.0</td>
<td>239.8</td>
</tr>
</tbody>
</table>
Summary of On-Farm Reductions

Estimated On-Farm Reduction

Reduction (taf per yr)

Investment Level

Reduction in Recov. Flow (taf)  Reduction in Irrecov. Flow (taf)

irrecoverable flow reductions do not include RDI estimate
Summary of District Reductions

Estimated District Reduction

Reduction (taf per yr)

Reduction in Recov. Flow (taf)  Reduction in Irrecov. Flow (taf)
Seasonal Application Efficiency

Statewide Average On-Farm Seasonal Application Efficiency

Annual Investment ($M) vs. \( \text{etaw/aw} \) (%)
Estimate of Unit Cost to Reduce Irrecoverable Flows

Cost/AF of Reduction in Irrecov Flow

Marg Cost ($/af) vs. Annual Investment ($M)

Annual Investment ($M)

Cost/AF of Reduction in Irrecov Flow

Marg Cost ($/af)

- $100
- $200
- $300
- $400
- $500
- $600

Annual Investment ($M)

- $0
- $50
- $100
- $150
- $200
In-stream flow and Quantifiable Objective for anadromous fish restoration in Sac Valley
WUE BDPAC Issues

- Irrecoverable flows going to beneficial uses - Salton Sea
- Are all irrecoverable flows “realistic”
- Adjustment of recoverable to account for reuse
- Savings in recoverable flows can affect 3\textsuperscript{rd} parties and may overstate benefit
WUE BDPAC Issues

- Draft results show “optimum” for given level of investment
- Monthly and annual time step for in-stream flows
- Combine on-farm and district or leave separate?
Schedule

- Draft report of Year 4 Comprehensive Review, May 2005
- Final draft, June 2005
- Final report, August 2005