Land Subsidence in the San Joaquin Valley

Subsidence Monitoring and Response in Central California Irrigation District

A Local Perspective

Presented by Chris White, General Manager
Central California Irrigation District

Water Education Foundation
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Subsidence Monitoring
Document the Signs
Federal Facilities
State Facilities
1960s
Subsidence

- New vs. Historical
US Bureau of Reclamation monitoring shows that the subsidence rate in vicinity of Sack Dam from December 2012 to December 2013 was about 0.6 feet.
Process to Define Problem, Monitor, Formulate Hypothesis and Develop Solutions

- Spring 2012 – CCID contacted by U.S. Bureau of Reclamation of a “potential” subsidence issue which they initially thought was a bust in the survey.
- CCID recognized that based on historic knowledge of the area – probably subsidence
- Reclamation become concerned that San Joaquin Restoration Program capital improvements could be impacted by subsidence
- Additional Land Elevation Surveys Conducted
Process to Define Problem, Monitor, Formulate and Develop Solutions

• Met with growers in areas that seemed to be sinking to start dialogue as to what might be happening
• Growers formed committee, invited Madera County and Merced County
• Growers assess themselves to define problem and develop solutions
  – Both counties and Exchange Contractors contribute funds, monitoring and time.
• Measure ground surface changes; regionally, along canals, channels and levees

Proactive approach to avoid future cost
Land Subsidence

• How bad can it get?

Approximate location of maximum subsidence in the United States identified by research efforts of Dr. Joseph F. Poland (pictured). Signs on pole show approximate altitude of land surface in 1925, 1955, and 1977. (28 feet in 50 years, .56 feet/year)

The site is in the San Joaquin Valley southwest of Mendota, California, 15 miles southwest of Sack Dam.
Subsidence, if not stopped, will...

- Cause flooding in Western Madera & Merced counties
  - Highway 152
  - Elementary school
  - City of Dos Palos
  - Valuable farmland and dairies
- Jeopardize water supply of neighboring districts – up to 20% reduction in water district conveyance capacity
  - Central California Irrigation District
  - San Luis Canal Company
- Jeopardize the San Joaquin River Restoration Program
Central Valley Subsidence
Total Subsidence
July 2012 to December 2016

Subsidence calculated by comparing survey values at monitoring points for the dates specified in the legend.

Subsidence Monitoring Points
- December 2011
- Added July 2012
- Added December 2013
Area monitored after December 2013

Subsidence (feet)
July 2012 to December 2016
- Less than 0.5
-1 to -0.5
-1.5 to -1
-2 to -1.5
-2.5 to -2
-3 to -2.5
-3.5 to -3
Delta and San Joaquin Valley Flood Control System

Flood Control and Water supply impacts – Reservoir Operations
Ground Subsidence along the left levee in the Upper and Middle Eastside Bypasses

Merced and Madera County
Additional Costs to Arroyo Canal Screening and Sack Dam replacement project

- Add pumping plant to deliver water to San Luis Canal Company (Currently a gravity diversion) - $30m
- Increase height of Sack Dam – Not yet designed - original costs of the project is $35m.
# Poso Canal Subsidence Mitigation Costs

## Table 4
Central California Irrigation District
Poso Canal Subsidence
Mitigation Cost Estimate for 2032 Conditions

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Raise canal banks with imported material</td>
<td>70,000</td>
<td>Cubic Yards (cy)</td>
<td>$6.00</td>
<td>$420,000</td>
</tr>
<tr>
<td>2</td>
<td>Replace check structures</td>
<td>16</td>
<td>each</td>
<td>$200,000</td>
<td>$3,200,000</td>
</tr>
<tr>
<td>3</td>
<td>Raise turnout &amp; lateral head gates</td>
<td></td>
<td>Lump sum</td>
<td>$50,000</td>
<td></td>
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<tr>
<td>4</td>
<td>Pump station</td>
<td></td>
<td>Lump sum</td>
<td>$1,000,000</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Right-of-way acquisition</td>
<td>7</td>
<td>acres</td>
<td>$15,000</td>
<td>$105,000</td>
</tr>
</tbody>
</table>

|              | Subtotal                                | $4,775,000 |
|              | Contingencies & Incidentals (40%)       | $1,925,000  |
|              | Total                                   | $6,700,000  |
Solution based on mature cropping demand, availability of flood flows, and transfers, and aquifer characteristics. (Landowner Gaming Session) $15M + Water costs.
Red Top Pipeline Crossing

- Vlot - Tri-T Poso Canal Turnout
- Proposed Vlot & Tri-T 36" Pipeline 475 ft
- Tri-T Existing 24" Pipeline Alignment: 2.56 miles
- Vlot Existing 24" Pipeline Alignment: 3.16 miles
- Vlot Red Top Turnouts (Existing)

Legend:
- Existing Turnouts
- Approx. Tri-T - Existing/Installed by Owners
- Approx. Vlot - Existing/Installed by Owners
- Approx. Proposed Vlot & Tri-T SJR Crossing
- New Vlot Property
- Parcel Line
- Temp Work Area Inside Low-Flow Channel - approx. .19 acres
- Staging Area - Approx. .95 acres
- Work Area Outside Low-Flow Channel - approx. .65 acres
- Pump Station

*2014 NAIP Aerial Imagery
Progress on Solutions

• Triangle T (Tri T) is a 12,000-acre property, with 530 acres are farmed to dryland crops in dry years, and groundwater recharge in wet years.
  
  o In 2017 they have recharged approximately 30,000 acre feet so far; groundwater level (gwl) rise of 60 feet + at ponds
  o Just as importantly, they have been able to use the Fresno River flood water to irrigate the almond and pistachio orchards as well, offsetting another 20,000 acre feet of groundwater pumping; regional gwl rise 20 feet.

• Long term monitoring, management and Expert Panel established in agreement; Cross River Pipeline under construction; Tri T and Vlot formed Water District; Neighbors wanting to join.
$4.5 Million Earthwork Project Area

OUTSIDE CANAL PROFILE

Station (miles)

Elevation (feet)

BM=154.095 (Headworks, MP 0.078)
BM=152.963 (Vargas Weir, MP 5.193)
BM=151.915 (S-Turn Weir, MP 10.958)
BM=150.04 (o’Bannon Weir, MP 24.280)
BM=148.141 (Fagan Pond Weir, MP 32.797)
BM=148.014 (Volta Weir, MP 38.376)
BM=147.529 (Wolfsen Weir, MP 40.514)
BM=146.232 (Duarte Weir, MP 42.270)
BM=144.45 (Cardoza Weir, MP 46.090)
BM=143.58 (Menzel Weir, MP 48.272)
BM=143.207 (Cottonwood Weir, MP 52.115)
BM=141.91 (Azavedo Weir, MP 55.004)

RIGHT BANK  LEFT BANK  HIGH WATER MARK  BENCH MARK  PROPOSED HIGH WATER MARK  PROPOSED TOP OF BANK  PROPOSED WEIR ELEVATION

CAD232D001009/REVISED OUTSIDE CANAL/Outside Canal

4/5/2005, 11:54 AM
$4.1 Million Russell Ave Bridge
Subsidence Study - Long Term Solutions

- Complete subsidence and wheeling agreement and import water through Red Top Pipeline. (Avoid adjudication)
- Continue to revive existing districts, to manage water supply, subsidence and SGMA.
- Convene expert panel in the Triangle T area. (Red Top)
- Curtail Subsidence and help our neighbors comply with SGMA.
- Subsidence at Red Top has been reduced by 50% through management.
Contact Information

Chris White, Central California Irrigation District
Telephone: (209) 826-1421
Email: cwhite@ccidwater.org