SGMA Overview
### Timeline

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWR publishes a report on water available for groundwater replenishment</td>
<td>12/31/2016</td>
</tr>
<tr>
<td>DWR publishes best management practices for sustainable management of groundwater.</td>
<td>2017</td>
</tr>
<tr>
<td>DWR publishes the interim update to Bulletin 118 (California Groundwater), documenting basin boundary modifications, basin prioritization, and critical overdraft.</td>
<td>1/1/2017</td>
</tr>
<tr>
<td>SWRCB begins collecting annual reports from persons extracting more than 2 AFY from areas outside GSA jurisdiction.</td>
<td>12/15/2017</td>
</tr>
<tr>
<td>SWRCB may hold hearing to designate a basin as “probationary” if a GSA or alternative is not established</td>
<td>6/30/2017</td>
</tr>
<tr>
<td>SWRCB adopts a fee schedule for State back-stop-related costs</td>
<td>7/1/2017</td>
</tr>
<tr>
<td>Board may hold hearings to designate critically-overdrafted basins as “probationary” if DWR determines their GSP is inadequate or will not achieve sustainability.</td>
<td>1/31/2020</td>
</tr>
<tr>
<td>SWRCB begins development of interim plans for critically-overdrafted basins designated as “probationary”.</td>
<td>1/1/2021</td>
</tr>
<tr>
<td>SWRCB may designates a groundwater basin as “probationary” if DWR determines the GSP is inadequate or not being implemented properly and SWRCB determines the basin is in a condition where groundwater extractions result in significant depletion of interconnected water surfaces.</td>
<td>1/31/2022</td>
</tr>
</tbody>
</table>

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*Today*
Groundwater Sustainability Agencies (GSAs)

- GSAs must be formed and ‘approved’ by June 30, 2017
- GSAs must contain local public agency that has water supply, water management, or land use responsibilities
- For basins where no agency forms a GSA, the County assumes the GSA role
- GSAs required to develop and implement GSP to achieve sustainability goal by 2040
Groundwater Sustainability Plans (GSPs)

- Must be adopted by GSAs and submitted to DWR by January 31, 2020
- Groundwater sustainability to be achieved within 20 years
- GSP to have 50-year planning horizon
- DWR approval of GSP required to avoid State intervention
- Annual reporting required to demonstrate progress towards sustainability goal
- GSPs must be updated every 5 years
- Groundwater monitoring is required
Planning and Resources
GSP Requirements

- **Technical and Reporting Standards**
  - Monitoring Protocols

- **Administrative Information**
  - General Information
  - Agency Information
  - Description of Plan Area and Map(s)
  - Water Resources Monitoring and Management Program
  - Land Use Elements
  - Additional GSP Contents
  - Notice and Communication

- **Basin Setting**
  - Hydrogeologic Conceptual model
  - Recharge Areas with Map
  - Current and Historical Groundwater Conditions
  - Water Budget Information
  - Surface Water Supply
  - Management Areas

- **Sustainable Management Criteria**
  - Sustainability Goal
  - Undesirable Results
  - Minimum Thresholds
  - Measurable Objectives

- **Monitoring Networks**
  - Monitoring Network
  - Representative Monitoring
  - Assessment and Improvement of Monitoring Network

- **Projects and Management Actions**
  - Projects and Management Actions
Optional Components

- **Description of actions related to:**
  - Control of saline water intrusion
  - Wellhead protection
  - Migration of contaminated groundwater
  - Well construction, abandonment and destruction program
  - Replenishment of groundwater extractions
  - Conjunctive use and underground storage
  - Policies, addressing groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects
  - Impacts on groundwater dependent ecosystems.

- **Descriptions of:**
  - State and federal regulatory agencies
  - Efficient water management practices
  - Land use plans and efforts to coordinate with land use planning agencies
## Required Data

<table>
<thead>
<tr>
<th>HYDROGEOLOGIC CONCEPTUAL MODEL</th>
<th>CROPPING AND CROP WATER USE</th>
<th>GROUNDWATER RECHARGE</th>
<th>OTHER PARAMETERS</th>
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</thead>
<tbody>
<tr>
<td>Management Area Boundaries</td>
<td>Cropping Data/Maps</td>
<td>Groundwater inflow parameters (gradient and transmissivity)</td>
<td>Groundwater storage change parameters (groundwater levels and specific yield)</td>
</tr>
<tr>
<td>Hydrostratigraphy</td>
<td>Irrigation Methods</td>
<td>Deep percolation of crop irrigation</td>
<td>Soils</td>
</tr>
<tr>
<td>Geology</td>
<td>Irrigation Efficiencies</td>
<td>Deep percolation of precipitation</td>
<td>Soil infiltration rates</td>
</tr>
<tr>
<td>Well Construction Characteristics</td>
<td>Crop Evapotranspiration</td>
<td>Deep percolation of M&amp;I water use</td>
<td>Subsidence</td>
</tr>
<tr>
<td>Depth of usable water</td>
<td>Effective Precipitation</td>
<td>Channel and pipeline leakage</td>
<td>Population / Anticipated growth</td>
</tr>
<tr>
<td>Configuration of surface water features</td>
<td>M&amp;I Landscape Evapotranspiration</td>
<td>Reservoir and lake seepage</td>
<td>Groundwater levels</td>
</tr>
<tr>
<td>Water resources facilities</td>
<td>NON-RECOVERABLE LOSSES</td>
<td>Urban stormwater recharge</td>
<td>Groundwater-surface water interactions</td>
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</tbody>
</table>

### WATER SUPPLIES

| Surface Water (Irrigation)     | Groundwater outflow parameters (gradient and transmissivity) | Local stream/river seepage | Geology |
| Surface Water (M&I)            | Channel evaporation | Intentional groundwater recharge | Well locations |
| Reservoir/recharge basin evaporation | Reservoir/recharge basin evaporation | WATER QUALITY | Temperature |
| Agency groundwater pumping (Irrigation) | Precipitation evaporation and runoff | Surface water quality | Land use |
| Private groundwater pumping (Irrigation) | Operational spills | Groundwater quality |
| Agency Groundwater Pumping (M&I) | Water exports | |
| Private Groundwater Pumping (M&I) | | |
| Precipitation | | |
# State and Federal Databases

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<th>Database Name</th>
<th>Description</th>
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<td>CASGEM (California Statewide Groundwater Elevation Monitoring Program)</td>
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<td>WDL (Water Data Library)</td>
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<tr>
<td>GAMA (Groundwater Ambient Monitoring and Assessment Program)</td>
<td></td>
</tr>
<tr>
<td>SWAMP (Surface Water Ambient Monitoring Program)</td>
<td></td>
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<tr>
<td>eWRIMS (Electronic Water Rights Information Management System)</td>
<td></td>
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<tr>
<td>CEDEN (California Environmental Data Exchange Network)</td>
<td></td>
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<tr>
<td>CEIC (California Environmental Information Clearinghouse)</td>
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<tr>
<td>CERES (California Environmental Resources Evaluation System)</td>
<td></td>
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<tr>
<td>National Water Information System</td>
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</table>
Data Acquisition

- Acquire data
- ‘Normalize’ and evaluate data
- Select Data Management System (DMS)
- Develop protocols with adjacent basins
## Data Management Success Criteria

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<thead>
<tr>
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<td>User and Agency Security/Permissions</td>
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<tr>
<td>Reporting and Tracking of Critical Parameters</td>
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<tr>
<td>Outreach</td>
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<tr>
<td>Framework and Ability to Link to other Data Management Systems</td>
<td>■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■</td>
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## Data Management Systems Costs and Timeline

<table>
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<tr>
<th>DMS Options</th>
<th>Estimated Cost Range</th>
<th>Estimated Timeline</th>
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</thead>
<tbody>
<tr>
<td>Option 1: Off-the-shelf DMS with no modification</td>
<td>$5,000 - $30,000</td>
<td>1 – 2 months</td>
</tr>
<tr>
<td>Option 2: Off-the-shelf DMS with modification</td>
<td>$10,000 - $50,000</td>
<td>1 – 3 months</td>
</tr>
<tr>
<td>Option 3: Custom developed DMS</td>
<td>$100,000 - $250,000</td>
<td>6 – 12 months</td>
</tr>
<tr>
<td>Data Conversion (required for all of the above)</td>
<td>$10,000 - $40,000</td>
<td>1 – 2 months</td>
</tr>
</tbody>
</table>
Tools
Tools for GSP Preparation

- Groundwater flow models
- Sustainability goals, measurable objectives & minimum thresholds
- Project development/analysis/prioritization
- Adaptive management
- Outreach
Hydrogeologic Conceptual Model
## Integrated Groundwater-Surface Water Models

<table>
<thead>
<tr>
<th>Key Feature</th>
<th>C2VSim</th>
<th>CVHM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code Platform</strong></td>
<td>IWFM</td>
<td>MODFLOW-FMP</td>
</tr>
<tr>
<td><strong>Public Domain Code</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Model Ownership</strong></td>
<td>DWR</td>
<td>USGS</td>
</tr>
<tr>
<td><strong>Availability</strong></td>
<td>Available from DWR</td>
<td>Available on USGS website</td>
</tr>
<tr>
<td><strong>Documentation</strong></td>
<td>Available on DWR website</td>
<td>Available on USGS website</td>
</tr>
<tr>
<td><strong>Integrated Model</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Geographic Area</strong></td>
<td>Central Valley</td>
<td>Central Valley</td>
</tr>
<tr>
<td><strong>Simulation Period (Water Years)</strong></td>
<td>1921 - 2009</td>
<td>1961 – 2003</td>
</tr>
<tr>
<td><strong>Number of Model Layers</strong></td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td><strong>Geologic Formations Represented in the Model</strong></td>
<td>Generalized upper unconfined aquifer, confined production zone, deep confined zone</td>
<td>Layers not explicitly tied to hydrogeologic units except for Corcoran Clay in the San Joaquin Valley; remainder based on uniform division of aquifer system for modeling purposes</td>
</tr>
<tr>
<td><strong>Agricultural Demand Estimation Method</strong></td>
<td>Integrated methodology using IDC</td>
<td>Integrated methodology using the Farm Process</td>
</tr>
<tr>
<td><strong>Stream-Aquifer Interaction Method</strong></td>
<td>Integrated methodology using IWFM Stream Package</td>
<td>Integrated methodology using MODFLOW Streamflow Routing Package</td>
</tr>
<tr>
<td><strong>Elements</strong></td>
<td>32,537</td>
<td>20,533</td>
</tr>
<tr>
<td><strong>Average Grid Size</strong></td>
<td>407 acres (0.64 square miles)</td>
<td>640 acres (1 square miles)</td>
</tr>
<tr>
<td><strong>Time Step</strong></td>
<td>Monthly</td>
<td>Monthly</td>
</tr>
</tbody>
</table>
C2VSim is Recommended Model

- Cost is the same for modifying both models
- DWR has selected C2VSim and IWFM platform for SGMA implementation
- Most adjoining groundwater basin are selecting IWFM
- C2VSim can provide a consistent set of inter-basin flows with the neighboring basins
- Can use data in CVHM to refine C2VSim model locally
Sustainability Goals and Objectives

- Required by SGMA
  - Sustainability Goals
  - Minimum thresholds
  - Management objectives
- Monitoring for compliance
- Interim goals to demonstrate progress
Project Identification and Prioritization

- Define the Problem
- Develop Method for Evaluation
- Identify Projects and Management Actions
- Screen Projects and Management Actions
- Create and Evaluate Portfolios
- Secure Funding
- Implement Projects and Management Actions
- Implement Adaptive Management
- Monitoring
Decision Support System (DSS) Models

A DSS can help solve problems that are:
- Too complex for humans alone
- Too qualitative for computers alone
- Have multiple possible solutions

Decision Process
Most Common Types of DSSs

Water Evaluation And Planning

STELLA®
Systems Thinking for Education and Research

GoldSim
Example DSS Network
SGMA Outreach Requirements

During GSA formation
• At least one public hearing
• List of interested parties and how their interests will be considered

During GSP development and implementation
• DWR notification of intent to initiate development of a GSP
• GSP adoption/amendment public hearing held
• Public meeting(s) for fee assessment
• List of persons interested in receiving notices and information
• Written statement describing how interested parties may participate

Throughout SGMA implementation
• Consider interests of all beneficial uses and users of groundwater
• Encourage active involvement of diverse social, cultural, and economical elements of the population
Possible Outreach Tools

- Joint fact finding
- Technical and Public advisory committees
- Web-based tools (databases, GIS mapping platforms, online document libraries)
- Third-party neutral researchers
- Collaborative models and decision-support tools
Funding
Near-Term Funding Options:
For GSP Development, Monitoring, Data Collection/Analysis, Outreach

**Outside Funding**
- Sustainable Groundwater Planning Grant (DWR)
- SGMA Facilitation Support Services (DWR)
- IRWM Implementation Grants (DWR)
- Groundwater Sustainability Grant (SWRCB)

**Other Funding**
- SGMA Authorities for GSAs (e.g. regulatory fees/assessments)
- USGS Grants and Cooperative Agreements
Long-term Funding Options:
For GSP Updates, Tool Development and Project/Program Implementation

- Future Propositions
  - IRWM Implementation Grants (DWR)
  - Water Recycling/Clean Water State Revolving Fund (SWRCB)
  - Drinking Water/Drinking Water State Revolving Fund (SWRCB)
  - Infrastructure State Revolving Fund (I-Bank)
  - Groundwater Sustainability Funding (SWRCB)
  - Water Storage Infrastructure Program (CWC)
  - New State Programs

- SGMA Authorities – permit fees, groundwater extraction fees, regulatory action fees, other fees, fees collected as taxes, assessments, charges or tolls

- Other
  - Non-Point Source Grant (SWRCB)
  - Small Community Wastewater Grant (SWRCB)
  - Rural Development Water and Waste Disposal Program (USDA)
  - Environmental Quality Incentives program (NRCS)
  - Community Development Block Grant program (Dept. of Housing and Community Development)
  - Conservation grant programs (BoR WaterSmart)
  - Stormwater Grant Programs (SWRCB)
  - Water Use Efficiency Grant Program (DWR)
  - Other future funding programs
GSP Preparation
## Success Criteria Development

<table>
<thead>
<tr>
<th>Categories for Criterion</th>
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</thead>
<tbody>
<tr>
<td>Water Budget</td>
</tr>
<tr>
<td>Groundwater Balance</td>
</tr>
<tr>
<td>Basin Stabilization</td>
</tr>
<tr>
<td>Monitoring and Reporting Effectiveness</td>
</tr>
<tr>
<td>Inter-Agency Coordination</td>
</tr>
<tr>
<td>Oversight and Management Tools and Actions</td>
</tr>
<tr>
<td>Data Accessibility</td>
</tr>
<tr>
<td>Communication</td>
</tr>
<tr>
<td>Plan for Uncertainties</td>
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</tbody>
</table>
Proposed GSP Outline

Executive Summary
1. Introduction
2. Plan Area
3. Governance
4. Outreach and Communication
5. Basin Setting
6. Sustainable Management Criteria
7. Measurable Objectives
8. Sustainability Implementation
9. Plan Implementation
10. References and Technical Studies

Appendices
- Contact Information for Plan Manager
- List of Public Meetings and Outreach Activities
- Interagency Agreements
- Technical Appendices
- Groundwater Model Documentation
- GSP Adoption Activities
Schedule for GSP Preparation

Initiate Work: March 27, 2017
General Front End Sections: March 27 – May 5, 2017
Data Collection and Basin Conditions: March 27 – June 23, 2017
Basin Setting: June 26, 2017 – March 30, 2018
Sustainable Management Criteria: April 2 – May 11, 2018
Identify Projects and Management Actions: May 14 – June 27, 2018
Monitoring Plan: April 17 – May 26, 2017
GSP Compilation: August 27 – November 19, 2018
Adoption: November 19, 2018 or later

Outreach and communication throughout whole period
## Estimated Level of Effort (LOE)

<table>
<thead>
<tr>
<th>Work Item</th>
<th>Manpower</th>
<th>Cost</th>
<th>Specialties/Contracting</th>
<th>Coordination with other GSAs</th>
<th>Stakeholder Outreach/Buy-in</th>
<th>Estimated Cost</th>
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<tbody>
<tr>
<td>GSP Front Sections (Introduction, Plan Area and Governance)</td>
<td></td>
<td>$</td>
<td>✓</td>
<td>🗈</td>
<td></td>
<td>$10,000 - $20,000</td>
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<tr>
<td>Data Collection and Review</td>
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<td>$30,000 - $50,000</td>
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<td>Data Management System Construction</td>
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<td>Data Analysis and Data Gap Identification</td>
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<td>$20,000 - $50,000</td>
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<td>Identification of Groundwater Dependent Ecosystems</td>
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<td>Hydrologic Conceptual Model – including summarizing current and historical</td>
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<td>$20,000 - $100,000</td>
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<td>ground water conditions</td>
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<td>Model Refinement (including calibration and sensitivity analyses)</td>
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<td>Sustainability Goal and Criteria</td>
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<td><strong>$1M - $2.5M</strong></td>
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<td>Potential Grant Funding (requiring 50% local match)</td>
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<td><strong>$1M - $2M</strong></td>
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## Alternatives for Cost Allocation

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<tr>
<th>Allocation Basis</th>
<th>No. Participants</th>
<th>Discussion</th>
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<tbody>
<tr>
<td>1 Gross Acreage</td>
<td>5</td>
<td>Simple division of cost by acreage in each GSA.</td>
</tr>
<tr>
<td>2 Equal Shares by GSA</td>
<td>5</td>
<td>Each GSA pays an equal share. May not represent value received by GSA.</td>
</tr>
<tr>
<td>3 50% by GSA, 50% by Acreage</td>
<td>5</td>
<td>50% cost split based on acreage and number of GSAs.</td>
</tr>
<tr>
<td>4 50% by Acreage, 50% by Seat at Table</td>
<td>13</td>
<td>50% of costs paid based on acreage served, with remaining 50% paid based on having a decision making role in the GSP development.</td>
</tr>
<tr>
<td>5 50% by Acreage per GSAs with &gt; 10% of Acreage, 10% by Areas with &lt; 10% of acreage</td>
<td>3</td>
<td>Allocates 10% of the cost to each of the GSAs with less than 10% of the acreage, with the remaining cost allocated to the remaining GSAs based on acreage.</td>
</tr>
<tr>
<td>6 Total Pumping within each GSA</td>
<td>TBD</td>
<td>Would allocate cost strictly on average annual groundwater pumping.</td>
</tr>
<tr>
<td>7 Total Average Annual Water Use by GSA</td>
<td>TBD</td>
<td>Would allocate cost strictly on total average annual water use.</td>
</tr>
<tr>
<td>8 50% by Total Annual Pumping, 50% by Acreage</td>
<td>TBD</td>
<td>Would allocate cost with 50% of cost based on average annual groundwater pumping and 50% based on acreage served.</td>
</tr>
<tr>
<td>9 50% by Total Annual Water Use, 50% by Acreage</td>
<td>TBD</td>
<td>Would allocate cost with 50% by total annual water use and 50% by acreage served.</td>
</tr>
<tr>
<td>10 Independent Formula Development</td>
<td>TBD</td>
<td>A new formula for cost allocation would be independently developed specifically for GSP preparation</td>
</tr>
</tbody>
</table>
Questions?
Statutory Requirements

- Empowers local agencies to manage groundwater basins in a sustainable manner over a long-term period
- Requires Groundwater Sustainability Agencies (GSAs) formation and development of Groundwater Sustainability Plans (GSPs)
- Limited to California’s alluvial groundwater basins that have been deemed to have a high or medium priority.
- 20-year implementation horizon
- 50-year planning horizon
- DWR evaluation and assessment of GSPs and their implementation required
- Non-compliance allows for state intervention
- GSP preparation exempt from California Environmental Quality Act [CEQA]
- SGMA does not “…determine or alter surface water rights or groundwater rights under common law or any provision of law that determines or grants surface water rights.”
Roles and Responsibilities

**Local Agencies** – Responsible for the formation of GSAs and the subsequent development and implementation of GSPs. Local agencies are expected to collaborate and coordinate their GSA formations on a basin-wide scale to sustainably manage groundwater at a local level.

**Department of Water Resources** – Primarily responsible for providing guidelines and assistance for the GSA and GSP development processes. Serves as the regulating and assisting agency and leads communication, engagement and coordination at a statewide level, and provides data, and information, tools, funding, and non-technical and technical support. Also responsible for reviewing GSPs for adequacy and for evaluating the GSP implementation and 5-year updates.

**State Water Resources Control Board** – Act as State’s ‘enforcing agency’ and may intervene and create an interim plan if a GSA is not formed or fails to develop or implement a GSP.

**Other Parties** – May include the federal government and tribal interests in addition to other stakeholders.
Groundwater Sustainability Agencies (GSAs)

- One or more local agencies that implement SGMA provisions
- Local agency = a local public agency that has water supply, water management, or land use responsibilities within a groundwater basin
- GSAs must be formed by June 30, 2017
- Key requirements to GSA formation are:
  - A public hearing held in the county or counties underlying the basin prior to GSA formation.
  - The proposing GSA must file a notification with DWR and include specific required back-up information.
  - Other coordination and notification requirements as required by the legislation and/or implementing regulations.
- For basins where no agency forms a GSA, the County assumes the GSA role
Groundwater Sustainability Plans (GSPs)

- GSPs serve as the primary resource by which the GSAs will operate
- Required to include measurable goals and objectives and implementation actions to achieve basin sustainability
- May be a single plan covering the entire basin prepared by one or more GSAs, or multiple plans prepared by multiple GSAs coordinated pursuant to an agreement that covers the entire basin
- If multiple plans are prepared for the same basins, GSAs must coordinate to ensure the same assumptions are made in GSP development
- Fundamental components of a GSP are:
  - Basin Setting/Conceptual Model
  - Management Area Definition
  - Sustainable Management Criteria
  - Monitoring Programs
  - Projects and Management Actions
GSP Implementation

- Groundwater sustainability to be achieved and maintained within 20 years
- Annual reporting to DWR showing progress towards sustainability goal, and including documentation of:
  - Groundwater elevation
  - Groundwater extraction
  - Surface water supply used for groundwater recharge
  - Total water use
  - Change in groundwater storage
- GSPs must be updated every 5 years
- GSAs are required to commit to groundwater management, monitoring, reporting, and planning
Best Management Practices (BMPs)

- DWR BMPs released in December 2016:
  - Monitoring Protocols, Standards, and Sites
  - Monitoring Networks and Identification of Data Gaps
  - Hydrogeologic Conceptual Model
  - Water Budget
  - Modeling

- Each document:
  - Outlines use and limitations of the BMP
  - Describes the fundamental concepts of the topic
  - Discusses the relationship with other BMPs
  - Describes available technical assistance to support the development

- Additional BMPs planned for future
GSP Requirements

- **Technical and Reporting Standards**
  - Protocols for data collection and management
  - Protocols for detecting changes in groundwater levels, quality, subsidence, and surface water quality

- **Administrative Information**
  - Describe organization structure of the GSA and legal authorities
  - Information regarding the GSA and maps showing the coverage area, adjudicated areas, jurisdictional boundaries of state and federal land, land use designations, and density of wells.
  - Plan area described through summary of jurisdictional areas and other features
  - Describe how existing water resources monitoring and management will be incorporated into the GSP and what limits they will place on operational flexibility

- **Land Use**
  - Summarizes relevant General Plans and other applicable land use and highlights potential impacts to these existing plans
  - Describes how the GSP will address those impacts to existing plans
  - Includes information regarding land use plans outside of the jurisdictional area of the GSP that have potential to impact the ability of the Agency to achieve sustainable groundwater management
  - Describe process for permitting new or replacement wells in the basin
GSP Requirements (cont’d)

- **Basin Setting**
  - Provide an overview on the current, historical, and projected conditions of the basin
  - Summarize hydrogeologic conceptual model, including scaled cross-sections and maps of the area’s physical characteristics
  - Include map of existing and potential recharge areas and discharge areas and description of how the recharge areas identified will contribute substantially to the replenishment of the basin
  - Describe current and historical groundwater conditions, including data such as groundwater elevation data, groundwater storage estimates, seawater intrusion conditions, groundwater quality issues, and land subsidence conditions.
  - Describe baseline conditions and refer to historic information used to project future basin conditions
  - Identify interconnected surface water systems and groundwater dependent ecosystems (GDEs)
  - Present basin’s water budget, including description of inflows into and outflows from the basin and change in storage, a quantification of overdraft, an estimate of sustainable yield, and quantification of current, historical, and projected water budgets.
  - Describe surface water supplies used for groundwater recharge or in-lieu use
  - Describe Management Areas within the and explain the purpose of each
GSP Requirements (cont’d)

- Sustainable Management Criteria
  - Describe the metrics used to track the sustainability goal and monitor for undesirable results through the use of minimum thresholds and measurable objective
  - Provide summary of the sustainability goal for the basin and a description on how it was formed using data from the basin setting
  - Identify undesirable results for any of the sustainability indicators and any groundwater conditions that would cause undesirable results
  - Describe potential effects of undesirable results on the beneficial uses and users of groundwater, land uses and property interests, and other areas
  - Define minimum thresholds established for each sustainability indicator and describe how they were established, how they relate to each sustainability indicator, and how each threshold may affect beneficial uses and users of groundwater
  - Define measurable objectives are used to monitor each sustainability indicator, including describing how the objectives were established for each relevant sustainability indicator and how a reasonable margin of safety was established for each objective
  - Describe interim milestones for each relevant sustainability indicator using the measurable objectives
GSP Requirements (cont’d)

- **Monitoring Networks**
  - Describe how the GSA is capable of collecting sufficient data to demonstrate short-term, seasonal, long-term trends in groundwater and related surface conditions, and will yield representative information about groundwater conditions as necessary to evaluate GSP implementation.
  - Include a map of the location and type of each monitoring network is provided along with a description of how the network will be developed and the methods used to monitor groundwater data.
  - Describe the monitoring protocols for data collection and monitoring by outlining the technical standards, data collection methods, and protocols required to ensure standard data and methodologies.
  - Described representative monitoring if used.
  - Describe data gaps.
GSP Requirements (cont’d)

- **Projects and Management Actions**
  - Describe actions that will help achieve the sustainability goal
  - For each project and management action, describe:
    - The expected benefit to be achieved
    - How each benefit will be evaluated and accomplished
    - Public noticing, overdraft, permitting and regulatory process, legal authority required, cost estimate, management of groundwater extraction and recharge, a time-table for initiation and completion, and the accrual of expected benefits

- **Plan Implementation**
  - Include a plan of action and a description of the efforts required to successfully report and evaluate the GS
  - Include an estimate of costs to implement the GSP and a schedule for implementation
  - Describe the process for periodic evaluations and annual reporting

- **Interagency Agreements**
  - Describe interagency agreements with other GSAs
Data Use in SGMA

- Developing a hydrogeologic conceptual model
- Developing and updating a water budget
- Preparing a numerical groundwater flow model
- Defining sustainability and setting a sustainability goal
- Determining measurable objectives and minimum thresholds for sustainability indicators
- Tracking sustainability indicators for undesirable results
- Preparing annual reports for submittal to the State
- Verifying assumptions while preparing 5-year Interim Updates, and
- Managing groundwater in the subbasin
Existing Data and Data Gaps

- Groundwater Management Plans
- Agricultural Water Management Plans
- General Plans
- Water Quality Studies
- Urban Water Management Plans
- Annual Reports – CASGEM, other
- Existing State and local databases
## State and Federal Databases

<table>
<thead>
<tr>
<th>Database Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASGEM (California Statewide Groundwater Elevation Monitoring Program)</td>
<td>Groundwater elevations database maintained by the SWRCB</td>
</tr>
<tr>
<td>WDL (Water Data Library)</td>
<td>DWR maintains the State’s WDL which stores data from various monitoring stations, including groundwater level wells, water quality stations, surface water stage and flow sites, rainfall/climate observers, and well logs.</td>
</tr>
<tr>
<td>GAMA (Groundwater Ambient Monitoring and Assessment Program)</td>
<td>GAMA provides a comprehensive assessment of water quality in water wells throughout the State.</td>
</tr>
<tr>
<td>SWAMP (Surface Water Ambient Monitoring Program)</td>
<td>SWRCB database for surface water quality data</td>
</tr>
<tr>
<td>eWRIMS (Electronic Water Rights Information Management System)</td>
<td>SWRCB Water Rights database containing information on Statements of Water Diversion and Use that have been filed by water diverters, as well as registrations, certificates, and water right permits and licenses that have been issued by the SWRCB and its predecessors.</td>
</tr>
<tr>
<td>CEDEN (California Environmental Data Exchange Network)</td>
<td>CEDEN is a central location to find and share information on California’s water bodies, including streams, lakes, rivers, and the coastal ocean.</td>
</tr>
<tr>
<td>CEIC (California Environmental Information Clearinghouse)</td>
<td>California Natural Resources Agency’s (CNRA) statewide metadata clearinghouse for geospatial data.</td>
</tr>
<tr>
<td>CERES (California Environmental Resources Evaluation System)</td>
<td>CERES is an information system developed by CNRA to facilitate access to a variety of electronic data describing California’s rich and diverse environments.</td>
</tr>
<tr>
<td>National Water Information System</td>
<td>United States Geological Survey (USGS) database including data on the occurrence, quantity, quality, distribution, and movement of surface and underground waters and disseminates the data to the public, state and local governments, public and private utilities, and other federal agencies involved with managing water resources.</td>
</tr>
</tbody>
</table>
CASGEM
ILRP GAR
CVHM Study
Subsidence Study

Figure 2. Land subsidence in the San Joaquin Valley, California, 1929-70 (modified from Ireland and others, 1984).
Data Management Approach

- Assess current data management setting within the basin
  - Local data management activities and databases
  - State and federal databases
  - Other databases
- Identify DMS features that will help meet data management needs
- Evaluate costs and timeline associated with different DMS options
- Determine DMS platform
- Develop implementation plan
# Data Management Systems Costs and Timeline

<table>
<thead>
<tr>
<th>DMS Options</th>
<th>Estimated Cost Range</th>
<th>Estimated Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1: Off-the-shelf DMS (no modification)</strong></td>
<td>$5,000 - $30,000</td>
<td>1 – 2 months</td>
</tr>
<tr>
<td>Includes configuration with little or no modification and potential license fees</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Option 2: Off-the-shelf DMS (with modification)</strong></td>
<td>$10,000 - $50,000</td>
<td>1 – 3 months</td>
</tr>
<tr>
<td>Includes configuration and modification to meet needs and potential license fees</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Option 3: Custom developed DMS</strong></td>
<td>$100,000 - $250,000</td>
<td>6 – 12 months</td>
</tr>
<tr>
<td>Includes design and development of a customized DMS and implementation at agency’s location</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Data Conversion (all Options)</strong></td>
<td>$10,000 - $40,000</td>
<td>1 – 2 months</td>
</tr>
<tr>
<td>Includes data collection, conversion/QAQC, and upload to the DMS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Central Valley Model Performance

- Change in Storage (AFY)
- Gain from Stream (AFY)
- Net Deep Perc (AFY)
- Pumping (AFY)
Adaptive Management

1. Decision Making
   • Should reflect current level of understanding and anticipate future consequences of decisions
   • Should consider management objectives, resource status, and knowledge of consequences of potential actions.

2. Follow-up Monitoring
   • Used to estimate resources status, underpin decision making, and facilitate evaluation and learning after decisions are made
   • Ongoing activity

3. Assessment
   • Monitoring data used along with other information to evaluate effectiveness of previous actions, understand resource status, and reduce uncertainty about management effects
   • Model generated predictions are compared with data based estimates

4. Learning and Feedback
   • Understanding gained from monitoring and assessment helps select future actions
   • Iterative cycle of decision making, monitoring, and assessment leading to better understanding of resource dynamics and adjusted management strategy moving forward

5. Institutional Learning
   • Periodically interrupt technical cycle to reconsider project objectives, management alternatives, and other elements of the setup phase
## Success Criteria Development

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Budget</td>
<td>Demonstrate that the overall surface and groundwater budget is in balance for the entire Basin.</td>
</tr>
<tr>
<td>Groundwater Balance</td>
<td>Establish a long-term basis for determining groundwater balance. Need to consider concept of conjunctive use, including increasing storage in wetter years and relying on banked groundwater in drier years.</td>
</tr>
<tr>
<td>Basin Stabilization</td>
<td>Evaluate the stability of the groundwater basin, and measure GSP performance through long-term monitoring of basin performance.</td>
</tr>
<tr>
<td>Monitoring and Reporting Effectiveness</td>
<td>Develop plan for total monitoring of water use, groundwater use, and changes in groundwater storage.</td>
</tr>
<tr>
<td>Inter-Agency Coordination</td>
<td>Monitor inter-agency coordination and cooperation. May include number of inter-agency exchanges, cooperative projects or programs, etc.</td>
</tr>
<tr>
<td>Oversight and Management Tools and Actions</td>
<td>Develop tools to understand individual landowner as well as agency-based water use, including groundwater pumping. Establish effective means of reporting and providing feedback to landowners, and providing basis for enforcement if necessary.</td>
</tr>
<tr>
<td>Data Accessibility</td>
<td>Monitor ability of all interested parties to have access, as appropriate, to available data.</td>
</tr>
<tr>
<td>Communication</td>
<td>Monitor outreach communications, and measure the effectiveness thru a feedback loop.</td>
</tr>
<tr>
<td>Plan for Uncertainties</td>
<td>Develop an emergency/drought response plan, including triggers for various management or other actions.</td>
</tr>
</tbody>
</table>
Alternatives for Cost Allocation

Independent Formula Development – Identify allocation factors and assign weights or percentages. Other possible factors to be considered in formula development include:

- Frequency and timing of allocations and distributions
- Measures of need and fiscal capability
- Likelihood of obtaining outside funding
- Income as a measure of capacity to pay
- Assessable income of members with large populations by the percentage difference between capita income and a per capita income threshold corresponding to the average per capita income
- Maximum and minimum rates of assessment
- Per capita ceiling
- A cap of pre-determined percent of total expenditures
- Scheme of limits designated to mitigate extreme variations in assessments
- Process by which formula application is adjusted in order to take account of relevant factors