Exploring Water Budget Use Cases for Decision Making

CWEMF 2022 Annual Conference

Paul Shipman (DWR) & Frank Qian (W&C)

April 5th, 2022

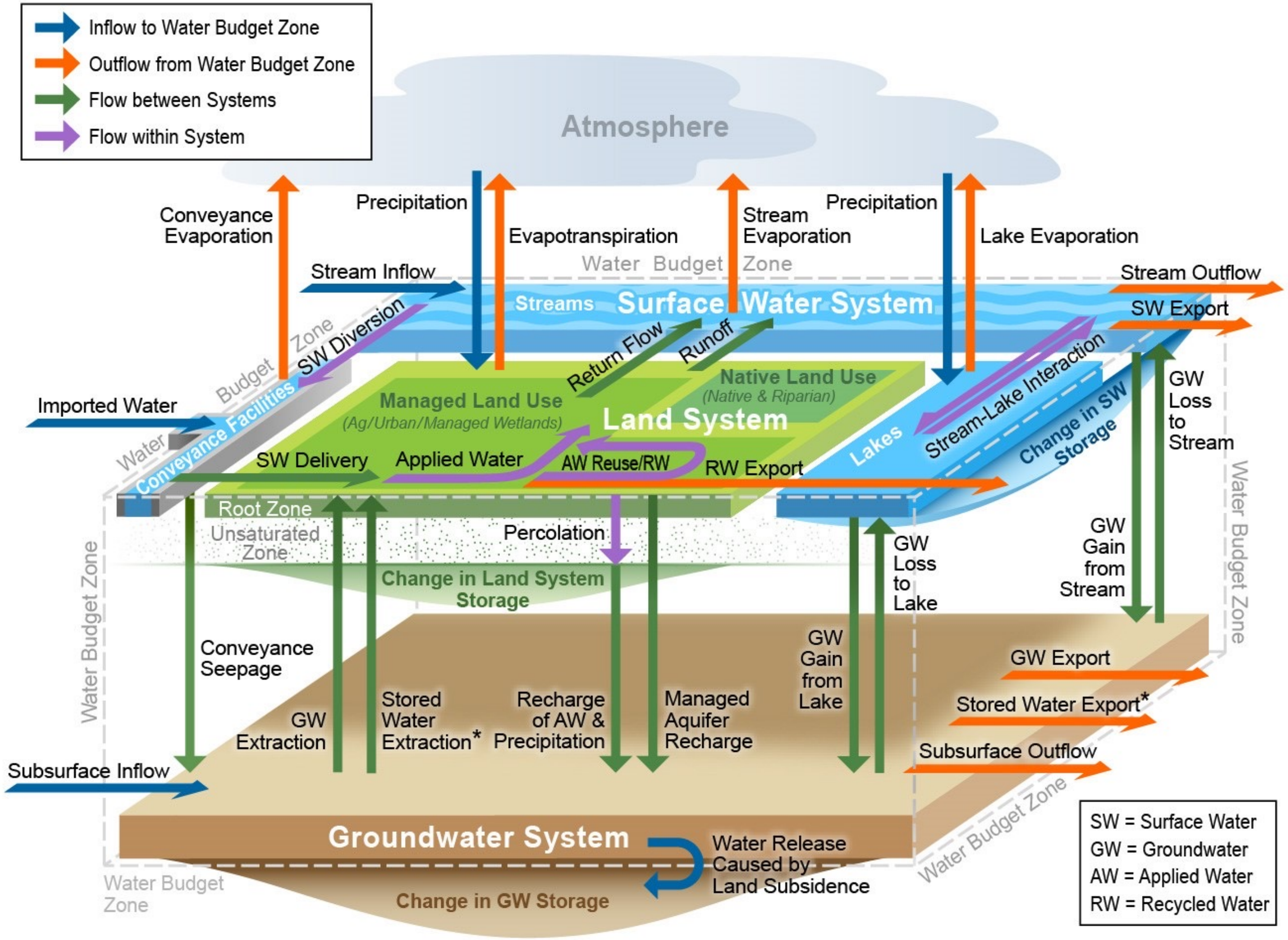
Background and Definition

Water Accounting System

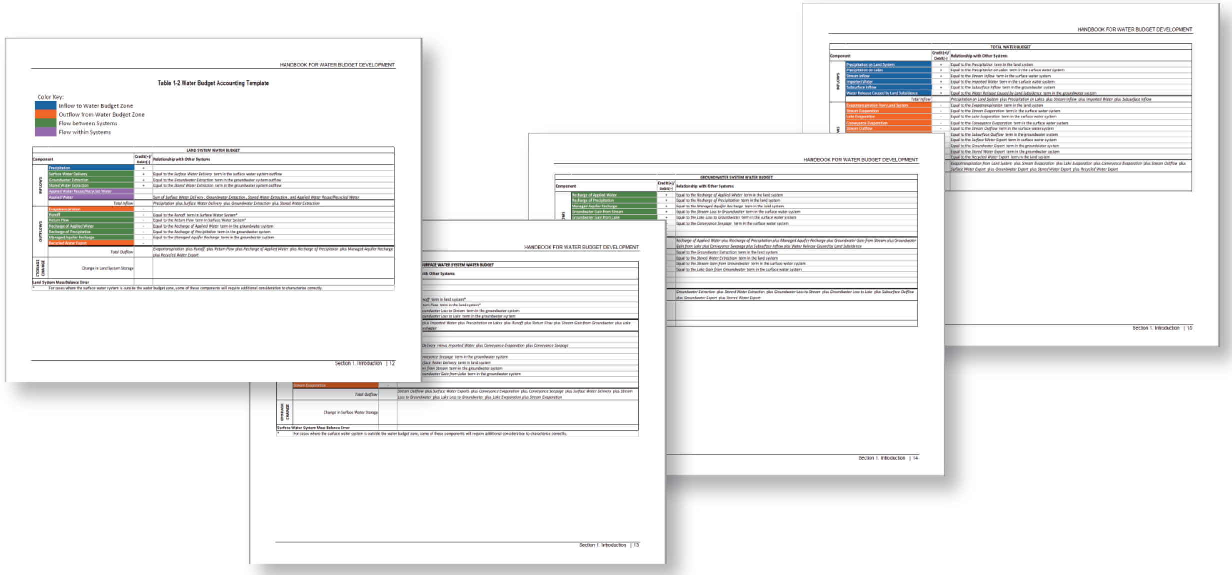
Water Accounting System is envisioned as a suite of tools to help modernize the State's water management and tracking by facilitating accurate and efficient accounting of California's water. A Water Accounting System could include:

- *Guidance on water budget development*
- *Operational and responsive short-term water tracking*
- *Hydrologic and strategic long-term water tracking*
- *Exploration of alternatives and decision support tools*

Water budget is the systematic and comprehensive accounting of all inflows to and outflows from three interacting systems in a water budget zone: land, surface water, and groundwater.



Water accounting is the systematic acquisition, analysis, and communication of information relating to water flows (from source to sinks) in natural, disturbed, or engineered environments, over time and space, of varying complexity and detail. While these two terms connote similar concepts, and we often use them interchangeably, the scope of water accounting is broader than that of water budget.



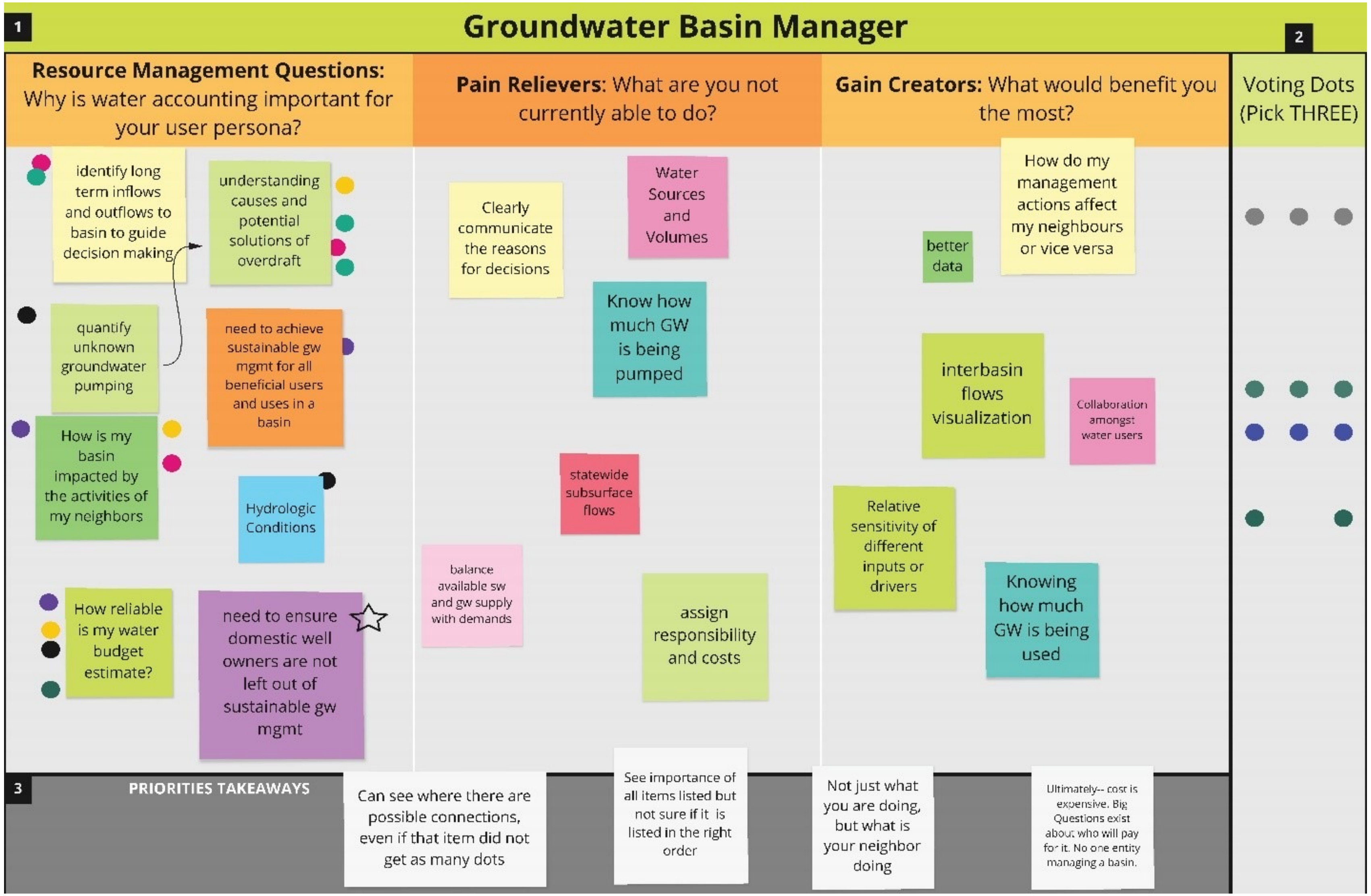
Looking to use cases to define core functionalities for tools to support a water accounting system

As a (user), I want to (action) so that I can (goal).

Process

DWR conducted internal workshops and subject matter experts

DWR Staff were asked to explore different possible users



Woodard & Curran

Then use cases developed were translated into needed functionalities for a tool

BREAKOUT 2. IDENTIFYING WATER ACCOUNTING TOOL DESIRED FUNCTIONALITIES

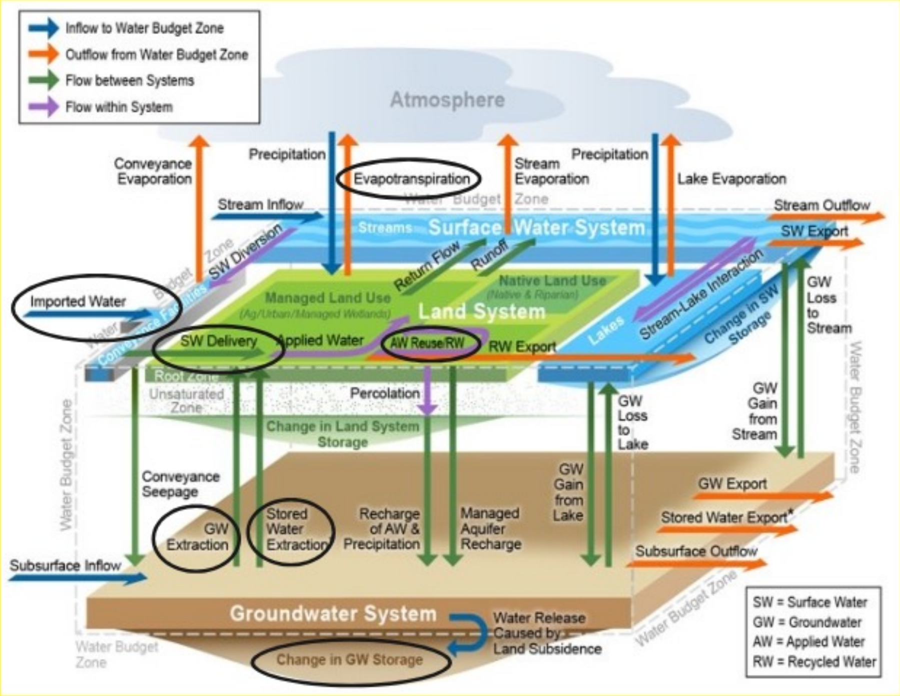
Question: As a grower, I want to be able to determine how much of my water will be used by the crops that I grow, so that I can make decisions what crops to grow. How does this change under future climate change conditions?

1 ASSUMPTIONS [5 min] Identify key assumptions in addressing

- **Historical** water budget data is available (2001-2020). Long-term average.
- **Present** year water budget is available
- Future Climate data is available. A water budget using **future climate data** is available based on most "likely" future conditions
- Information on cost of water is available
- SGMA is fully implemented (no long term negative effects to GW allowed)
- Acting under current environmental requirements.
- Environmental needs are already met by water budget data

STEP 3 - DATA/INFORMATION [5 min]

Use the Water Budget Schematic to identify related water budget components. Please add stickies where appropriate.



2 What are additional non-water budget data that are needed to answer your management question

- Information on cost of water
- How risk adverse is the user? Information available that would let the user identify most extreme conditions (33 percentile, 25 percentile, etc.)
- Need information on economic value of different crops (current and projected)
- regulatory information available, what regulations might be waved under significant adverse conditions

3 DESIRED FUNCTIONALITY [20 min]

- Need to be able to ingest cost of water data and be able to calculate more efficient ($) water sources.
- User identifies risk thresholds for future climate to identify potential lowest supply for a year.
- Need to be able to compare profitability of crop to cost of water required for the selected crop
- Identify if a crop is suitable under current conditions, but not suitable under future conditions (lack of after available under extreme future conditions)
- Identify if it might be more valuable to not grow and simply transfer water under adverse conditions (would be a penalty to permanent crops)

There used to be existing models that would do this kind of functionality, CVAG, SWAP, etc.

Woodard & Curran

Findings

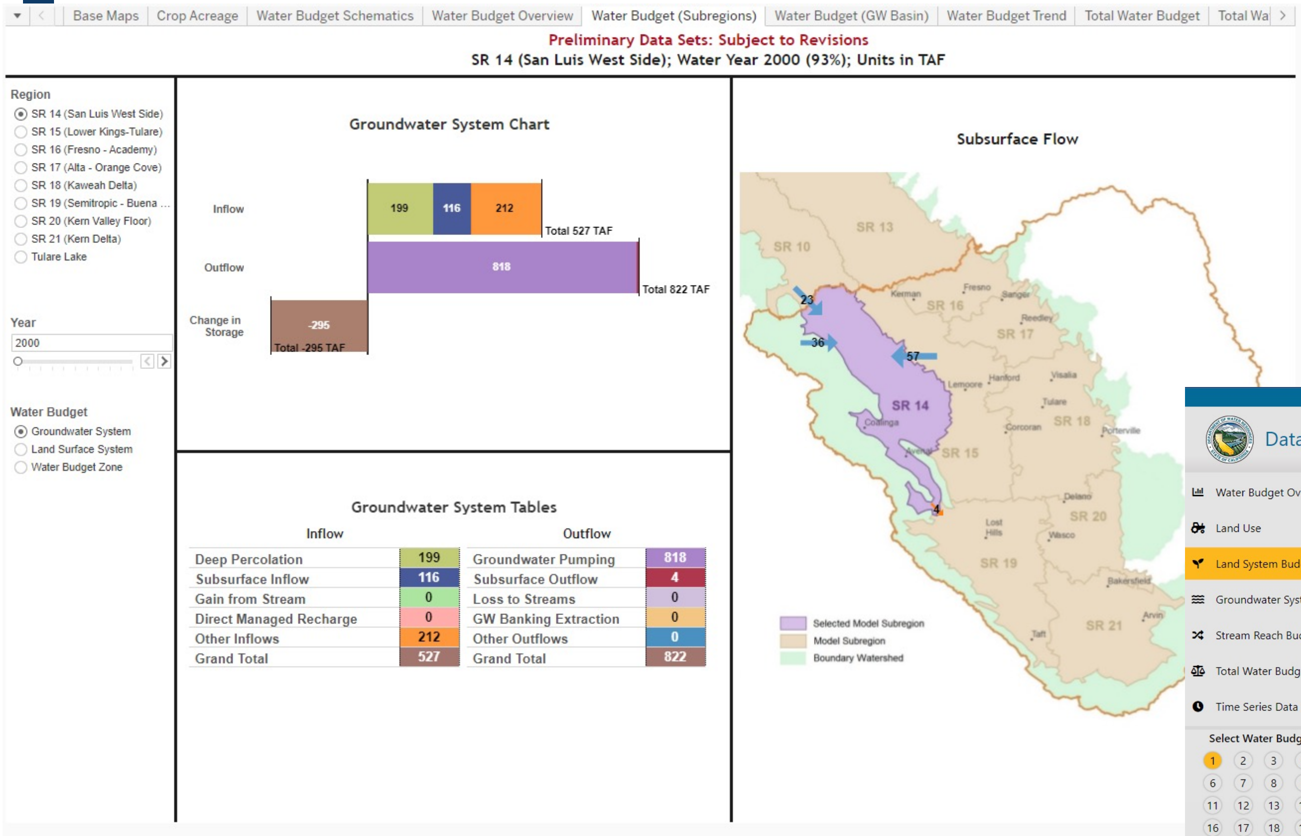
Use Case Sorting

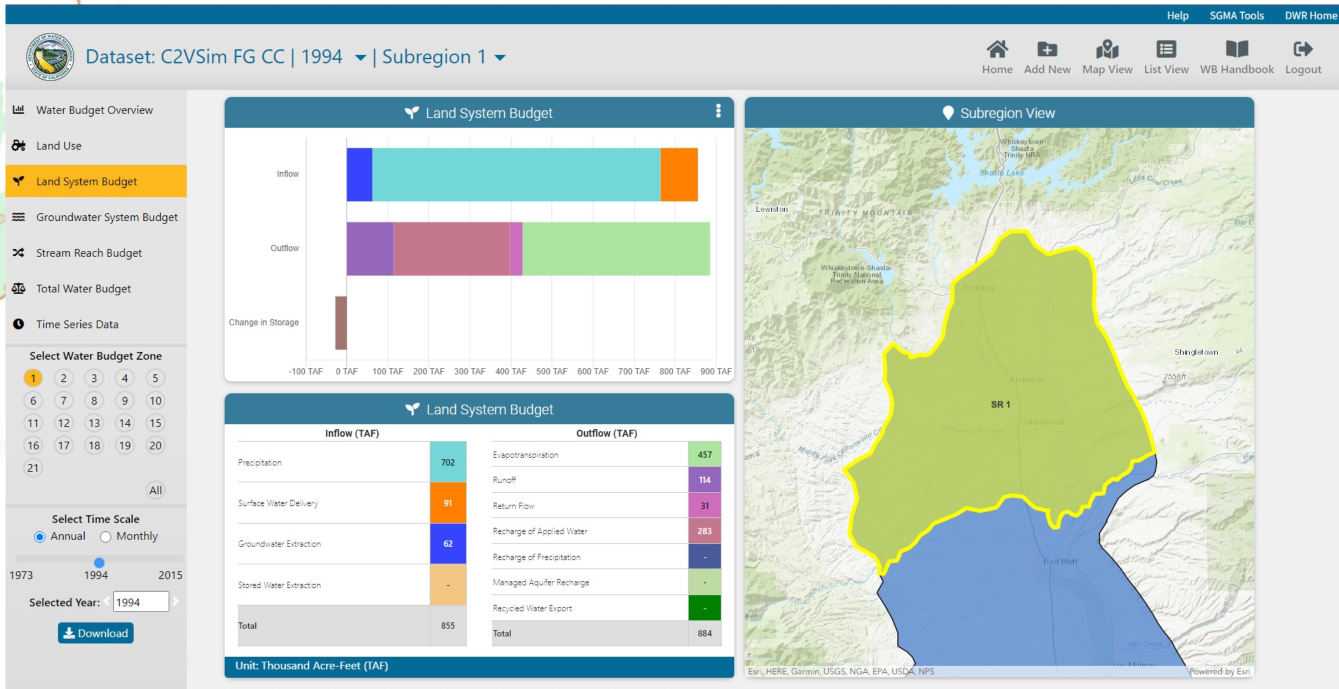
- 88 water accounting use cases
- 8 categories
  - Climate Change and Future Planning
  - Communication
  - Decision Support
  - Drought Planning & Response
  - Managed Aquifer Recharge
  - Operations Management
  - Regulatory Compliance
  - Water Trading

Use Case Examples

- As a water planner, I want to understand **vulnerabilities under different water year types** so I can prepare for a wider range of possibilities in the future.
- As a facilitator, I want to easily **decipher complex modeling results and spreadsheet calculations** into a synthesis of water budget information so I can more communicate and share the information with interested parties
- As a modeler, I want to **quickly check model results for accuracy** so that I can test if model changes are working correctly.
- As a water district, I want to understand **how and where water is being used** in my district so I can identify the biggest opportunities for conservation/water savings in my area.
- As an environmental manager, I want to **view stream-aquifer interaction at different spatial and temporal scales** so that I can understand location or time specific impacts.
- As a local agency, I want to quantify the **effects of a proposed recharge project** so I can better demonstrate its benefits to my users.
- As a basin manager, I want to **quantify my water use and water remaining in storage** so that I can manage my basin to avoid overdraft
- As a water district, I want to know how **much water I can use** annually without triggering adverse **change in storage** so that I can maximize water delivered to my users while still complying with SGMA

Water Budget Dashboard and Water Accounting Tool





Sorting Functionalities

Category	Use Cases	Percent	Description
1	17	19%	Tool is functional as is
2	17	19%	Minor enhancements
3	3	3%	Major data enhancements
4	10	11%	Major tool enhancements
5	15	17%	Major data and tool enhancements
6	26	30%	Management question needs to reframed

- Identified 33 Capabilities needed by tool to address management questions
  - 10 capabilities already exist in current tool
  - 11 capabilities could be added with minor enhancements
  - 12 capabilities added w/ major enhancements
- Fifteen enhancements and functional requirements identified for the tool

Woodard & Curran

Example Functionalities Identified for Tool

- Water Year Type

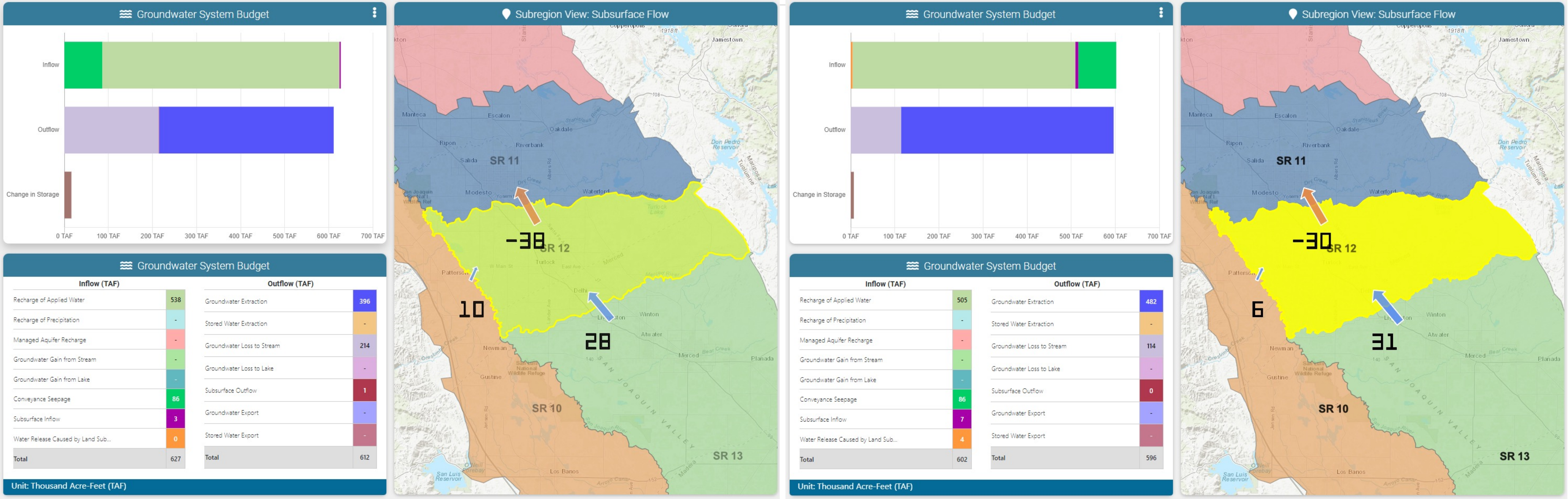
Woodard & Curran

Example Functionalities Identified for Tool

- Scenario Manager

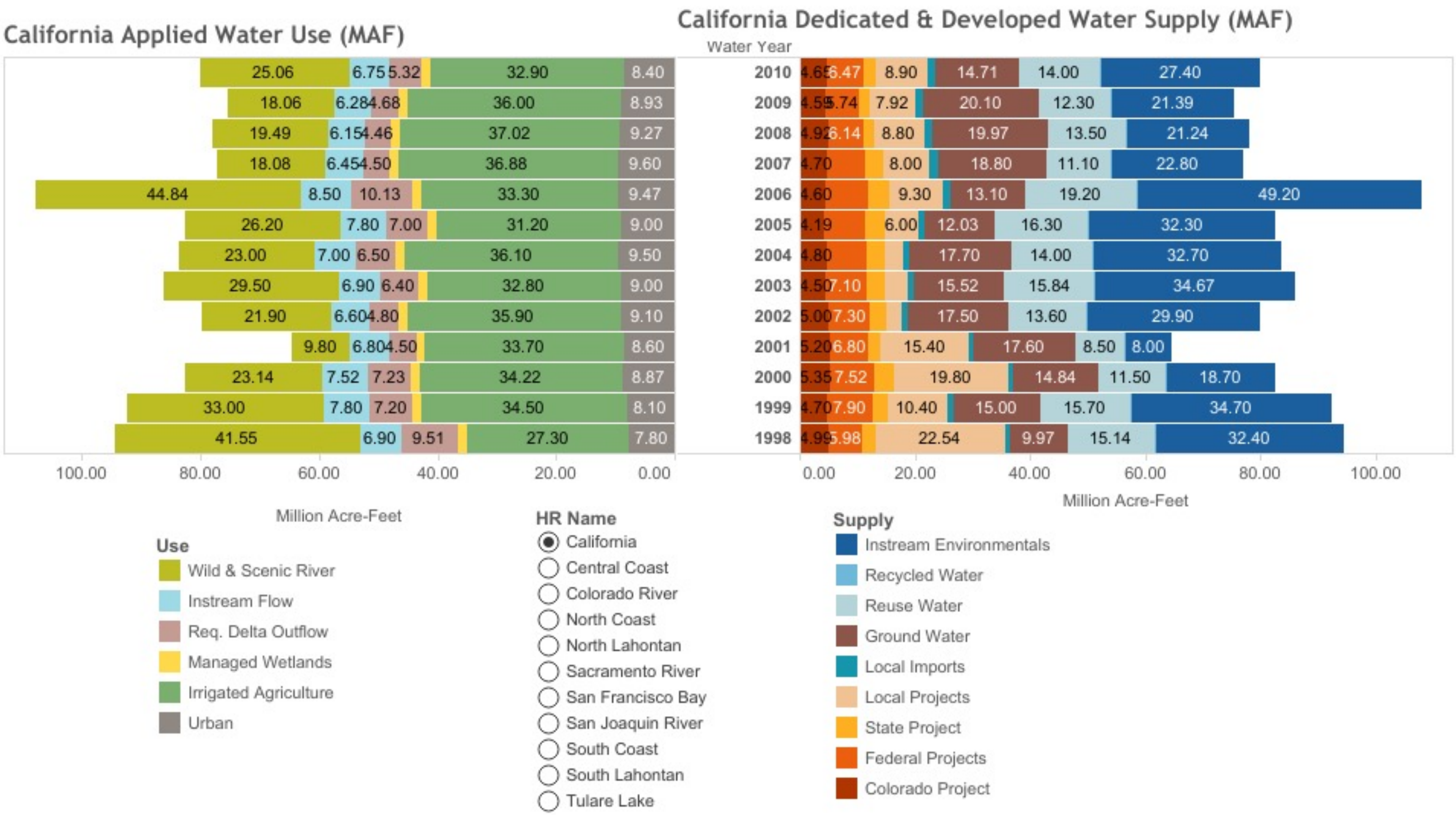
Available Datasets

Dataset Name	Scenario Name	Starting Year	Ending Year
C2VSim	C2VSim FG CC	1973	2015
C2VSim	C2VSim FG 1.01	1973	2015



Example Functionalities Identified for Tool

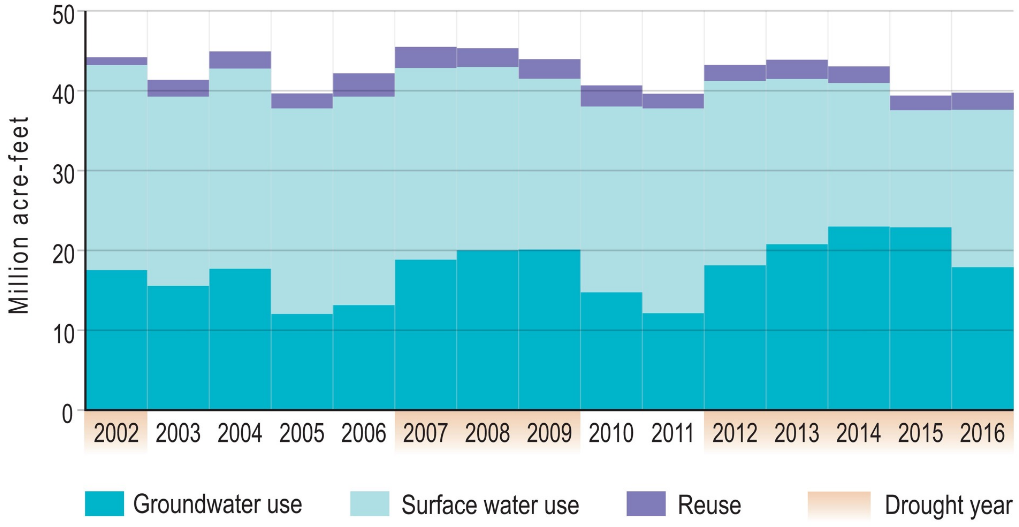
- Trend Analysis



Example Functionalities Identified for Tool

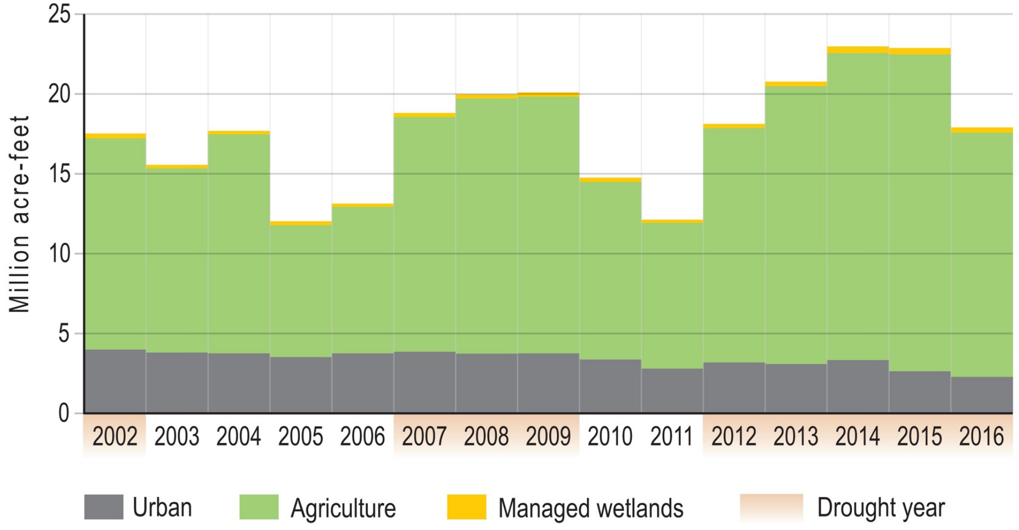
- User Defined Comparisons
  - Select graph type and water budget components
    - Breakdown of water use by source and sector
    - Groundwater pumping vs evapotranspiration

Figure 3-2 Statewide Annual Water Use by Source of Water (2002–2016)



Prepared by Department of Water Resources for California's Groundwater Update 2020

Figure 3-4 Statewide Annual Groundwater Use by Sector (2002–2016)

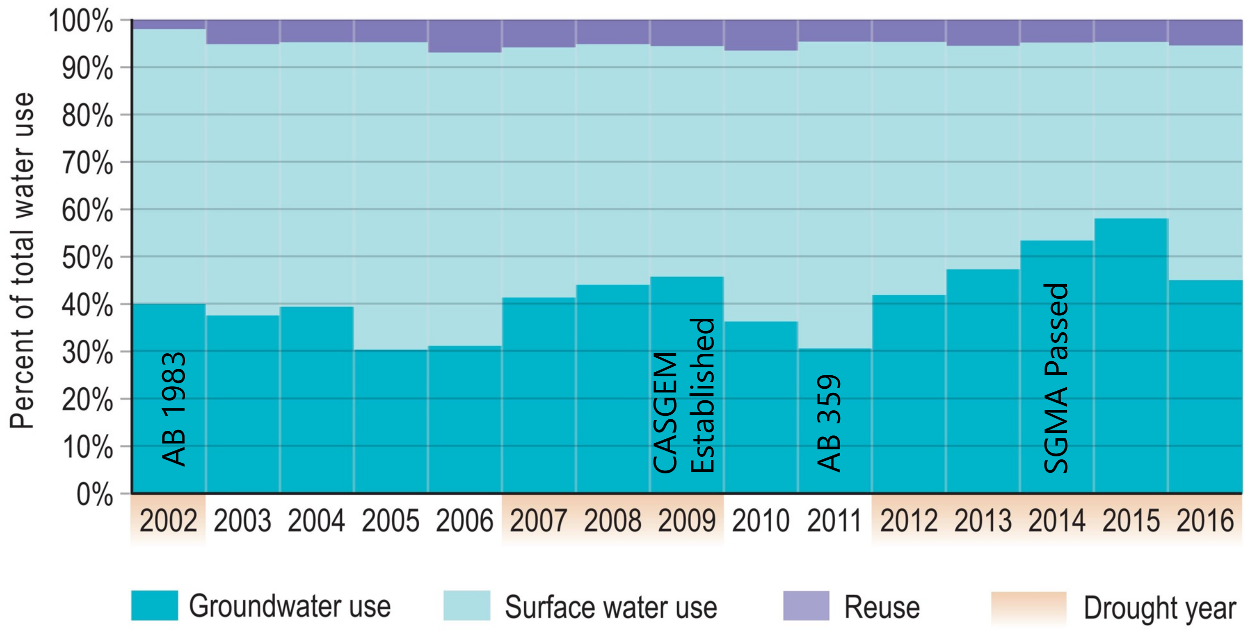


Prepared by Department of Water Resources for California's Groundwater Update 2020

Example Functionalities Identified for Tool

- Regulatory Timeline/Importing External data for comparisons

Figure 3-3 **Statewide Annual Water Use by Source as a Percentage of Total Water Use (2002–2016)**

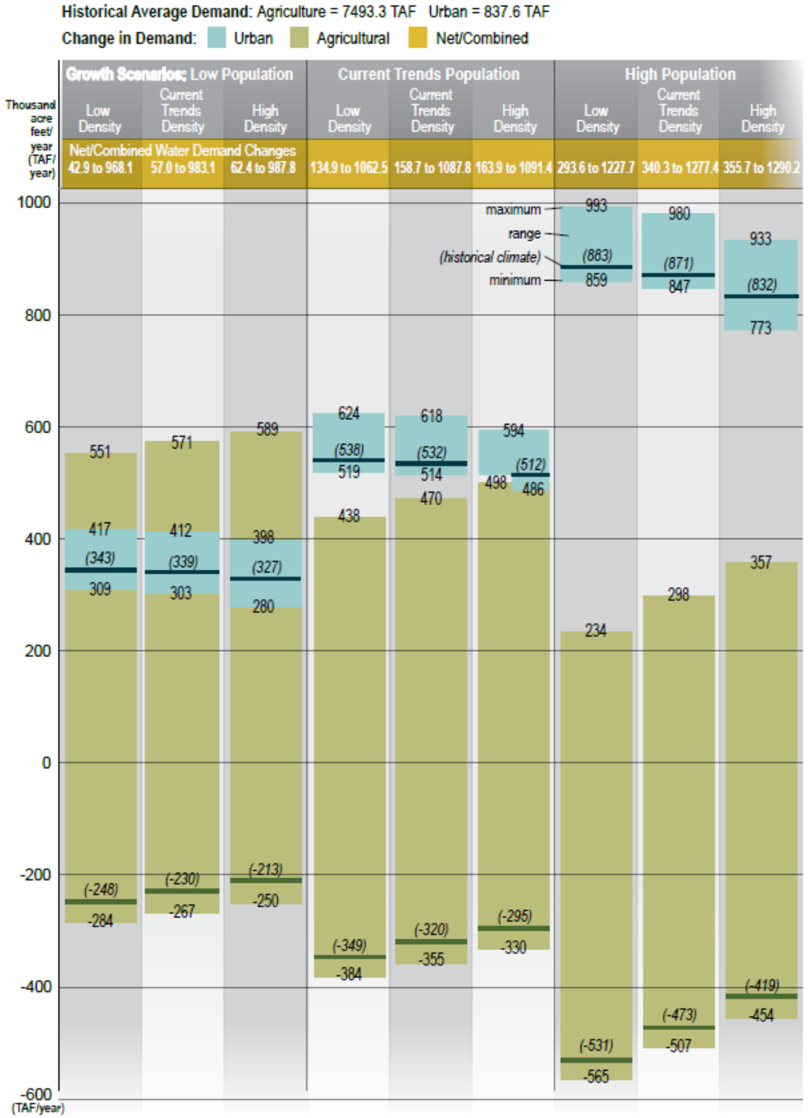


Prepared by Department of Water Resources for California's Groundwater Update 2020

Example Functionalities Identified for Tool

- Rapid Scenario builder and analyzer

Scenario[a]	2050 Population (thousand)	Population Change (thousand) 2006[b] to 2050	Development Density	2050 Urban Footprint (thousand acres)	Urban Footprint Increase (thousand acres) 2006[c] to 2050
LOP-HID	3,894.6[d]	1,010.2	High	807.1	109.5
LOP-CTD	3,894.6	1,010.2	Current Trends	823.4	125.8
LOP-LOD	3,894.6	1,010.2	Low	839.5	141.9
CTP-HID	4,486.2[e]	1,601.8	High	882.9	185.3
CTP-CTD	4,486.2	1,601.8	Current Trends	906.6	209.0
CTP-LOD	4,486.2	1,601.8	Low	930.2	232.6
HIP-HID	5,892.6[f]	3,008.2	High	1,007.8	310.2
HIP-CTD	5,892.6	3,008.2	Current Trends	1,053.4	355.8
HIP-LOD	5,892.6	3,008.2	Low	1,098.1	400.5



Why are we doing this?

- Current Functionality
  - Communicate complex water budget information quickly through an available online tool and, if desired, share publicly so it is available to stakeholders or other interested parties
- Minor enhancements
  - Demonstrate or quantify to stakeholders the benefits of the proposed project
    - example: managed aquifer recharge program, reservoir operation changes, neighboring proposed project, etc.
    - example: potential increase in water transfer from a change in agriculture water use
- Major Enhancements
  - For statewide planning perspective, query based on specific water budget component values
    - example: show all areas where cumulative change in storage is more than 10 TAF positive; show all losing streams that are losing more than 10 TAF per year; show areas where precipitation is greater than 10 TAF.

Thank You!

Questions?