Corning Subbasin

Groundwater Sustainability Plan

Technical Presentation

Presented to Corning Subbasin Advisory Board
07/01/2020 | Teleconference

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Presentation Overview

- Follow up on Action Items from Meeting #2 (June 3)
- Overview of Model Revisions and Introduction to Water Budgets
- Introduction to Management Areas

- **Discussion throughout – ask questions!**

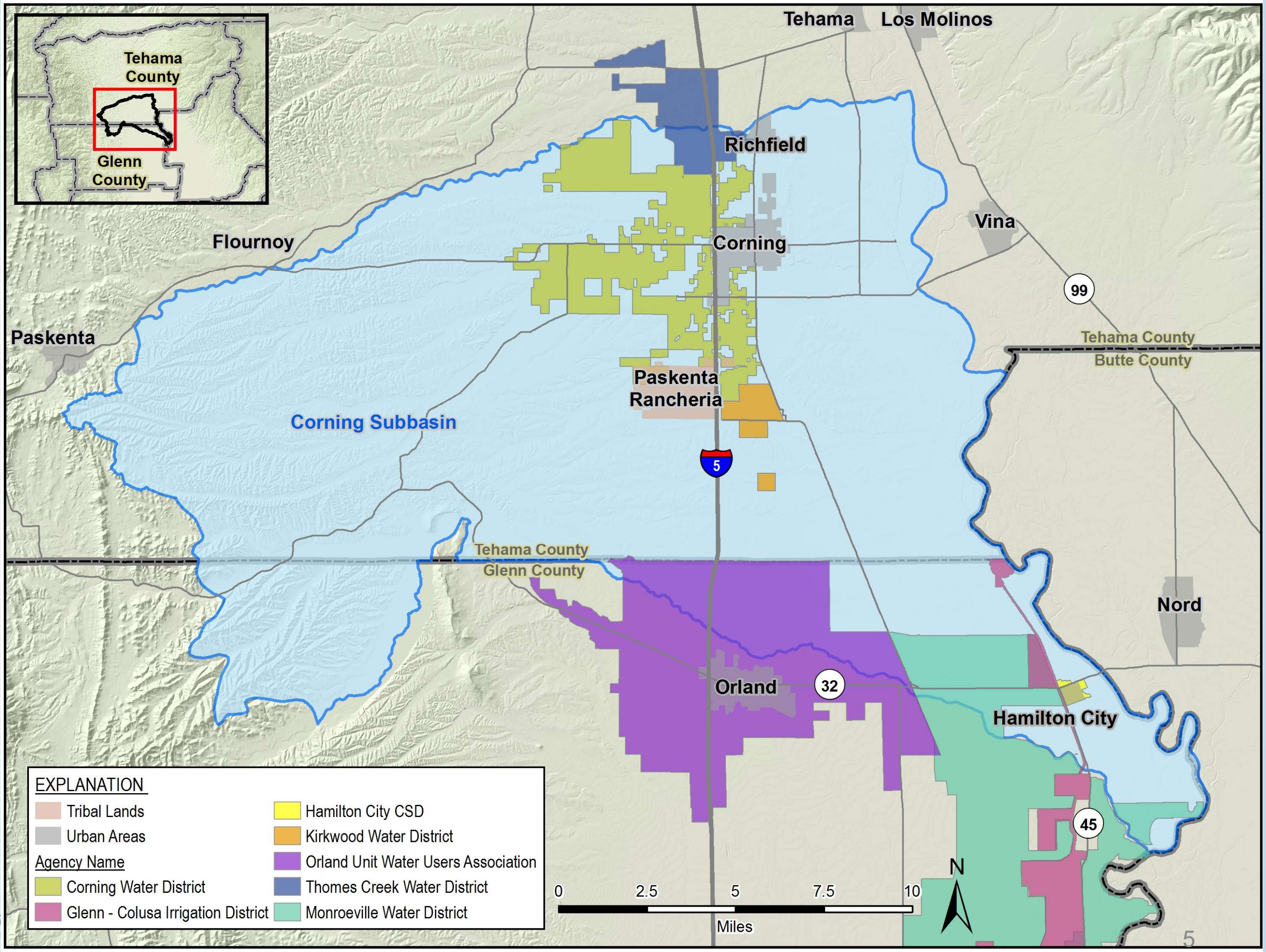
GSP Outline

- **Section 1**: Introduction (Administrative Information)
- **Section 2**: Plan Area and Basin Setting (HCM and GW conditions)
- **Section 3**: Water Budgets (with description of modeling tools)
- **Section 4**: Monitoring Networks
- **Section 5**: Sustainable Management Criteria
- **Section 6**: Projects and Management Actions
- **Section 7**: Plan Implementation

Plan Area
- Action Items and Clarifications

Water Districts Map –
- Removed Capay Rancho WD
- Added Monroeville Water District; just joined Corning Sub-basin GSA

Reviewing water source information for crop irrigation



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Hydrogeologic Conceptual Model (HCM)
- Clarifications on Principal Aquifer Designation

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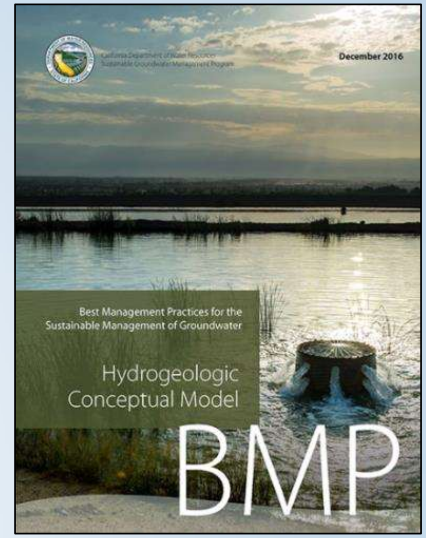
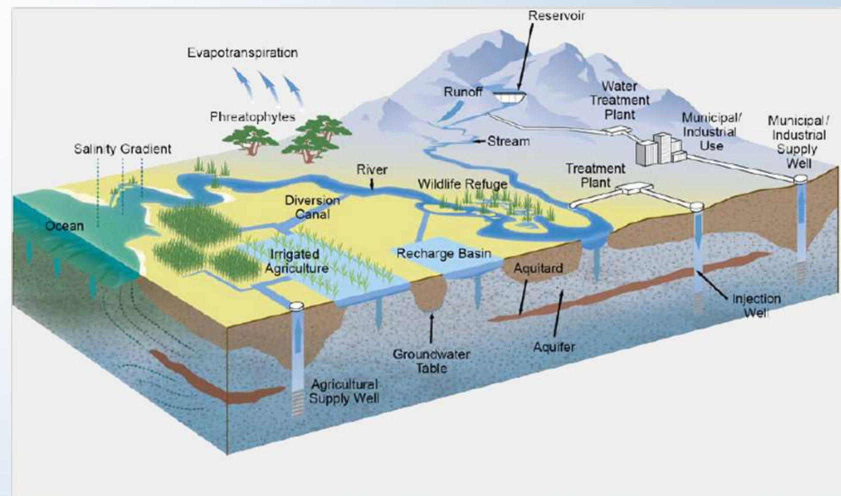
Hydrogeologic Conceptual Model (HCM)



- A big picture overview of the subbasin that provides the context for later GSP sections and for conversations with stakeholders.
- Specifically, the HCM:

"Provides an understanding of the general physical characteristics related to regional hydrology, land use, geology and geologic structure, water quality, principal aquifers, and principal aquitards of the basin setting"

- The HCM provides the necessary physical background information to develop integrated hydrologic computer models and compute water budgets.



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Principal Aquifer Determination

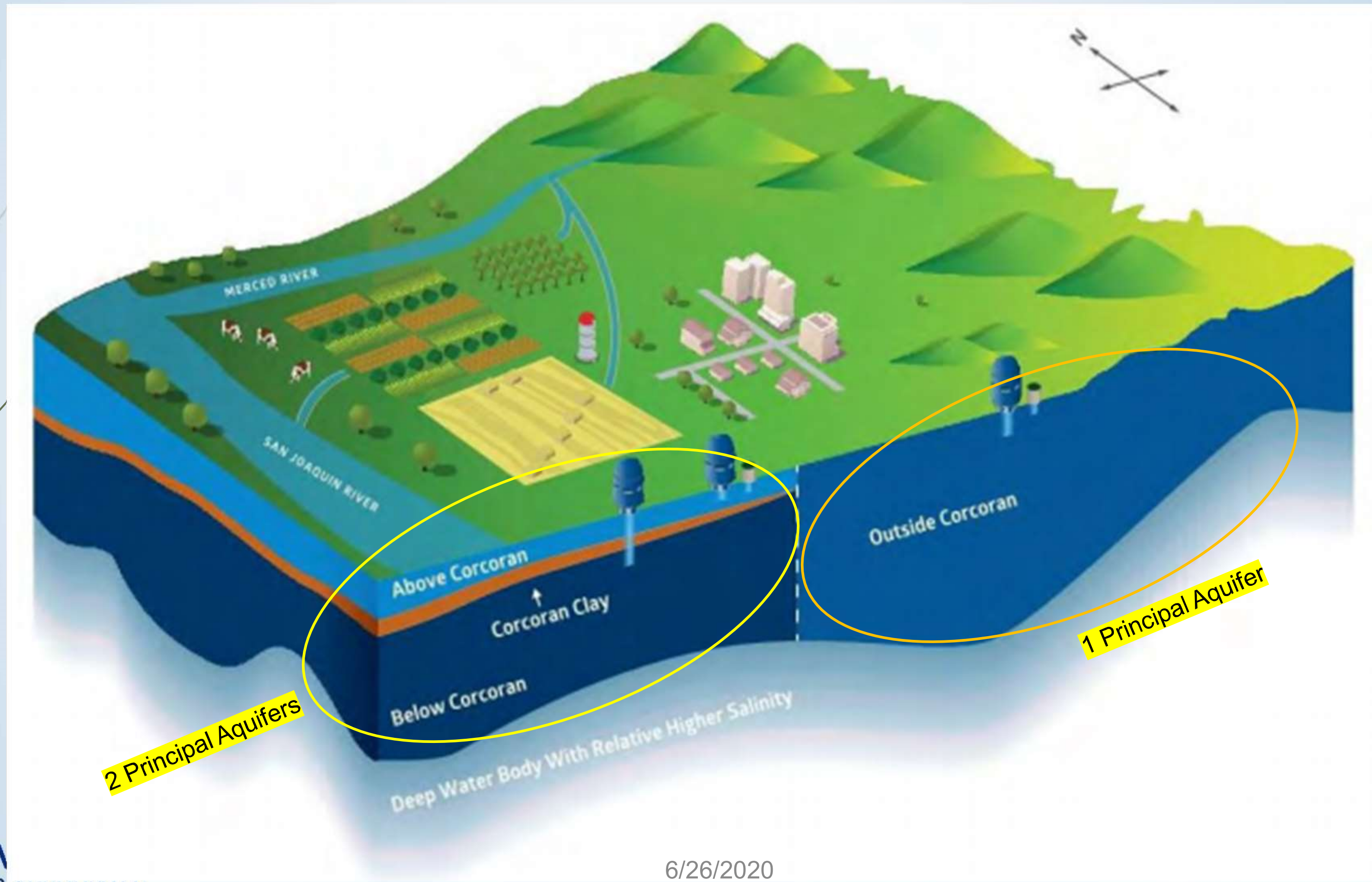
- HCM BMP:
  - "Principal aquifers" refer to aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems.
- Aquifers are separated by continuous impervious layers (aquitards) that impede or slow flow between different aquifers – *example of Corcoran Clay layer in the San Joaquin Valley*
- In Corning Subbasin, no such continuous layers are found, wells are often screened within several geologic units, and water flows mostly freely between vertical aquifer units
- **Recommendation: Designate 1 Principal Aquifer for the Corning Subbasin GSP**

Other GSP Examples

Yuba Subbasins GSP: *One principal aquifer exists across the Yuba Subbasins. The aquifer consists of the Riverbank, Laguna, and Mehrten formations deposited during the Miocene to Pliocene.* ***There are no known structural properties that significantly restrict groundwater flow within the Yuba Subbasins within the portion of the aquifer that stores, transmits, and yields significant quantities of water.***

Eastern San Joaquin Subbasin GSP: *The Eastern San Joaquin Subbasin HCM has* ***one principal aquifer*** *that provides water for domestic, irrigation, and municipal water supply and that is composed of* ***three water production zones****.*

Merced Subbasin GSP – Principal Aquifers separated by Corcoran Clay Layer



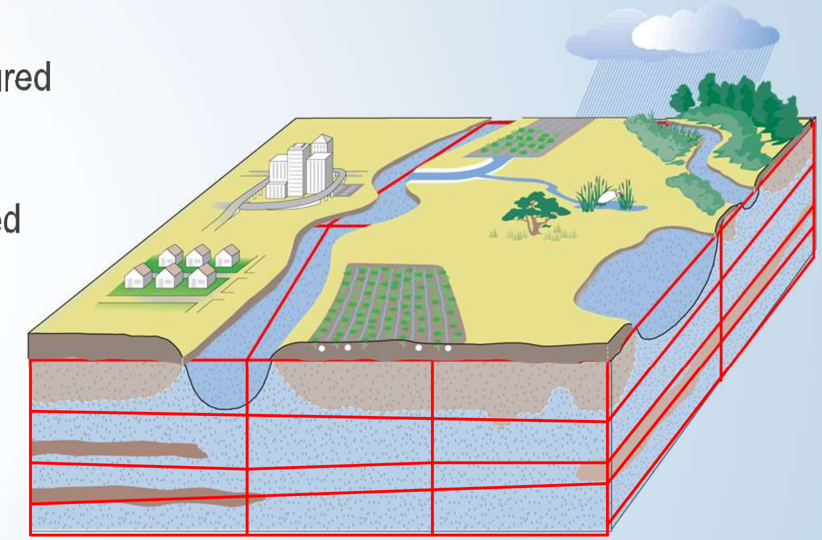
Additional Considerations

- SGMA requires the determination of "Principal Aquifer(s)" in order to develop management considerations; affects the development of Sustainable Management Criteria and adds more complexity to the monitoring network development.
- Principal Aquifers are determined at the Subbasin level and set the stage for subbasin-wide management
- Difference between geologic cross-sections (showing geologic deposits or units) and hydrogeologic characteristics (that govern the flow of groundwater) – i.e. even though there are different geologic units, groundwater flows easily in-between the geologic units (they have similar mixed deposits)

C2VSim Model Revisions

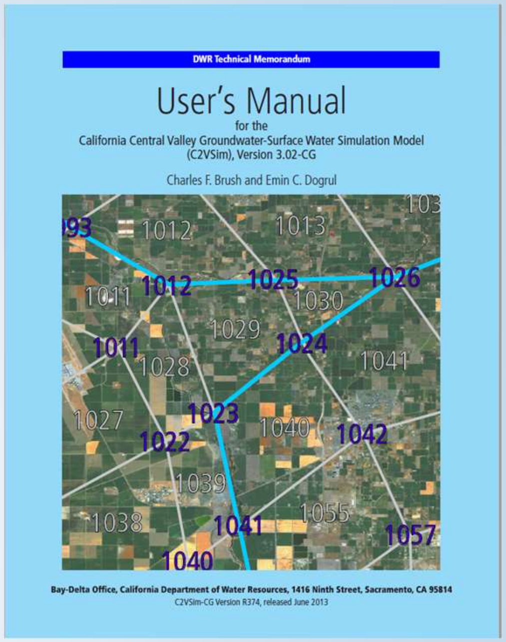
What is a Hydrologic Model?

- Models are a mathematical approximation of physical processes underground
- Models are powerful tools that integrate measured and observed hydrologic data and provide estimates within data gap areas
- Models organize and synthesize multiple related activities and hydrologic processes
  - Groundwater pumping
  - Rainfall and recharge
  - Evapotranspiration
  - River flows
  - Groundwater flow and fluxes
- Example use: provide detailed estimate of water budgets



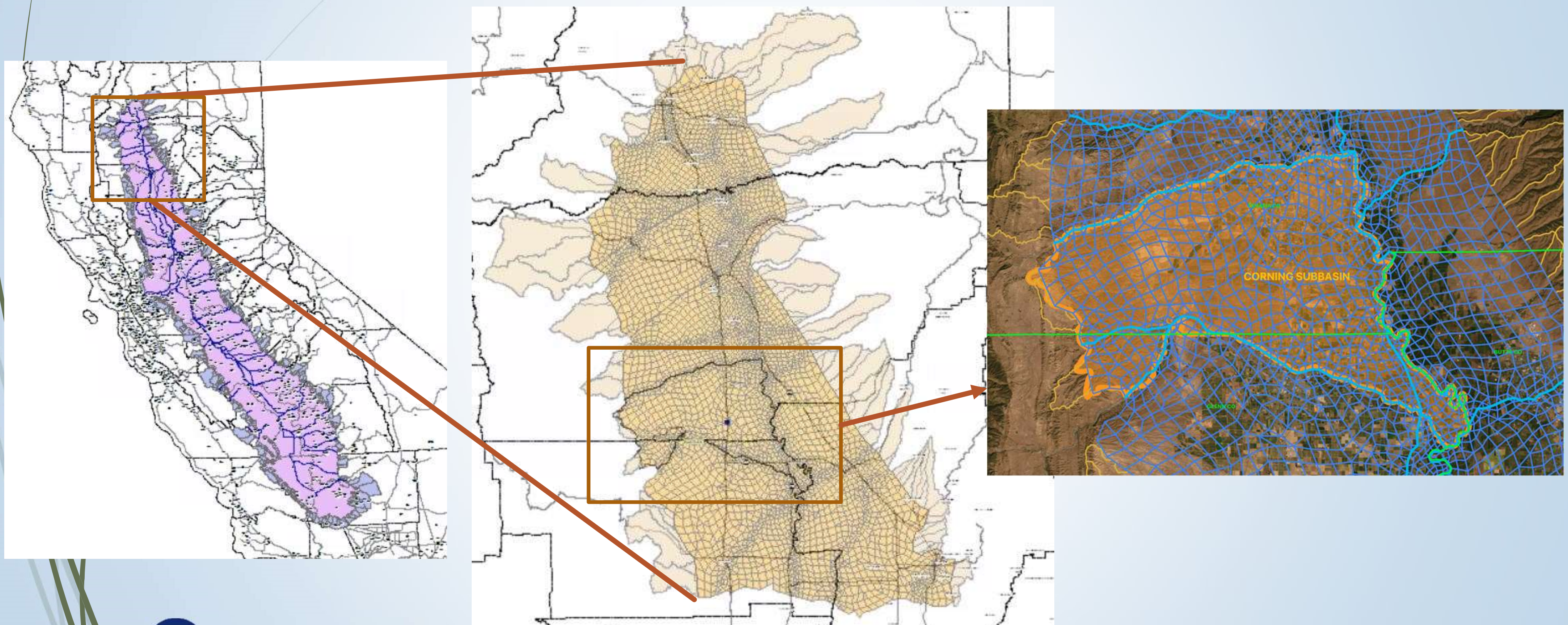
Brief C2VSim Description

Model	C2VSimFG
Simulation Area	Central Valley/North Sacramento Valley
Developer	DWR
Release Date of Beta2 (expected V 1.0)	2019 (7/2020)
Code	IWFM
Simulation Period for GSP	1973-2015
Publicly available supporting documentation?	Yes
Developed and calibrated with field data?	Yes
Cells in Corning Subbasin	675
Cell area in Corning Subbasin	38 – 1,102 Ac
Includes recent conditions?	Yes
Adequate calibration period?	Yes
Can extend to 50-yr future simulation?	Yes
Can add future climate change assumptions?	Yes
Can incorporate potential future land use changes?	Yes
Can incorporate potential future water supply and demand changes?	Yes
Can evaluate sustainability indicators?	Yes
Can help identify sustainable management criteria?	Yes



User's Manual Released by DWR in 2013

Northern Sacramento Valley Model Extent



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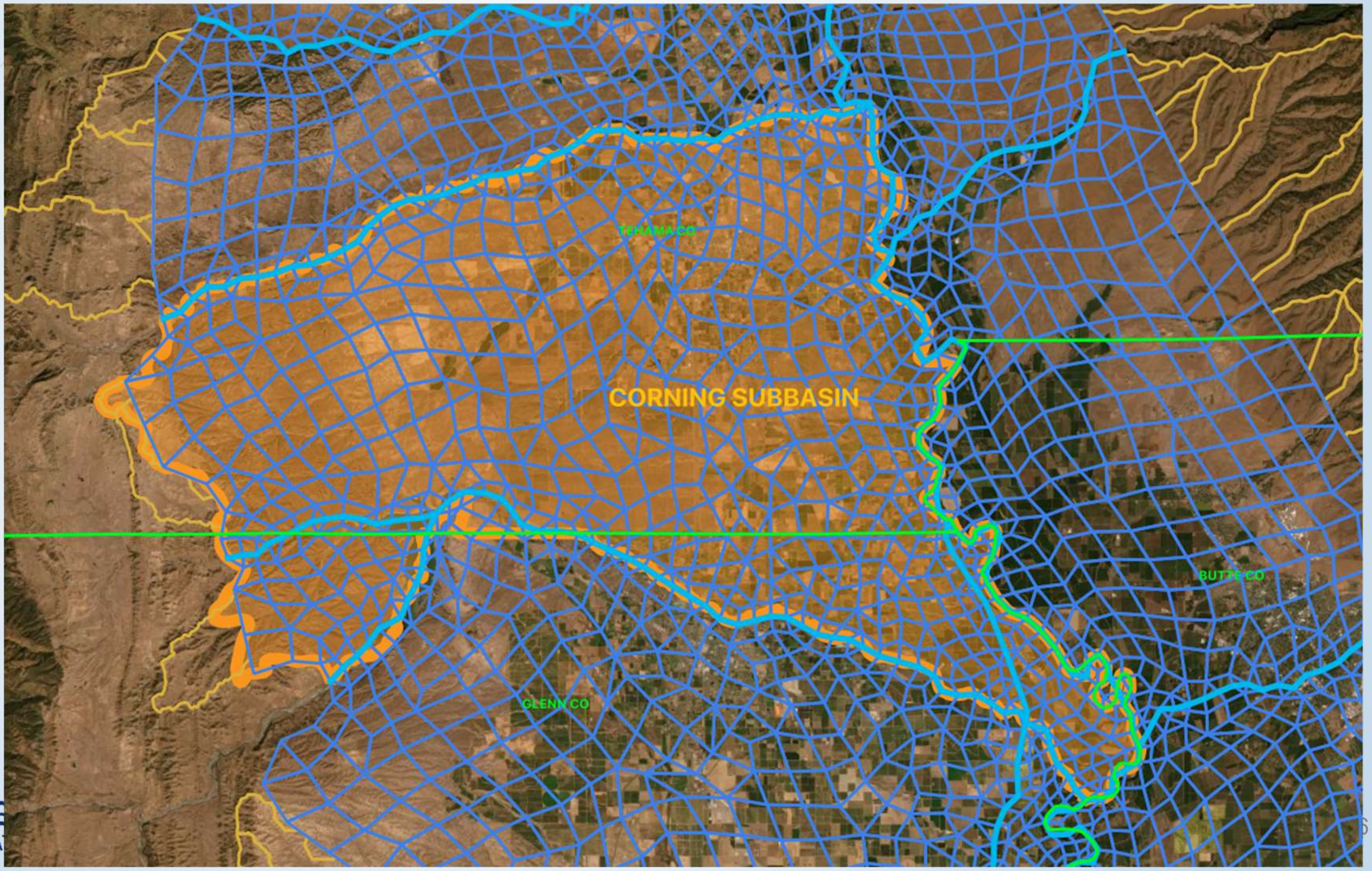
Corning Subbasin Model Grid



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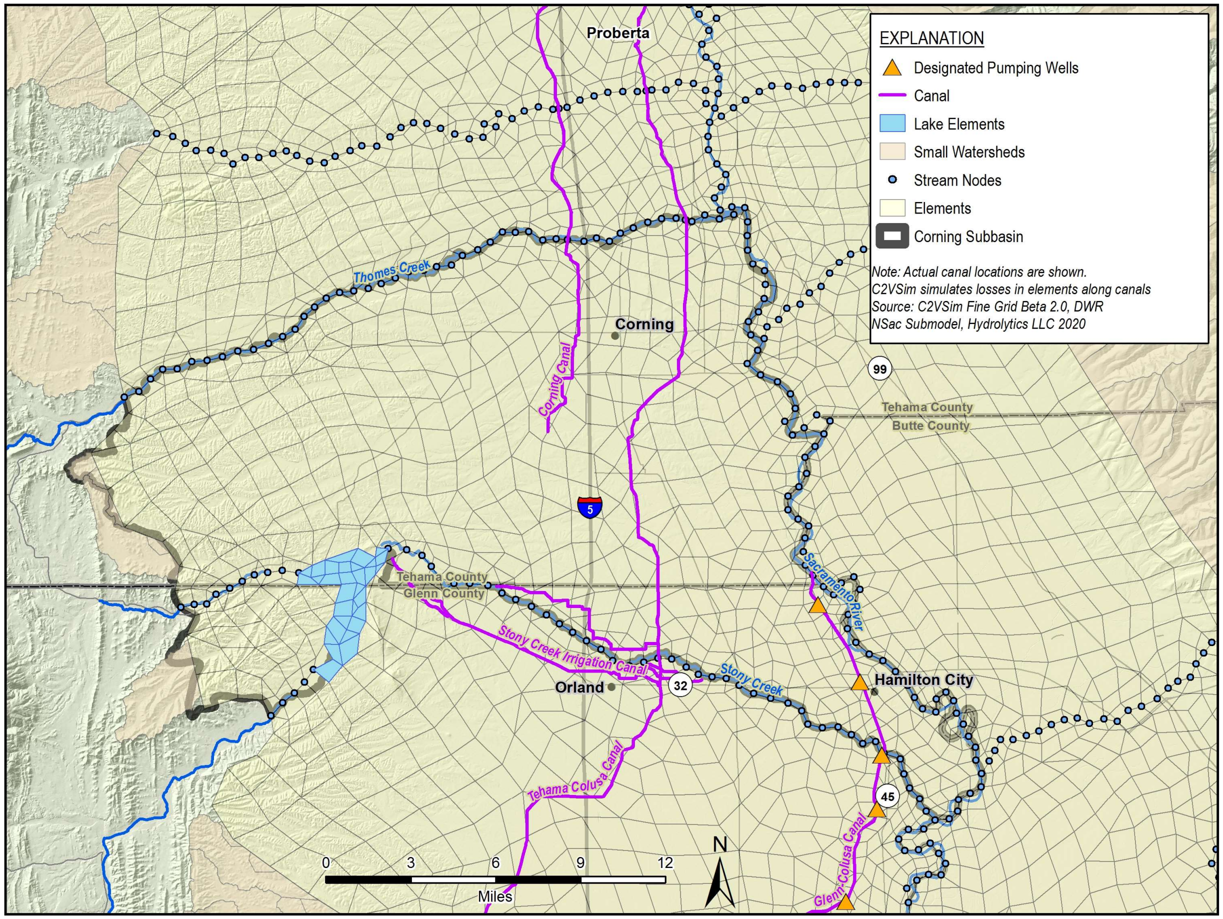
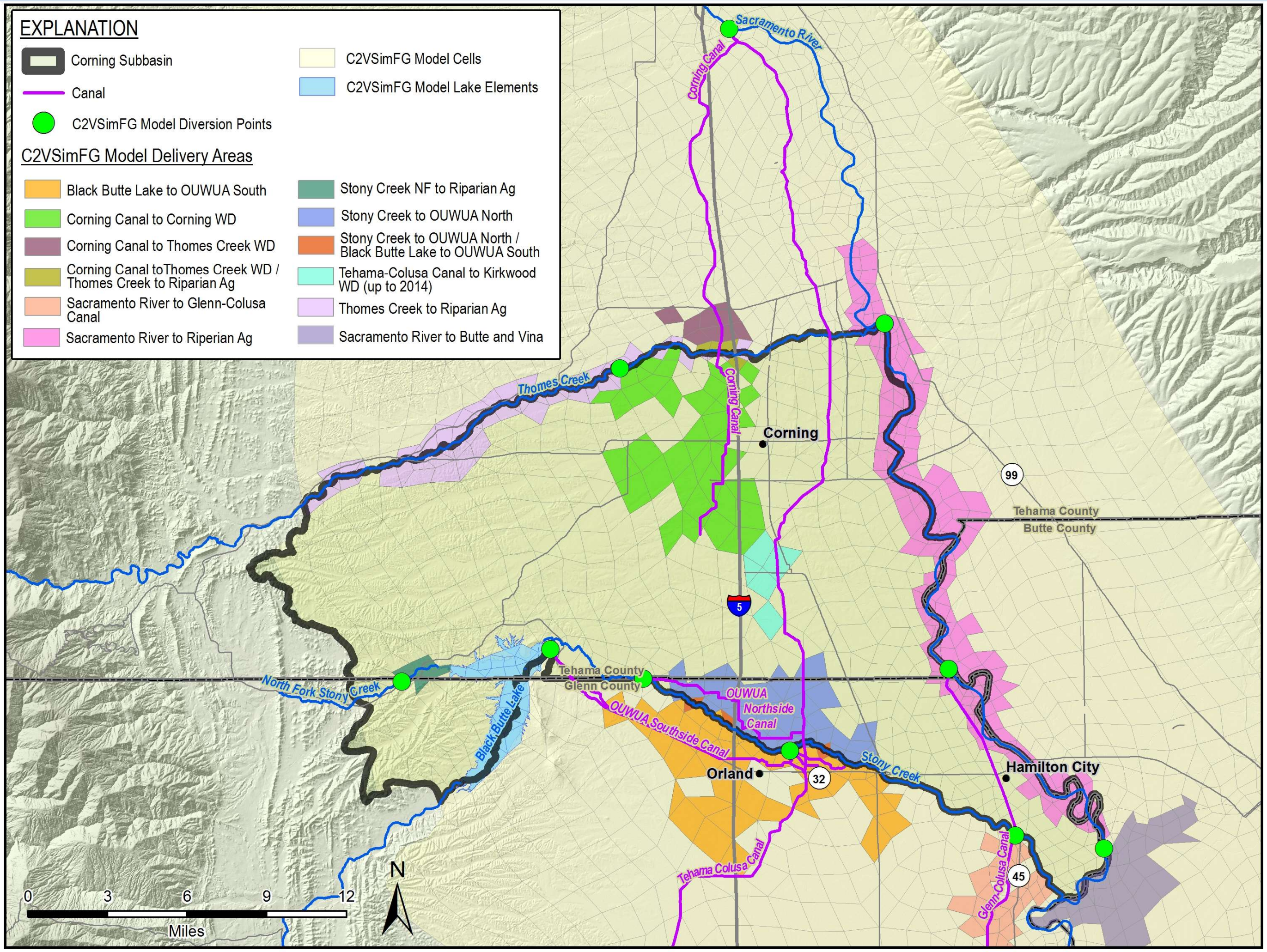
Initial refinements were made to the C2VSim-FG Base model to better represent local conditions

- Refined surface water delivery areas and delivery volumes from canal delivery areas to individual water districts,
- Refined groundwater pumping depths within the Corning Subbasin to match well completion records provided by DWR,
- Incorporated detailed historical urban water usage for City of Corning and Hamilton City,
- Replaced the boundary condition representing Black Butte Lake with a simulated lake feature, and modifying Stony Creek to conform to this lake feature,
- Incorporated all available observation wells into the model, and
- Applied minor adjustments to hydrogeologic model parameters to better match historical observations after incorporating these model changes.

Map of Simulated Boundary Conditions



Map of Diversions and Deliveries



Note: Stony Creek Diversion to Glenn Colusa Canal ends in 2000

Ongoing Modeling Tasks

- Compare model input data to compiled local information
- Identify and implement model revisions
  - Make refinements to diversions
  - Make refinements to Black Butte Lake representation
  - Check crop consumptive use and irrigation demands
- Document model changes
- Re-run the model and check outputs and calibration
- Develop draft historical and current water budgets for review

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Water Budgets in GSPs

General Water Budget Components and SGMA Requirements

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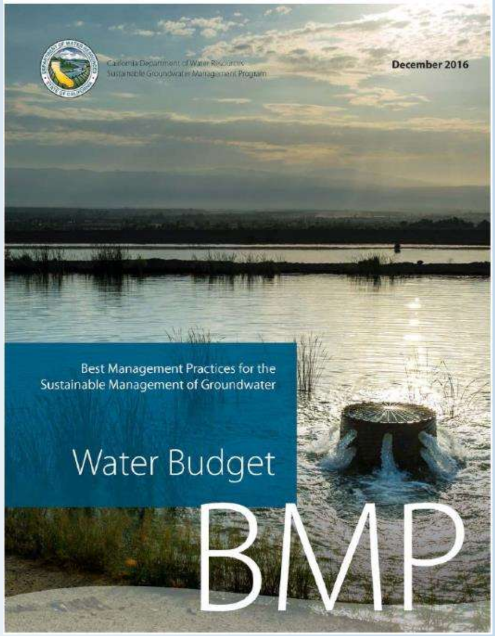
SGMA Water Budgets

- CA CCR §354.18 & Best Management Practices document
- Water budget must include:
  - Inventory of all inflows (supply) and outflows (demand)
  - Summary of both groundwater budget and surface water budget
  - Annual and cumulative changes in groundwater storage
  - Estimate of groundwater overdraft (if applicable)
  - Estimate of sustainable yield
- Three subbasin-wide water budgets for GSP:
  1. Historical conditions
  2. Current conditions
  3. Projected conditions over the 50-year planning and implementation horizon (including climate change)



Summary of Typical Groundwater Budget Components

Groundwater Inflows

- Deep percolation (infiltration) of precipitation
- Deep percolation (infiltration) of applied irrigation water (or irrigation return flows)
- Streambed recharge to groundwater
- System loss return flows
- Subsurface inflows
- Foothills inflows

Groundwater Outflows

- Groundwater pumping (agricultural, urban, domestic)
- Groundwater discharge to streams
- Subsurface outflows to adjacent basins
- Riparian and crop evapotranspiration

Summary of Typical Surface Water Budget Components

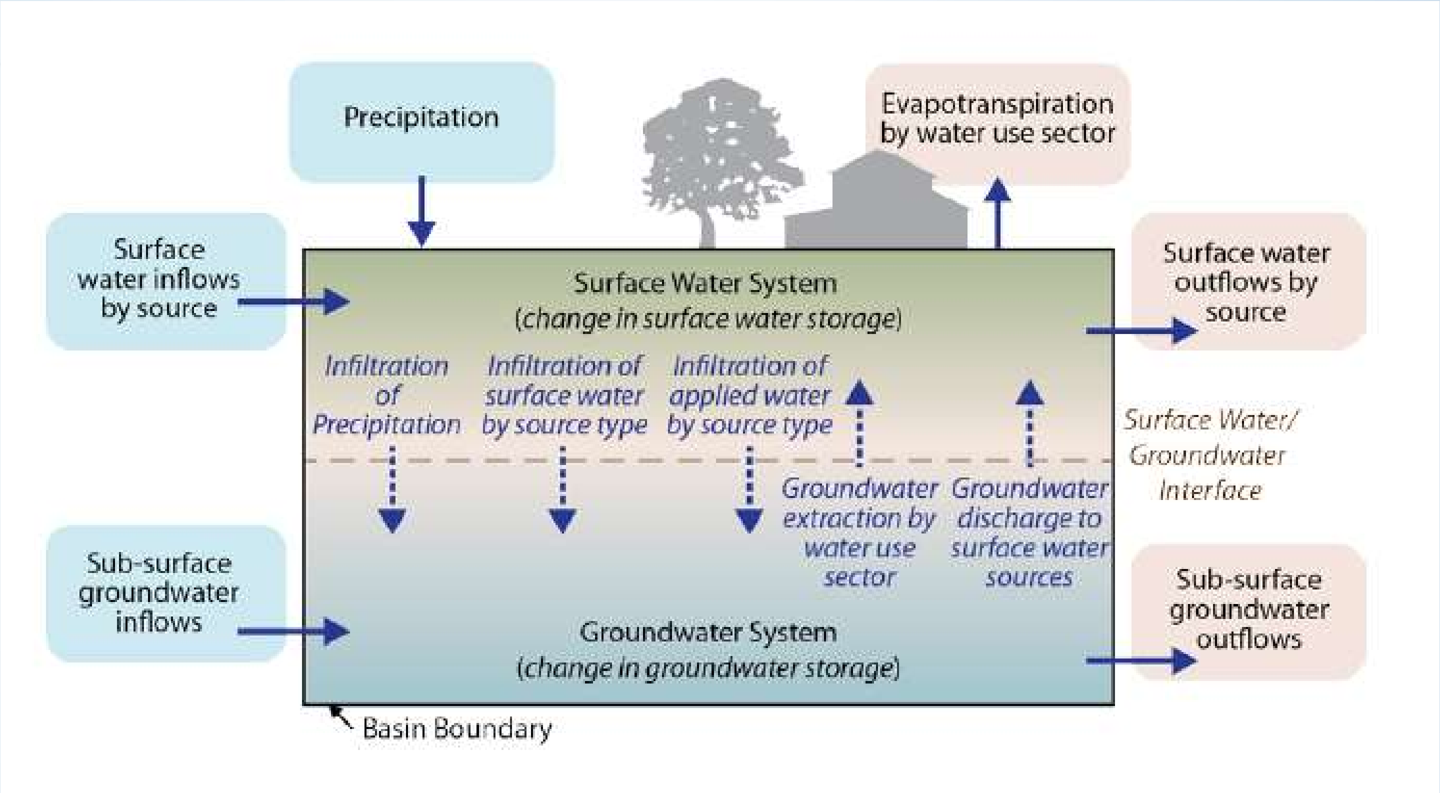
Surface Water Inflows

- Stream inflows from outside of basin
- Overland runoff (from precipitation)
- Groundwater discharge to streams
- Irrigation return flows

Surface Water Outflows

- Streambed recharge to groundwater
- Direct stream diversions
- Evaporation (often negligible or hard to compute)

Water Budget Diagram



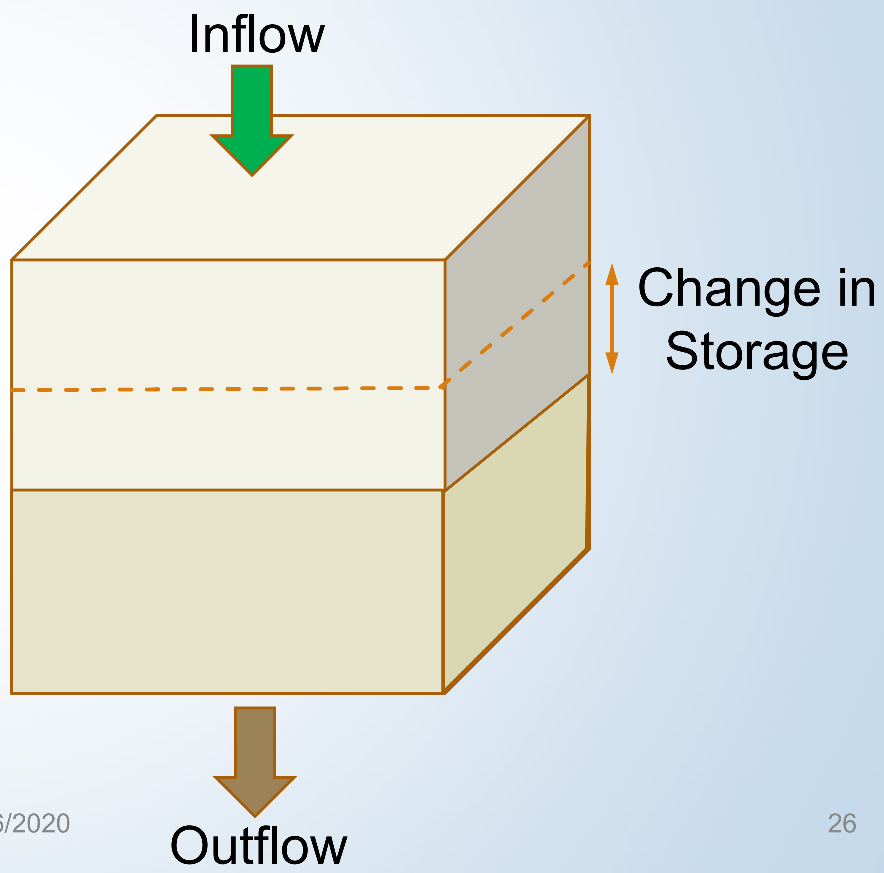
From: Water Budget BMP, California Department of Water Resources, 2016

Let's break this down - The Basic Water Budget of a Box

Pour water into the top of a box, and let water seep out the bottom

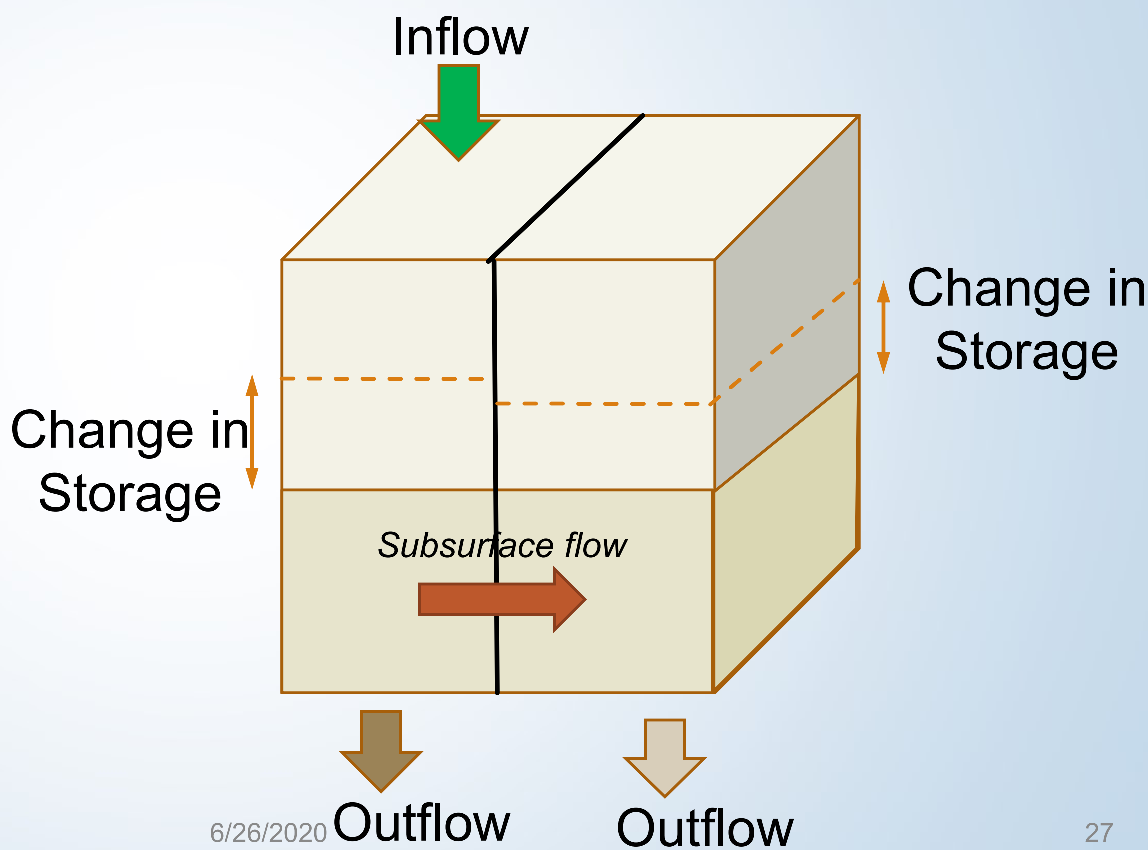
- Inflow – Outflow = Change of Storage
- Change of Storage ~ Change in Groundwater Level

But what if we know water is poured into only one half of the box?



Split the Box in Half: Two Water Budgets

- Each half gets its own water budget
- Groundwater flows from one half to the other half
  - Flow out of left cube equals flow into right cube
  - Groundwater budgets are linked through this flow



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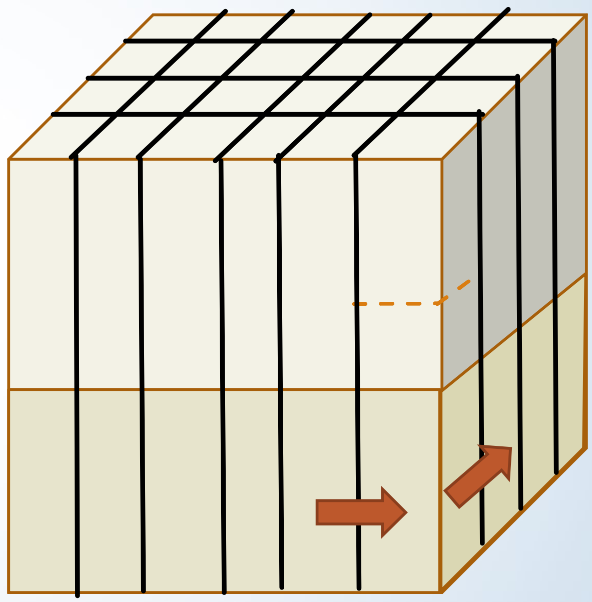
Continue to Split the Box – A Numerical Model!

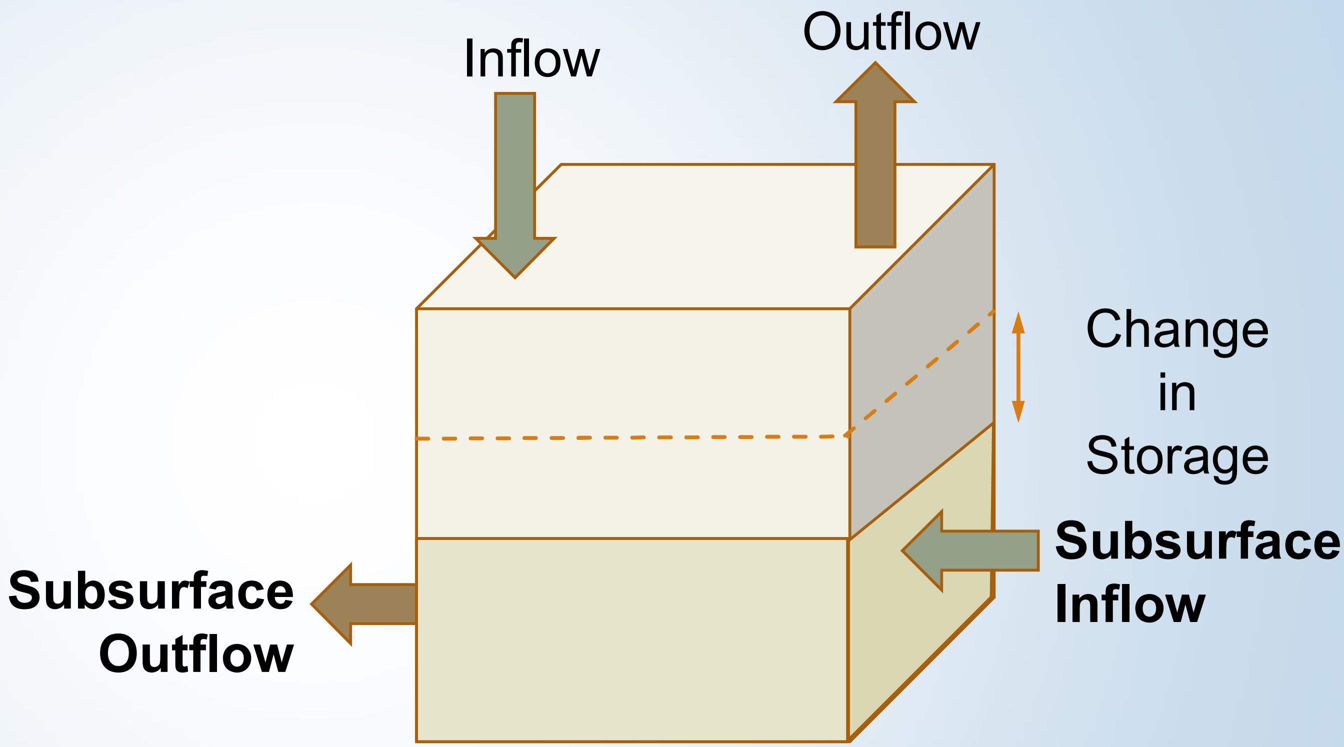
- Many cubes, each with its own water budget
- All water budgets are connected by flow between cubes
  - Six sides
  - Six flows in or out of the cube



So Why Does it Seem So Complicated?

Inflow
- Percolation of precipitation
- Streambed percolation
- Return flow from irrigation
- Canal leakage
- Foothills

Outflow
- Evapotranspiration
- Well pumping
- Streams and Creeks
- Springs



Estimates of All of These in Every Model Cell – Then Aggregate at the Subbasin Level

Corning Subbasin Draft Water Budgets

Note: these are initial estimates prior to full model verification – for discussion purposes only

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Key Items to Remember for GSP Water Budgets

- Basin-wide estimates
- Water budgets shown as annual estimates, by water year (no seasonal variation)
- A balanced water budget does <u>not</u> prove sustainability; it is only 1 component that helps identify aquifer interactions (need to look at sustainable management criteria as well)
- All inflows and outflows need to be accounted for, not just net values

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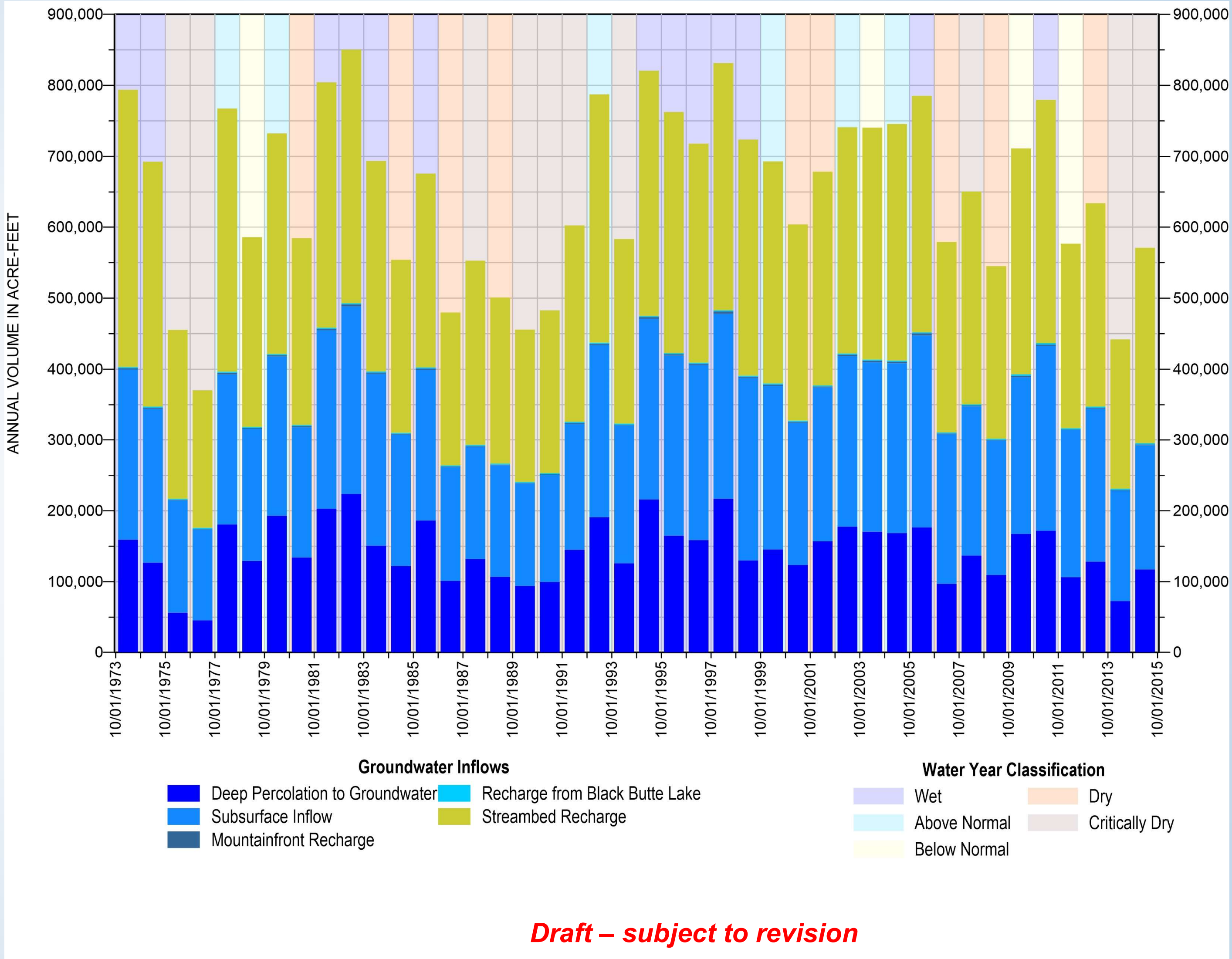
Groundwater Inflows

3 main inflows:

- Recharge from precip and irrigation
- Subsurface inflow from other subbasins
- Streambed recharge



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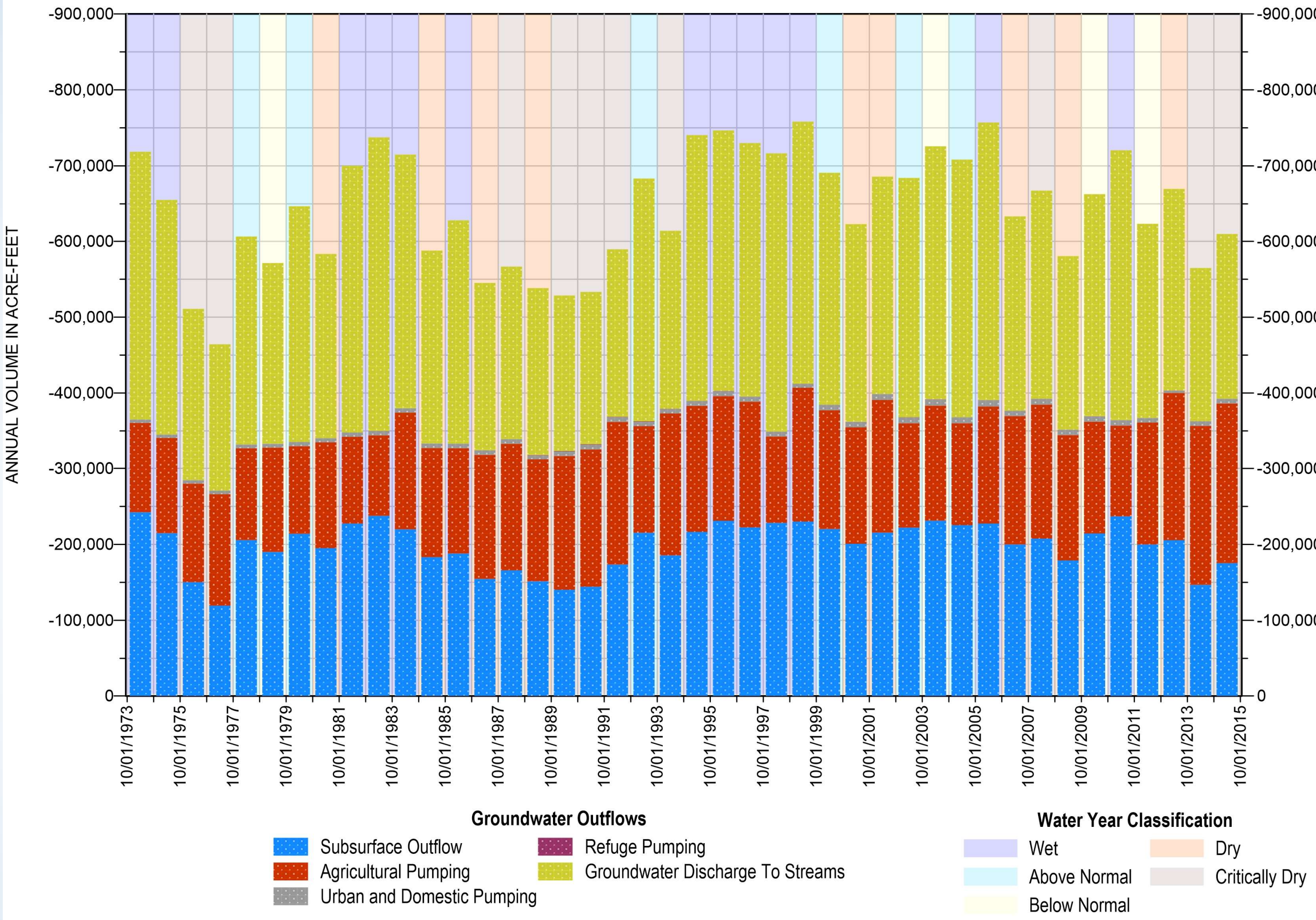
Groundwater Outflows

3 main outflows:
- Agricultural pumping
- Subsurface outflow to other subbasins
- Discharge to streams



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Draft – subject to revision

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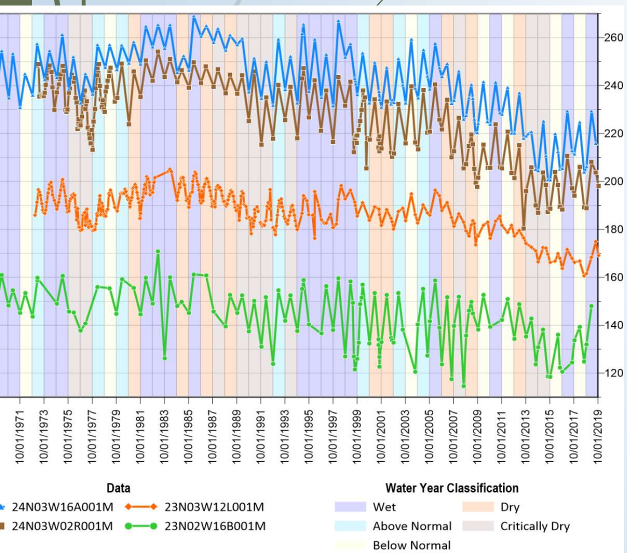
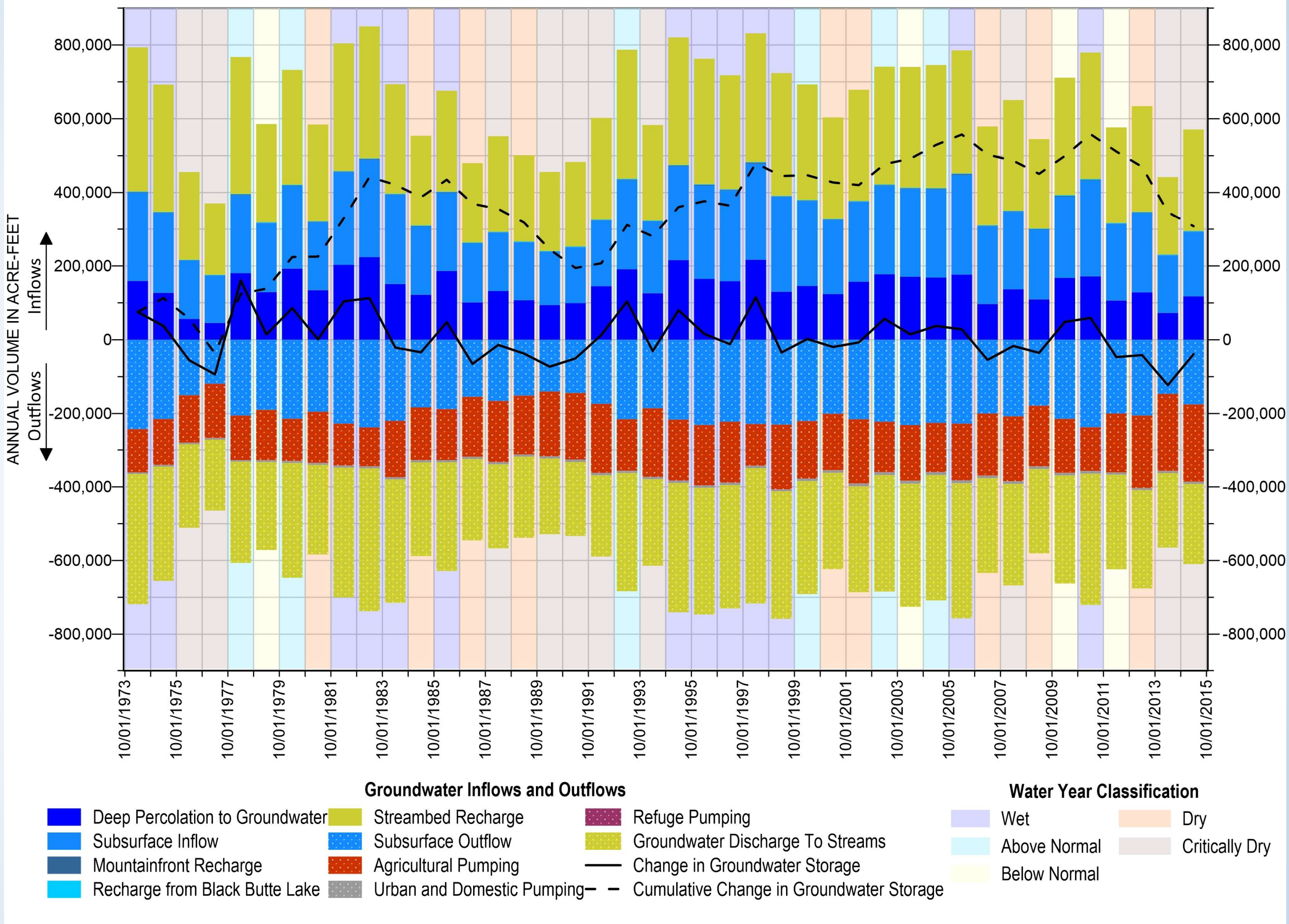
Draft Historical Groundwater Budget





Draft – subject to revision

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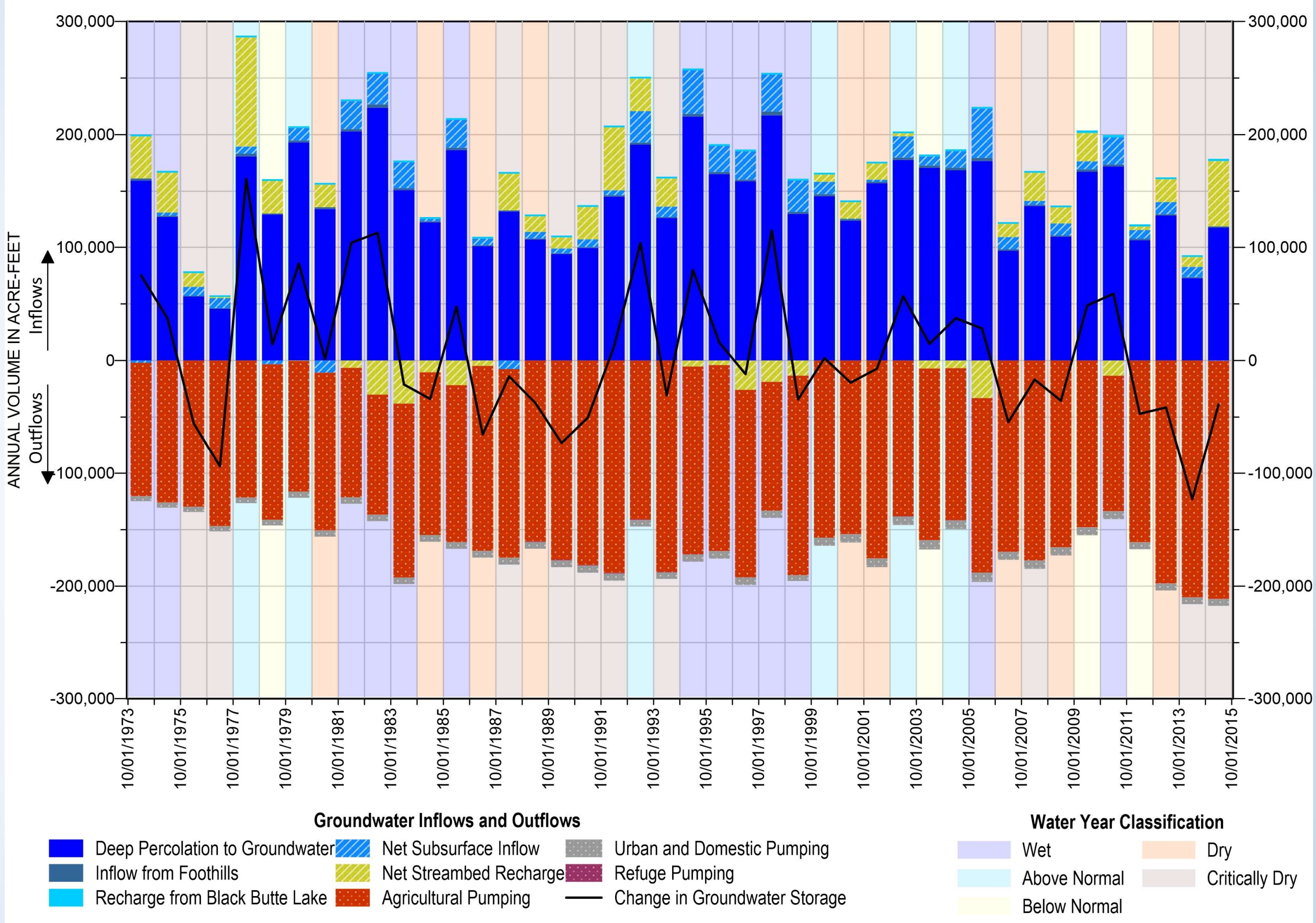
Draft Historical Groundwater Budget

Net subsurface flows

Net stream depletions/accretions



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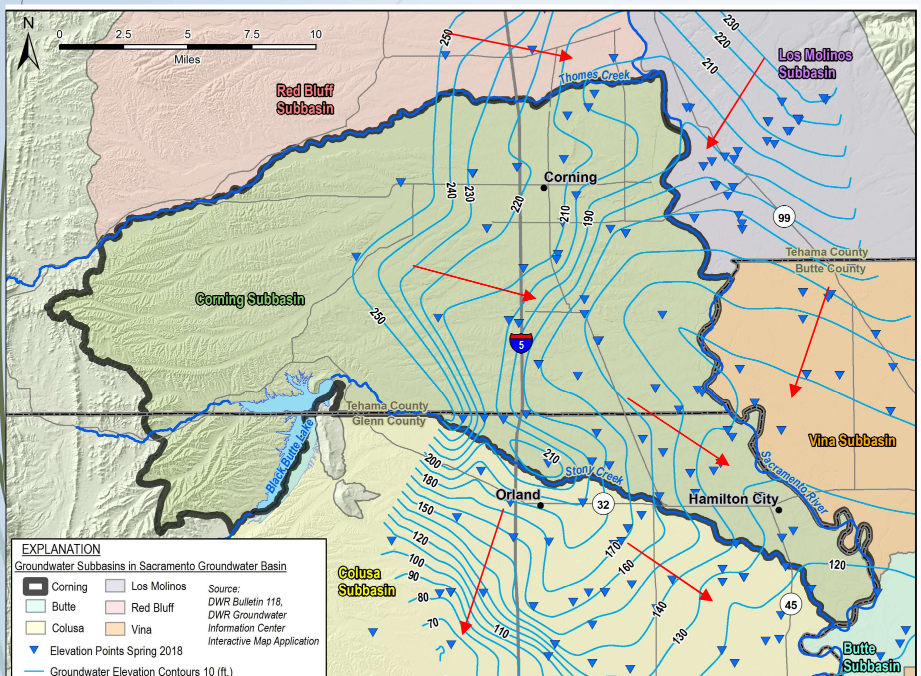
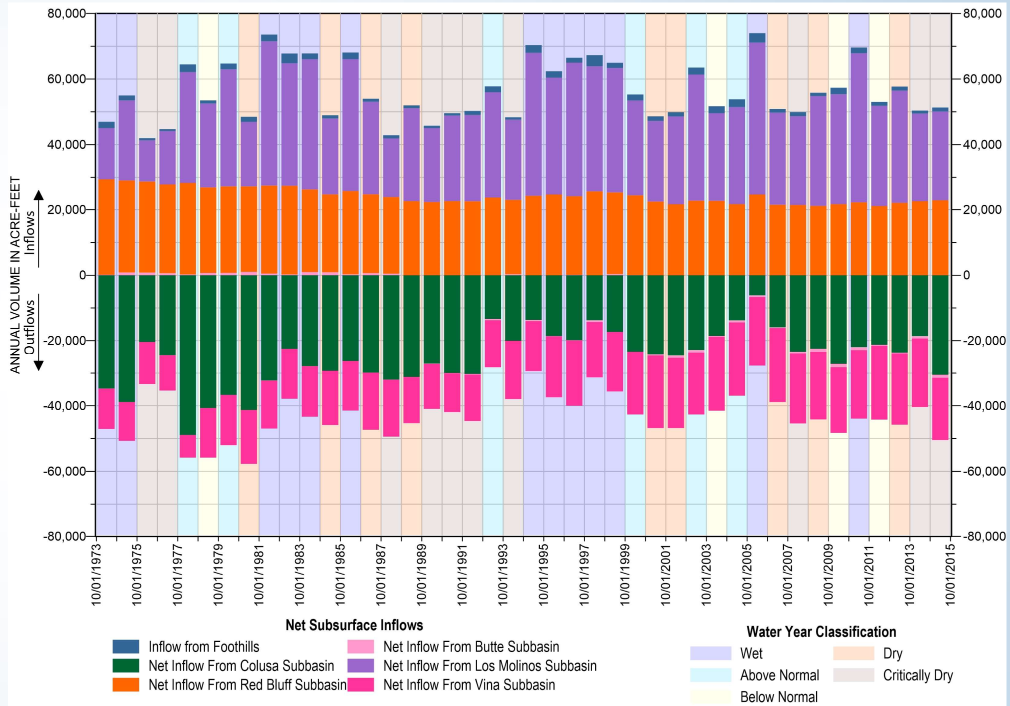
Draft Historical Groundwater Subsurface Flows





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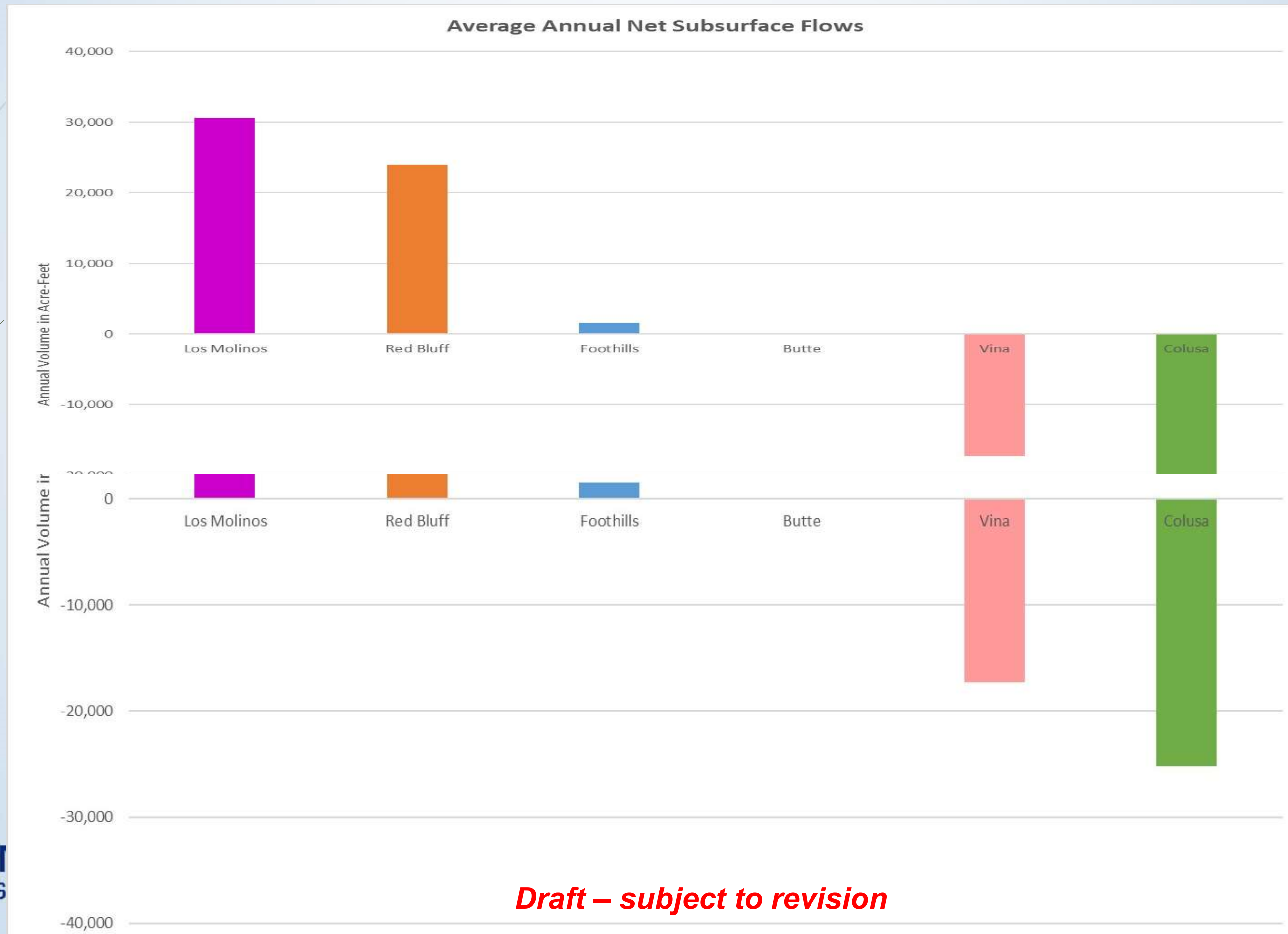
Net Subsurface Flows (Average Annual)



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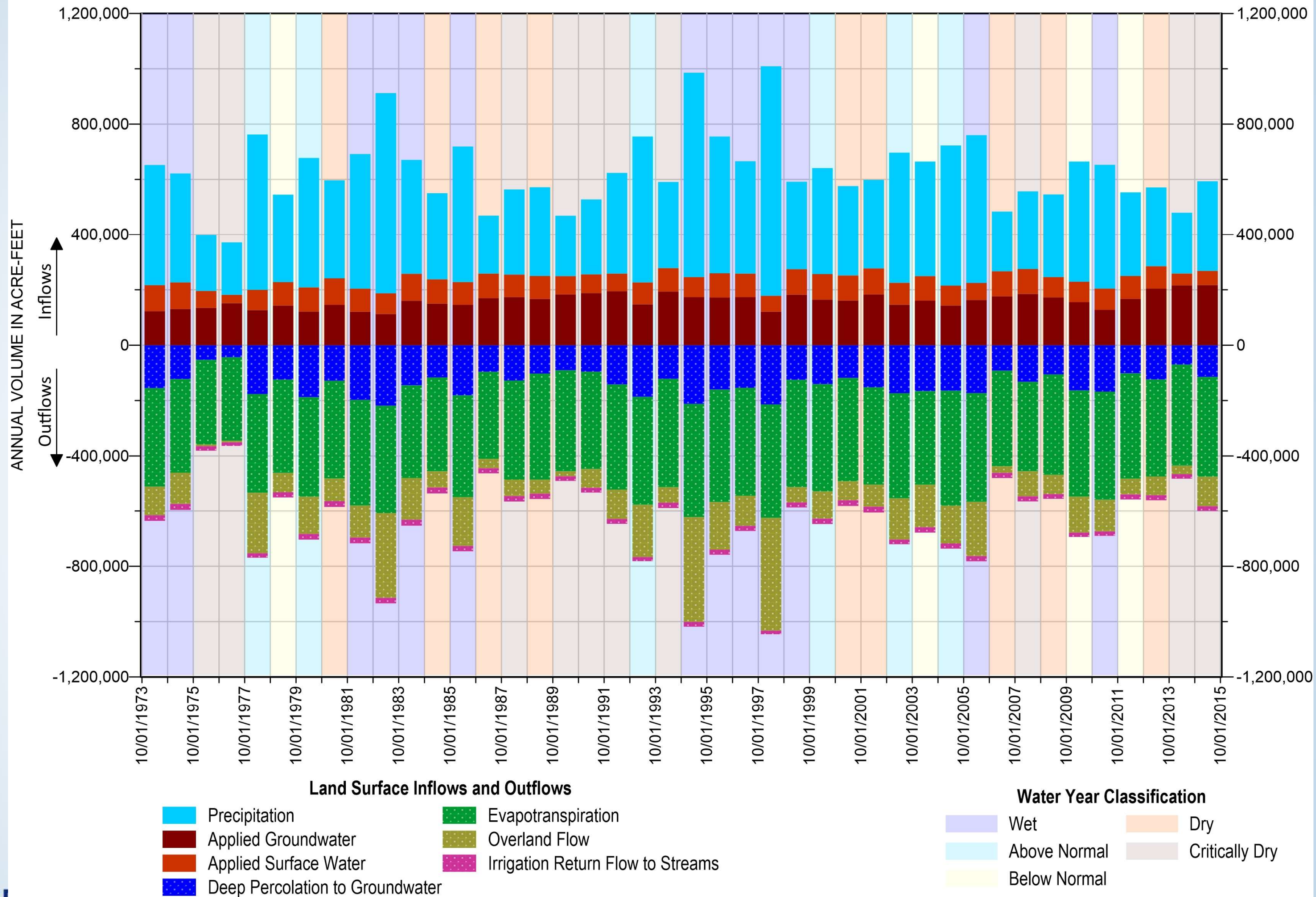
Draft Land Surface Budget

Shows the use of ag water



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Key Water Budget Take-Aways

- The Corning Subbasin is not currently in overdraft; however, water levels have been dropping in the past 15 years in some areas, reflected in the change in storage for the Subbasin
  - Need to be aware of this change and focus on future water management for subbasin sustainability
- Historical water budget is not the most important one to look at for GSP; it gives an understanding of past behavior and interactions → the projected future water budget is what the GSP will evaluate and which will define the sustainable yield of the Subbasin
- Simulated water budgets, with monitoring networks and Sustainable Management Criteria evaluation will provide "proof" of continued sustainability.

Water Budgets – Questions and Comments?

Introduction to Management Areas

Background and Pros and Cons

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DWR definition from Draft BMP for Sustainable Management Criteria

A GSA may wish to define management areas for portions of its basin to facilitate groundwater management and monitoring.

Management areas may be defined by natural or jurisdictional boundaries, and may be based on differences in water use sector, water source type, geology, or aquifer characteristics.

Management areas may have different minimum thresholds and measurable objectives than the basin at large and may be monitored to a different level.

However, GSAs in the basin must provide descriptions of why those differences are appropriate for the management area, relative to the rest of the basin.

Specific Regulatory Sections Applicable to Management Areas

§ 354.20. Management Areas (last Section of Basin Setting)

- (a) Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.
- (b) A basin that includes one or more management areas shall describe the following in the Plan:
  - (1) The reason for the creation of each management area.
  - (2) The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.
  - (3) The level of monitoring and analysis appropriate for each management area.
  - (4) An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.

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Example Management Areas from 2020 GSPs

- Statistics: 11 submitted GSPs designated management areas in their basin/subbasin
- Reasons for Including management areas:
  - 4 were primarily jurisdictional
  - 4 were primarily diverse hydrogeologic conditions across the basin, including fault barriers, significant seawater intrusion and overdraft
  - 2 driven by subsidence and significant infrastructure damage and associated costs
- Examples:
  - Different hydrogeologic and land use settings (Kern GSP): defined three management areas for urban, agricultural, and groundwater banking portions of region.
  - Existing water quality management boundaries (Tulare Lake GSP): defined management areas in portions of the Tulare Lake Bed that were declared not suitable for beneficial use by the State Water Board due to poor water quality. This allowed the GSP to not monitor water level and water quality in this area.

Management Areas – Some Pros and Cons

Pros	Cons
Identify areas that have unique characteristics and management challenges for focused groundwater management	May require additional time and resources to address separate management areas – also, the justification for developing management areas may be tricky; the GSP requires good justification on why they were chosen
Develop Minimum Thresholds/Measurable Objectives with a different methodology than the rest of the basin or other management areas, with potentially denser monitoring, if needed	Reality - can do this without a management area (SMC are developed at the Representative Monitoring Point, not at Management Area level)
Can set up separate projects and management actions and fees focused only on the management area	Fee base would be smaller if restricted to the management area - Can do this without a management area
Highlight specific management areas and their characteristics to the public and State	Can do this without a management area

Management Areas are best reviewed during development of sustainable management criteria

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Management Areas – Questions and Comments?

- Reasons why you think we need management areas in the Corning Subbasin?

Meeting Wrap Up

- Final throughs and comments?
- Action items and next steps
- Preview for next month:
  - Review Potential Monitoring Networks
  - Introduction to Sustainable Management Criteria