What are the Groundwater Management Options?
Sustainable Groundwater Management Act: Part 3
Sustainable Groundwater Management Act

- Governs High/Medium Priority basins delineated by DWR (Bull. 118)
- Governs the establishment of groundwater sustainability agencies (GSA)
  - Provides authority
- Exempts adjudicated basins
- Special Districts can elect to become GSAs or continue managing sustainably
- Preparation of groundwater sustainability plans (GSP)
- Institutes state evaluation and intervention if needed
GSA Formation Options

• Local agency
  – Provide water supply, water management, or have land use responsibility
  – Boundaries of agency must overlie basin
  – County is default agency

• Form a joint powers authority, MOU

• Do nothing – State Water Resources Control Board

• Other option: Adjudicate
Forming a GSA

• Submit notice of intent to DWR (Jan 2017)
  – Identify basin or portion of basin to be managed
  – Provide resolution forming agency and other supporting information
  – Provide explanation of how the agency will protect beneficial uses and groundwater users
  – Identify other agencies managing within the basin (if applicable)
    • Must then coordinate with other GSAs regarding data, GSP
Groundwater Management Examples

• Adjudicated Basin
  • Chino Basin, Peter Kavounas
• Formation of a GSA
  • Sacramento Groundwater Authority, Rob Swartz
• Legislature designated special district
  • Orange County Water District, Adam Hutchinson
CHINO BASIN WATERMASTER

GRAcast on
Sustainable GW Management Examples
February 25, 2015
Chino Basin Management: An Early Vision of Sustainable Management Being put to the Test
Outline

- Chino Basin overview
- Key Judgment and OBMP Provisions
- Chino Basin Watermaster & OBMP vs. GSA & GSP
- What works well and what doesn’t?
Chino Basin Overview
Major Water Agencies in the Santa Ana River Watershed

- Santa Ana River Watershed
- San Bernardino Valley MWD
- Western MWD
- Eastern MWD
- Orange County Water District
- Chino Basin
- Three Valleys MWD
- Inland Empire Utilities Agency
- SGPWA
Outline

- Chino Basin overview
- Key Judgment and OBMP Provisions
- Chino Basin Watermaster & OBMP vs. GSA & GSP
- What works well and what doesn’t?
1978 Judgment

- Established the Safe Yield of the Basin
- Allocated rights according to priority
  - Overlying land owners
  - Appropriators
- Established Physical Solution
- Provided for orderly transfer of agricultural rights to appropriators as land is developed
- Created a Watermaster
2000 Optimum Basin Management Program

- Created by Watermaster in the late 1990’s as a result of growing dissatisfaction with results of basin management
- Identified essential goals for management of the Basin:
  - Enhancement of water supplies
  - Protection/enhancement of water quality
  - Protection against further land subsidence
  - Equitable financing
2000 Optimum Basin Management Program

OBMP goals are achieved through 6 Elements:

- Comprehensive Monitoring Program
- Comprehensive Recharge Program
- Water Supply Plans for Impaired Areas and Regional Supplemental Water Program
- Groundwater Management Plan for MZ1
- Cooperative Programs with RWQCB to Improve Basin Management; Salt Management
- Groundwater Storage Management and Conjunctive Use Programs
Outline

- Chino Basin overview
- Key Judgment and OBMP Provisions
- Chino Basin Watermaster & OBMP vs. GSA & GSP
- What works well and what doesn’t?
## Watermaster vs. GSA

<table>
<thead>
<tr>
<th>Watermaster</th>
<th>GSA</th>
</tr>
</thead>
</table>
| Administer the Judgment:  
Control storage  
Regulate Supplemental water | Manage groundwater sustainably |
| Implement the OBMP:  
Meter wells and collect extraction data  
collect groundwater elevation, water quality, land elevation data  
Evaluate MPI  
Direct recharge  
Adopt Rules, Budgets, Fees  
Purchase Replenishment Water | Require registration of wells  
Require meter installation on wells  
Require annual extraction statements  
Impose well spacing requirements and control extractions from individual wells  
Conduct investigations  
Assess fees |
| Normal Course of Business |   |
## Watermaster vs. GSA cont’d

<table>
<thead>
<tr>
<th>Watermaster</th>
<th>GSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>State of the Basin Report (bi-annual): basin boundaries, precip and</td>
<td>Description of physical setting</td>
</tr>
<tr>
<td>stormwater runoff relation;</td>
<td>Historical data</td>
</tr>
<tr>
<td>groundwater production and</td>
<td>Map of boundaries</td>
</tr>
<tr>
<td>recharge, including recycled water</td>
<td>Map of recharge areas</td>
</tr>
<tr>
<td>groundwater levels and storage</td>
<td>Monitoring and management of water levels, water quality, land</td>
</tr>
<tr>
<td>groundwater quality</td>
<td>subsidence</td>
</tr>
<tr>
<td>land subsidence</td>
<td>Measurable objectives</td>
</tr>
<tr>
<td>Material Physical Injury: degradation of water quality, liquefaction, land</td>
<td>Planning and implementing horizon</td>
</tr>
<tr>
<td>subsidence, increase in pump lifts, rising groundwater</td>
<td>Monitoring type, protocols</td>
</tr>
<tr>
<td></td>
<td>Other local government plans</td>
</tr>
</tbody>
</table>
Outline

- Chino Basin overview
- Key Judgment and OBMP Provisions
- Chino Basin Watermaster & OBMP vs. GSA & GSP
- What works well and what doesn’t?
What works well and what doesn’t

- Information is centralized and easily communicated; problems can be identified and resolved
- Governance is complicated; getting anything done collaboratively requires complete consensus
- Disputes can be resolved quickly
- Funding of agreed-upon monitoring programs, studies, projects is streamlined
Governance

- Pools of like-right pumpers:
  - Overlying (Agricultural) Pool
  - Overlying (Non-Agricultural) Pool
  - Appropriative Pool
- Advisory Committee
  - All Pools represented, weighted volume voting
- Watermaster Board
  - All Pool represented, and MWD member agencies serving the area
Current Challenge: Resetting the Safe Yield

Safe Yield changes over time depending on how a basin is used, especially in light of changing hydrology and land use.

The 1978 Judgment set the Safe Yield at 140,000 afy and, for certainty, provided the Safe Yield would not be re-examined for 10 years.

During the development of the OBMP in 2000, it was agreed that Safe Yield would re-evaluated in 2011 allowing for 10 years of rigorous data collection.
Current Challenge: Resetting the Safe Yield

Change in storage over time indicates the yield may need to be set lower than 140,000 afy, resulting in potentially negative impacts to water suppliers.

The impacts would be borne by those with appropriative rights, e.g. cities, water districts, and not those with overlying land owner rights (agriculture, non-agricultural users).

Difficult economic times and drought make the problem even more acute.
Current Challenge: Resetting the Safe Yield

Working toward consensus through multiple workshops, technical review panels, formal and informal briefings, and recently, facilitation among parties and pools.

Number of parties and need for consensus requires patience, and for Watermaster, a neutral mindset and transparent methods.

Court has retained jurisdiction and will ultimately decide, a feature which adds some certainty to the collaborative process.
Land use has changed over time
Consider the changes from the perspective of water supply and demand
Some observations

- Having a common, trusted technical resource is very constructive
- The past has affected present conditions, not pristine
- Land use is not static and results in water management practices which include basin management
- Being able to resolve disputes in Court drives all to be more collaborative
- Water rights matter, if there is water
- Surface water is part of basin management and needs to be integrated, as do all natural and human processes
Thank You
Sacramento Groundwater Authority: An Example of Local Cooperative Management
Overview

• Sacramento Groundwater Authority Management Area

• The Need for Management
  – Overdraft
  – Contamination
  – Water Forum Agreement

• How SGA Works
  – Governance
  – Administration
  – Funding
  – Organizational Powers

• What might or might not work well for others
Overdraft
Contamination
The Water Forum Agreement

• Started in 1993 following decades of conflict
• Nearly 7-year facilitated process
• Integrated set of solutions
• Signed by representatives of 40 stakeholder groups
Groundwater Management Areas

Sacramento Groundwater Authority
(formed 1998)

Sacramento Central Groundwater Authority
(formed 2006)

South Area (in progress)
<table>
<thead>
<tr>
<th>SGA Board Position</th>
<th>Appointing JPA Signatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>California American Water**</td>
<td>Sacramento City Council</td>
</tr>
<tr>
<td>Carmichael Water District</td>
<td>Sacramento County Board of Supervisors</td>
</tr>
<tr>
<td>Citrus Heights Water District</td>
<td>Citrus Heights City Council</td>
</tr>
<tr>
<td>City of Folsom</td>
<td>Folsom City Council</td>
</tr>
<tr>
<td>City of Sacramento</td>
<td>Sacramento City Council</td>
</tr>
<tr>
<td>Del Paso Manor Water District</td>
<td>Sacramento City Council</td>
</tr>
<tr>
<td>Fair Oaks Water District</td>
<td>Sacramento County Board of Supervisors</td>
</tr>
<tr>
<td>Golden State Water Company**</td>
<td>Sacramento City Council</td>
</tr>
<tr>
<td>Natomas Central Mutual WC**</td>
<td>Sacramento City Council</td>
</tr>
<tr>
<td>Orange Vale Water Company**</td>
<td>Sacramento County Board of Supervisors</td>
</tr>
<tr>
<td>Rio Linda/Elverta Community WD</td>
<td>Sacramento County Board of Supervisors</td>
</tr>
<tr>
<td>Sacramento County Water Agency</td>
<td>Sacramento County Board of Supervisors</td>
</tr>
<tr>
<td>Sacramento Suburban Water District</td>
<td>Sacramento City Council</td>
</tr>
<tr>
<td>San Juan Water District</td>
<td>Sacramento County Board of Supervisors</td>
</tr>
<tr>
<td>Agricultural Representative**</td>
<td>Sacramento County Board of Supervisors</td>
</tr>
<tr>
<td>Self-Supplied Representative**</td>
<td>Sacramento City Council</td>
</tr>
</tbody>
</table>
Administration

• Staffed through agreement with Regional Water Authority (RWA)
  – 2.3 full-time equivalent staff for SGA
  – Shared administrative/office expenses

• FY14/15 Planned Expenses
  – $600,000 staffing/office/admin consulting
  – $85,000 general technical consulting
  – $125,000 special project (partial grant funded)
Funding Model (for FY14/15)

Two Primary Components

1. Base Administrative Fee
   – Recognize that surface water users also benefit from basin management
   – Minimum fee is $7,150
   – $0.92/connection (for connections over 6,000)

2. Groundwater Extraction Fee
   – $4.10/acre-foot fee
   – Use 5-year groundwater pumping averages to smooth out rates
Organizational Powers

Not Authorized to:

• Regulate land use
• Engage in retail sale of water
• Restrict or otherwise limit extraction of groundwater other than through economic incentives and disincentives
• Fund capital construction projects
Organizational Powers

Authorized to:

✘ Require permitting of extraction facilities
✘ Require installation of meters
✘ Acquire property convenient to exercise power
✘ Buy, sell, exchange, recharge, store water
✘ Fix rates for water acquired for replenishment
 ✓ Maintain records of extraction
 ✓ Cause taxes, assessments, fees or charges to accomplish purposes of the Authority
 ✓ Carry on studies and other technical investigations
 ✓ Establish and administer conjunctive use program
# Sustainability Goal

<table>
<thead>
<tr>
<th>Agency</th>
<th>Baseline Extraction (ac-ft)</th>
<th>Sustainability Reduction (ac-ft)</th>
<th>Sustainability Pumping Target (ac-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carmichael WD</td>
<td>7,516</td>
<td>870</td>
<td>6,646</td>
</tr>
<tr>
<td>City of Sacramento</td>
<td>23,287</td>
<td>2,696</td>
<td>20,591</td>
</tr>
<tr>
<td>California American Water</td>
<td>20,351</td>
<td>2,356</td>
<td>17,995</td>
</tr>
<tr>
<td>Del Paso Manor WD</td>
<td>1,657</td>
<td>192</td>
<td>1,465</td>
</tr>
<tr>
<td>Golden State WC</td>
<td>1,242</td>
<td>144</td>
<td>1,098</td>
</tr>
<tr>
<td>Rio Linda/Elverta Community WD</td>
<td>3,259</td>
<td>377</td>
<td>2,882</td>
</tr>
<tr>
<td>Sacramento County WA</td>
<td>4,850</td>
<td>562</td>
<td>4,288</td>
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<tr>
<td>Sacramento Suburban WD</td>
<td>39,622</td>
<td>4,587</td>
<td>35,035</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>101,784</strong></td>
<td><strong>11,784</strong></td>
<td><strong>90,000</strong></td>
</tr>
</tbody>
</table>
## Sustainability Goal Status

<table>
<thead>
<tr>
<th>Status through 2014</th>
<th>Basin Sustainability Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carmichael WD</td>
<td>12,752</td>
</tr>
<tr>
<td>City of Sacramento</td>
<td>22,885</td>
</tr>
<tr>
<td>California American</td>
<td>15,020</td>
</tr>
<tr>
<td>Del Paso Manor WD</td>
<td>79</td>
</tr>
<tr>
<td>Golden State WC</td>
<td>95</td>
</tr>
<tr>
<td>Rio Linda/Elverta CWD</td>
<td>288</td>
</tr>
<tr>
<td>Sacramento County WA</td>
<td>-2,222</td>
</tr>
<tr>
<td>Sacramento Suburban WD</td>
<td>6,683</td>
</tr>
<tr>
<td>Central Area Total</td>
<td>55,580</td>
</tr>
</tbody>
</table>
Conjunctive Use

2011
- 45% Surface Water
- 55% Groundwater

2014
- 61% Surface Water
- 39% Groundwater

SGA
What Might Work Well For Others?

- Governance structure
  - JPA allows for significant powers
  - Board composition ensures broad representation
  - Individual agencies maintain responsibility for their own operations

- Administration
  - Dedicated staffing, but shared to achieve cost efficiency
  - Expandable with consulting services

- Funding model
  - Recognizes that all benefit from management
What Might Not Work Too Well?

• Governance – had plenty of time to decide
• Administration – commitment to staffing results in relatively high ongoing expenses
• Funding model
  – Our region has large percentage of M&I suppliers, so we have larger rate base to fund ongoing management
  – Independent pumpers not charged extraction fee
• Location, location, location…
  – Not reliant on inter-regional conveyance for conjunctive use operations
  – Local surplus surface water generally available
www.sgah2o.org
The Orange County Water District: An Experiment in Supply-side Groundwater Management

Adam Hutchinson, P.G., CH.G.
Recharge Planning Manager
Orange County Water District

GRACast
Sustainable Groundwater Management Agency Examples
February 25, 2015
The Orange County Water District was formed by the State in 1933 to protect and manage Orange County’s groundwater supplies.

Why?
- Declining flow of Santa Ana River
- Basin overdraft
- Seawater intrusion
- Attempts by LA County to obtain water rights in Orange County

First Board of Directors
OCWD encompasses 370 square miles in the lower watershed of the Santa Ana River.

Orange County groundwater basin provides water for over 2.4 million people.

Semi-arid region: 14 inches/year
Recharge operations to capture and recharge Santa Ana River flows started in the early 1930s.
OCWD’s original mandate was insufficient to sustainably manage the basin.

- Financed by ad velorem taxes
- Purchased Santa Ana River bed
- Enhanced recharge of river flows
- No authority to manage pumping

**Results**

- Natural replenishment insufficient
- Insufficient funding to purchase replenishment water
- Continued overdraft and seawater intrusion
“We have a public problem!”

Whatever one pumper does, affects other individual pumpers and pumpers as a group.

- Orange county elected to manage groundwater as a “common pool”
  - Equal access
  - All share equally in pains and gains
  - Pumpers pay for increased supplies
- Rejected adjudication as a “philosophy of scarcity”
  - Believed they could have more if they worked together
Amendments to District Act in 1953 and 1969 expanded OCWD’s authorities.

- All pumping metered (1953)
- Pumpers pay for groundwater (1953)
  - Replenishment Assessment (RA)
  - RA used to purchase imported water
- Annual Engineer’s Report (1953)
  - Basin condition
  - How much replenishment water needed
- Basin Production Percentage (BPP) (1969)
- Basin Equity Assessment (BEA) (1969)
Imported water is a key source of supply to Southern California.

- Los Angeles Aqueduct: 1913
- Mokelumne Aqueduct: 1926
- Hetch Hetchy Aqueduct: 1934
- Central Valley Project: 1933
- Colorado River Aqueduct: 1939
- State Water Project: 1960

All Imported water is a key source of supply to Southern California.
OCWD uses economic incentives to manage pumping.

Example Water Utility with 20,000 afy of Total Water Demands

- **Basin production percentage (BPP)** = amount of total demand that can be met with groundwater
- **Replenishment assessment (RA)** = charge for groundwater below BPP
- **Basin equity assessment (BEA)** = additional charge for water pumped above BPP

\[
\text{RA + BEA} = \text{Imported water cost}
\]
Revenue generated by the RA allows OCWD to import water and develop local supplies.

- Natural recharge (rainfall, subsurface inflow)
- Santa Ana River base flow
- Storm flow
- Recycled water
- Imported water
  - Surface
  - Injection
  - In-lieu

Use surface recharge and injection wells to replenish aquifer
Since 1936, the District has purchased nearly 1,600 acres for recharge.
The deep basins are able to recharge up to 100,000 acre-feet per year.
Recharge water sources have played different roles at different times.
Santa Ana River base flow has declined by more than 50 percent over the last 9 years.

**Fiscal Year (July-June)**

- 2003-04: 140,000
- 2004-05: 160,000
- 2005-06: 140,000
- 2006-07: 120,000
- 2007-08: 100,000
- 2008-09: 80,000
- 2009-10: 60,000
- 2010-11: 40,000
- 2011-12: 28,000
- 2012-13: 28,000
- 2013-14: 28,000

**58% Decline**
Water Factory 21 was replaced in 2008 with the Groundwater Replenishment System (GWRS)*.

*70 MGD
2015: 100 MGD
Future: 130 MGD
With GWRS, recycled water is now a critical component of recharge to the basin.

Total FY12-13 Recharge: 238,646 af

- Santa Ana River Base Flow: 84,572 af (35%)
- Recycled Water: 73,486 af (31%)
- Imported Water: 41,004 af (17%)
- Storm Flow: 19,698 af (8%)
- Natural Recharge: 19,886 af (8%)
Demand for groundwater has more than doubled in last 60 years.
Basin storage provides insurance during times of drought.
Basin storage must be managed within limits or risk adverse impacts.

Available storage for one wet year

Allows for 2-4 consecutive dry years, including 66,000 af Conjunctive Use Storage

Negative Impacts
- Shallow groundwater

Short-term Emergency Storage

Acre-Feet
- 700,000
- 500,000
- 100,000
0
FULL
OCWD has basin management triggers tied to basin storage conditions.

<table>
<thead>
<tr>
<th>Basin Storage Conditions (acre-feet below full)</th>
<th>Basin Management Actions to Consider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 100,000 af</td>
<td>Raise BPP</td>
</tr>
<tr>
<td>100,000 to 300,000 af</td>
<td>Maintain and/or raise BPP</td>
</tr>
<tr>
<td>300,000 to 350,000 af</td>
<td>Seek additional supplies to refill the basin and/or lower the BPP</td>
</tr>
<tr>
<td>Greater than 350,000 af</td>
<td>Seek additional supplies to refill the basin and lower the BPP</td>
</tr>
</tbody>
</table>
The BPP has ranged from 62 to 89 percent and may be lowered in 2015-16.
High imported water costs makes local resources development attractive.

- **Desalination:** $1900
- **Replenishment Assessment**
- **MWD Treated Water**
- **MWD Replenishment Water (1949-2007)**
- **Natural Recharge:** $0
- **Santa Ana River/Storm Flow:** $20
- **Untreated MWD:** $600
- **GWRS:** $500
Development of local water resources has increased the sustainable yield of the basin.

<table>
<thead>
<tr>
<th>Without OCWD</th>
<th>10-Yr Avg (2005-2014)</th>
<th>Future Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>36,500</td>
<td>57,718</td>
<td>65,000</td>
</tr>
<tr>
<td>61,000</td>
<td>43,139</td>
<td>134,000</td>
</tr>
<tr>
<td>112,000</td>
<td>64,000</td>
<td>70,000</td>
</tr>
<tr>
<td>61,000</td>
<td>61,000</td>
<td>36,000</td>
</tr>
</tbody>
</table>

- Imported Water
- Recycled Water
- Storm Flow
- Santa Ana River Base Flow
- Natural Recharge (Rain, subsurface inflow)
What makes OCWD tick?

- Cooperative, common pool approach
- All pumpers treated equally
- Economic incentives used to manage pumping
- Supply-side focus
- Agency with narrow mission to manage groundwater
- Agile agency with ability to act quickly and construct projects
- Agency overlies most of groundwater basin
Experiment Results

- Cooperative, common-pool approach works
- Maximal development of local sources, such as storm water and recycled water
- Diverse water portfolio
- Reduced dependence on imported water
- Sustainable yield of the basin has more than doubled
- Additional yield would not be possible without well developed recharge system
Questions?
Total recharge to the basin has been below average for 6 of the last 10 years.
Recycled water is projected to provide 30 percent of recharge by 2015-16.
Recycled water has helped OCWD weather the current drought.

- Drought has resulted in reduced natural recharge
- Santa Ana River base flows have declined by more than 50% in last 9 years
- Basin storage has fallen to 400,000 af below full
- May need to reduce pumping from basin
- Increased supply of recycled water has greatly mitigated impact of drought
Orange County Has Two Major Water Sources of Water

Imported:
- Metropolitan Water District
  - $1,000 AF

Groundwater:
- Orange County Water District
  - $300 AF*

*Excludes pumping costs.
Rainfall in Anaheim has been below average 8 of the last 10 years.