San Benito County Water District
Groundwater Sustainability Agency

Technical Advisory Committee

October 30, 2019

Overview of Agenda

- Update on GSP schedule and progress
- Draft section on Water Budget
- Sustainability Goal Definition
- Update on outreach
- TAC next steps

Update

Last TAC Meeting

- Management Areas

Round 3 Grant Application

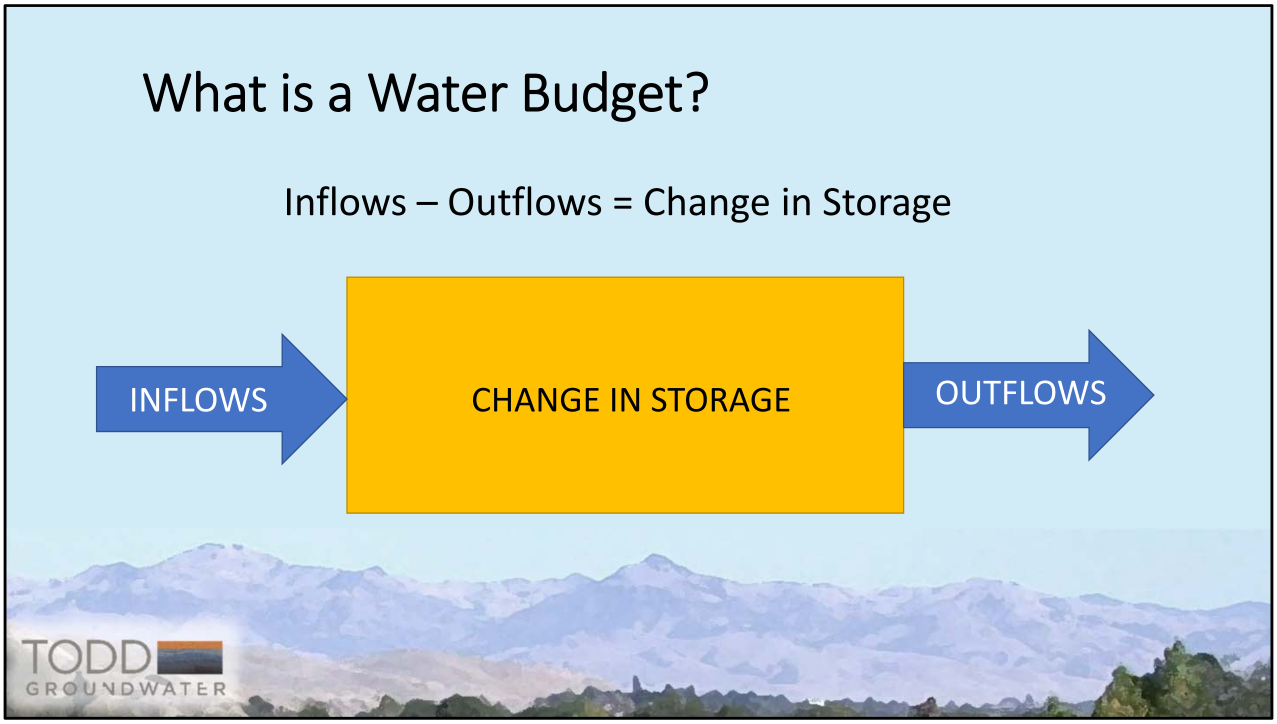
- Supports completion of GSP
- Dedicated Monitoring Well Program
- Managed Aquifer Recharge Study
- Annual Reports for 2020 and 2021

Water Budget Analysis

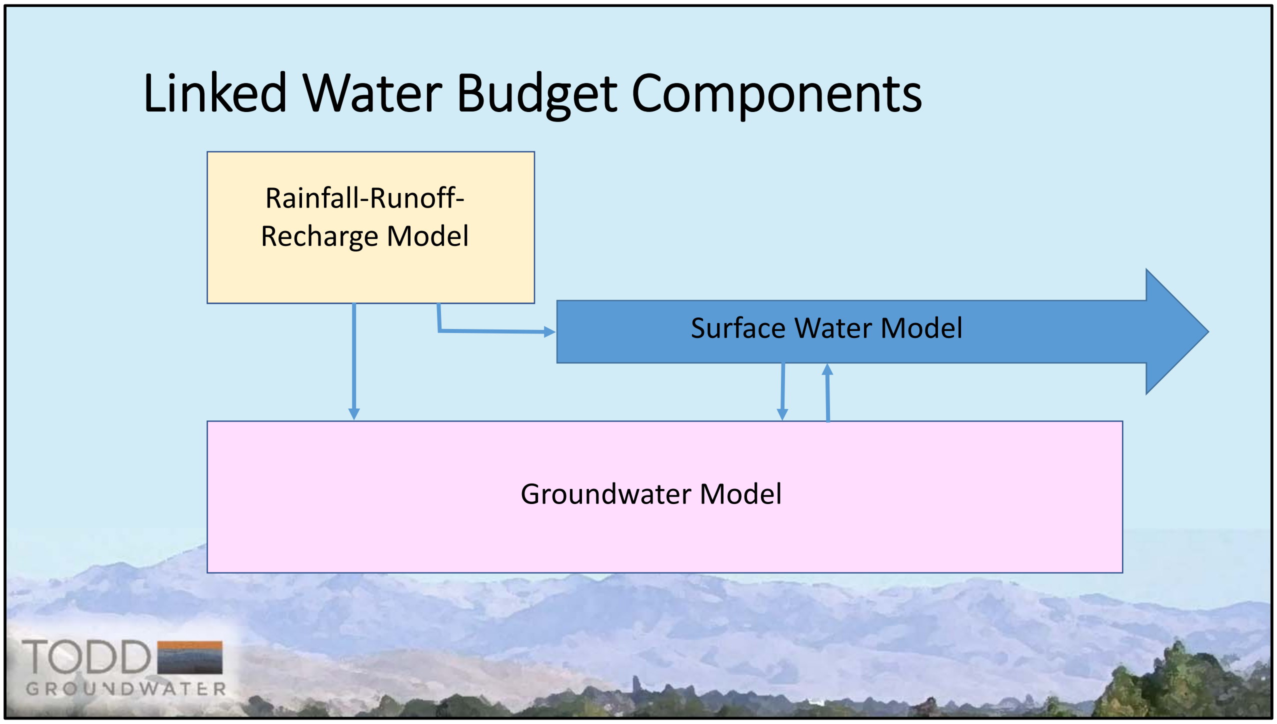
SGMA requirements for water budget analysis:

- Itemized
- Annual
- Surface water and groundwater
- Historical, current and future conditions
  - Pre-CVP historical (1975-1988)
  - Historical – Recovery (1997-2014)
  - Current (2015-2017)
  - Future (next 50 years)

"Water Budget" = "Water Balance"
Note that current period is short (only 3 years) and skewed by wet year in 2017.



Need to define the “control volume”: what is included inside the box? For the GSP, there are two budgets for two control volumes: surface water and groundwater.
Itemized breakdown of inflows and outflows can be as detailed as desired.



This breakdown of control volumes reflects three linked modeling tools.
The rainfall-runoff-recharge model simulates daily precipitation, runoff (an inflow to the surface water model), soil moisture, evapotranspiration, and deep percolation (an inflow to the GW model). It also simulates groundwater pumping for irrigation (outflow from GW model).
The surface water model is actually a module of the MODFLOW groundwater model. It consists of water in stream channels. In this basin, it also includes CVP water (even though that is not in stream channels). Stream channels typically have large rates of inflow and outflow, small gains/losses to and from GW, and negligible in-channel storage. Or reservoir storage.
Inflows and outflows of the GW control volume come from the MODFLOW model.

Groundwater Pumping for Irrigation

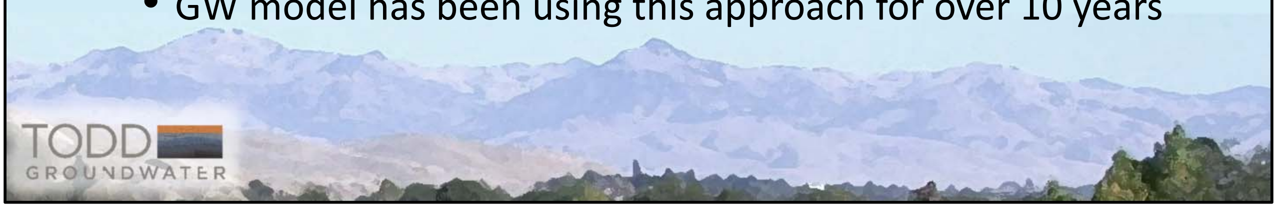
Measured

- Hours of operation x discharge rate
- Results consistently lower than expected “agronomic rate”
- Available only in Zone 6 and only for 1988-present

Groundwater Pumping for Irrigation—2

Simulated

- Rainfall-runoff-recharge model: daily soil moisture balance
  - $SM_t = SM_{t-1}$ + rain infiltration – (ETo x Kc)
  - If SM_t < threshold, $Irr_{tot} = (SM_{max} – SM_t)$/efficiency
  - $Irr_{gw} = Irr_{tot} – Irr_{cvp} - Irr_{rw}$
- This approach improved model calibration results
- GW model has been using this approach for over 10 years



Simulating Future Conditions

- SGMA requires exactly 50 years in the future analysis period
- GW model presently simulates 43 years
- Preliminary results shown here are for a 43-year simulation

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Simulating Future Conditions—2

Assumptions for future baseline simulation:

- Existing land use (urban footprint, crop types)
- Repeat of 1975-2017 rainfall, ETo and stream flow
- CVP availability from DWR's CalSim II model
- Current CVP treatment capacity
- Target CVP/GW use for muni supply is 70%/30%
- Initial water levels = September 2017

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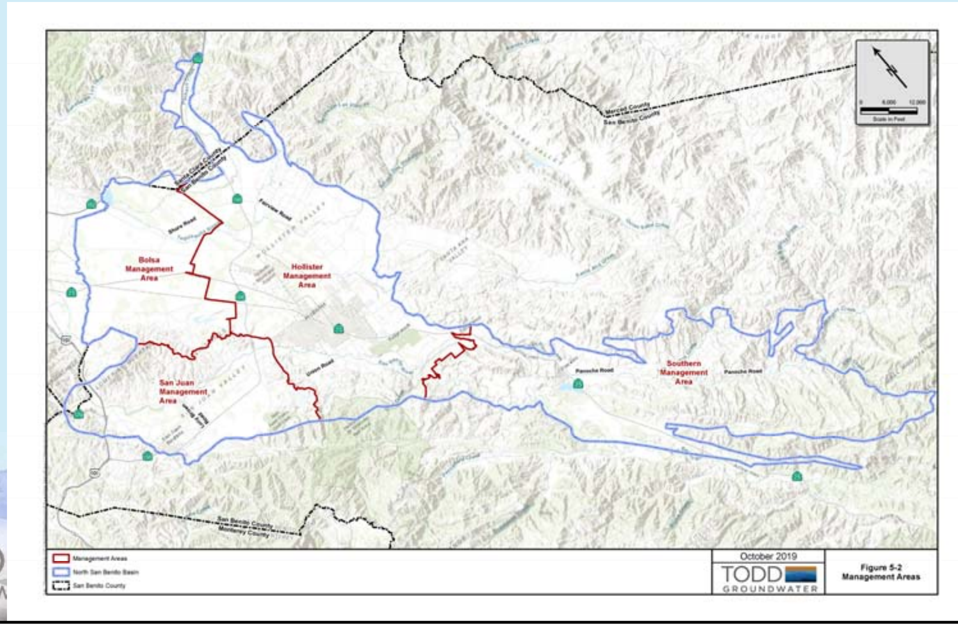
Results: Lots of Water Budgets!

Two categories
x four management areas
x four analysis periods
= 32 budgets

… each with tables and charts

We have selected the most useful summary tables and charts for the GSP and for this presentation

Management Areas



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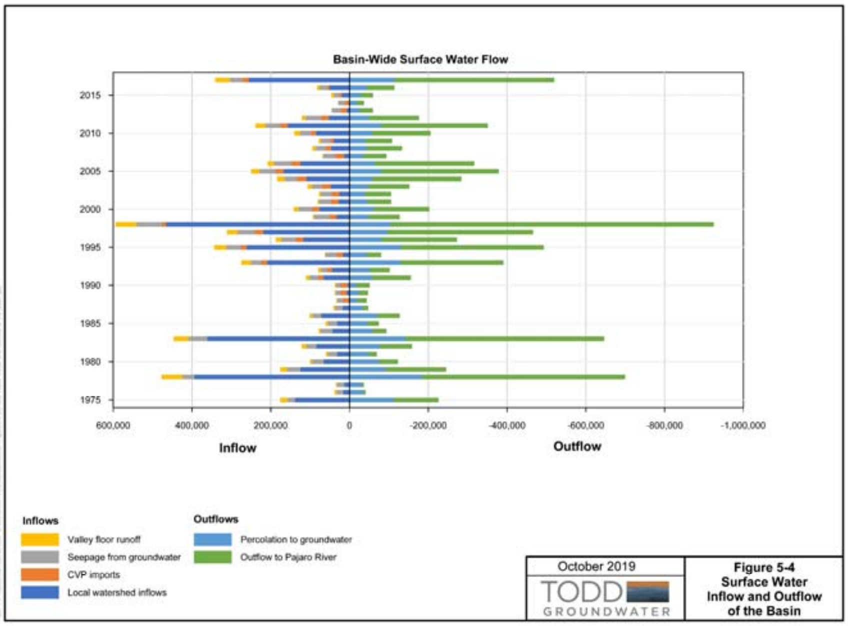
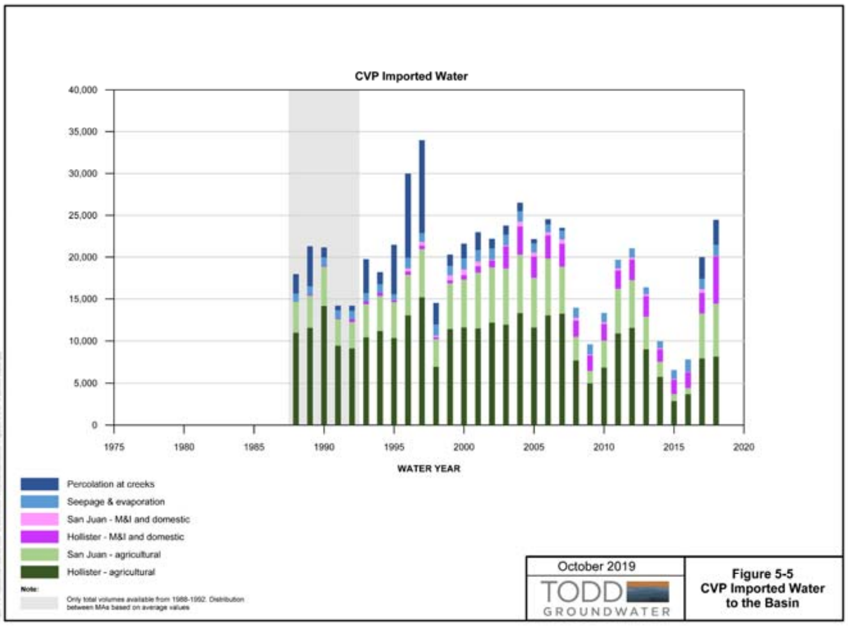


Surface Water Budgets

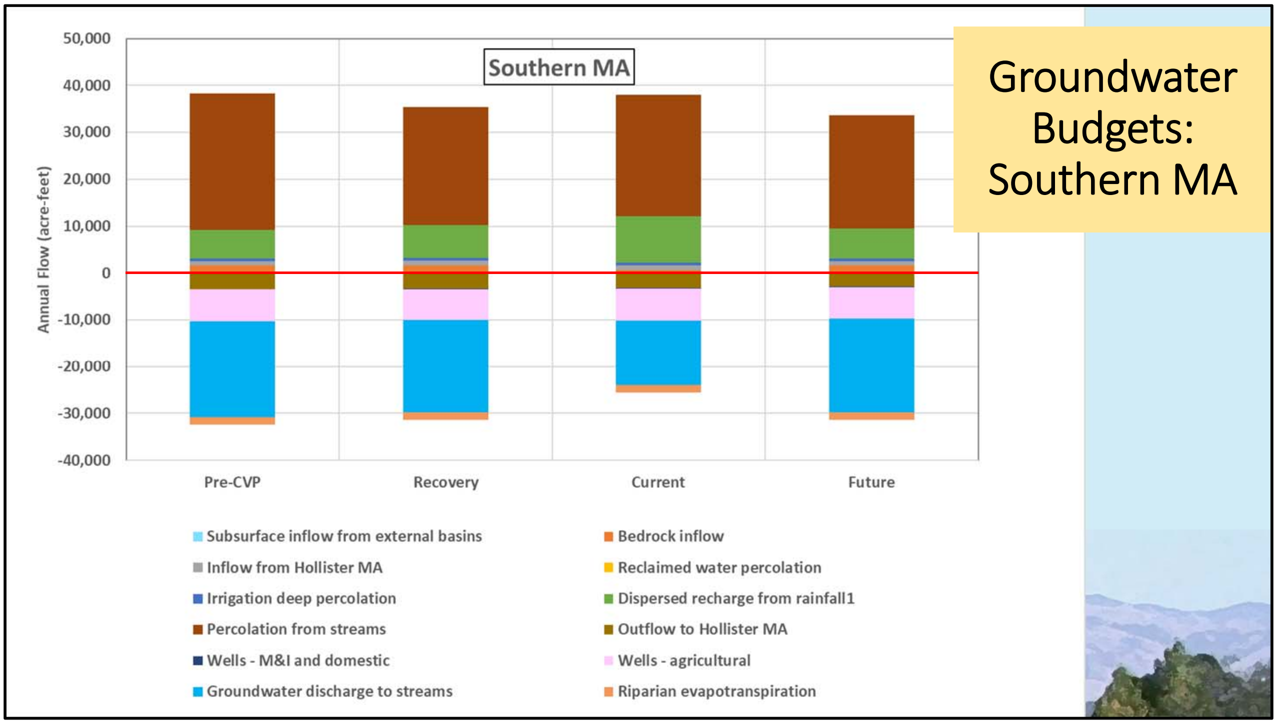
General pattern among all management areas: lots of water moves through the streams, and groundwater-surface water exchanges are usually a small part of those flows.

CVP Imports



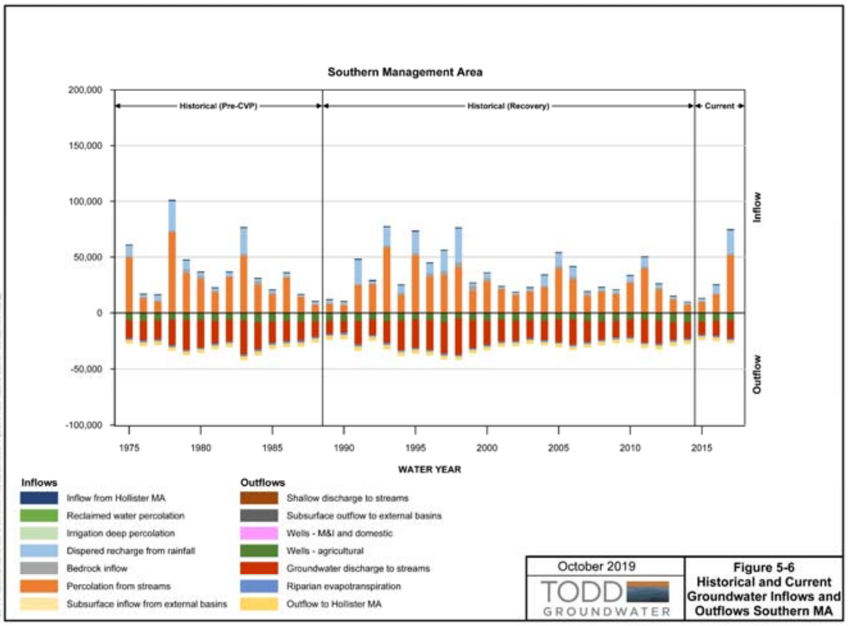
CVP availability and use have changed over time:

- Percolation in creek channels was large in the 1990s, but now it is prohibited.
- M&I use began with construction of the Lessalt treatment plant in 2003, and treatment capacity has increased since then.
- Restrictions on Delta exports diminished CVP availability across the board for south-of-Delta contractors beginning around 2007.

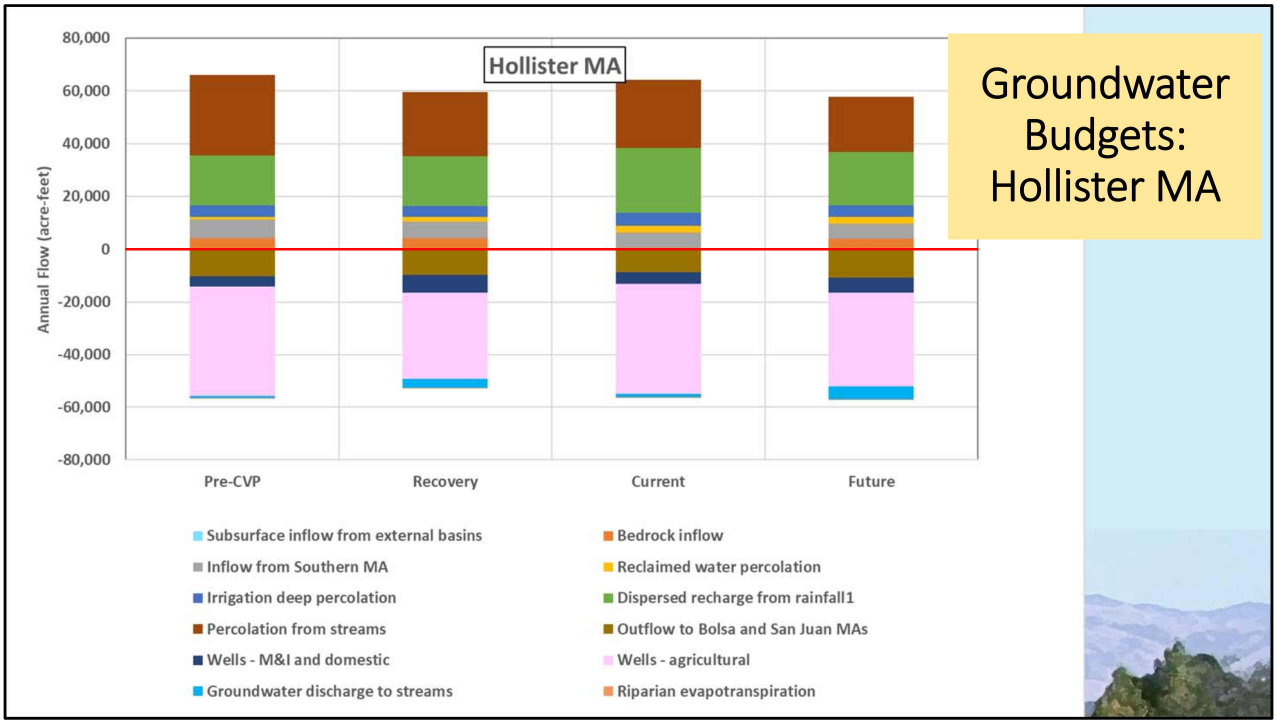


Southern MA groundwater budget dominated by percolation from streams (San Benito River and Tres Pinos Creek) and GW discharge to streams.
The decrease in GW discharge to streams in the Current period is because GW levels were still recovering from the 2013-2015 drought.
Otherwise, proportions of inflows and outflows are fairly consistent among the analysis periods.

Groundwater Budgets: Southern MA



These Southern MA annual water balances show how variable the individual years are within the analysis periods.
Inflows from stream percolation and rainfall respond to current-year hydrology.
Subsurface outflow and GW discharge to streams respond gradually due to GW storage effects.



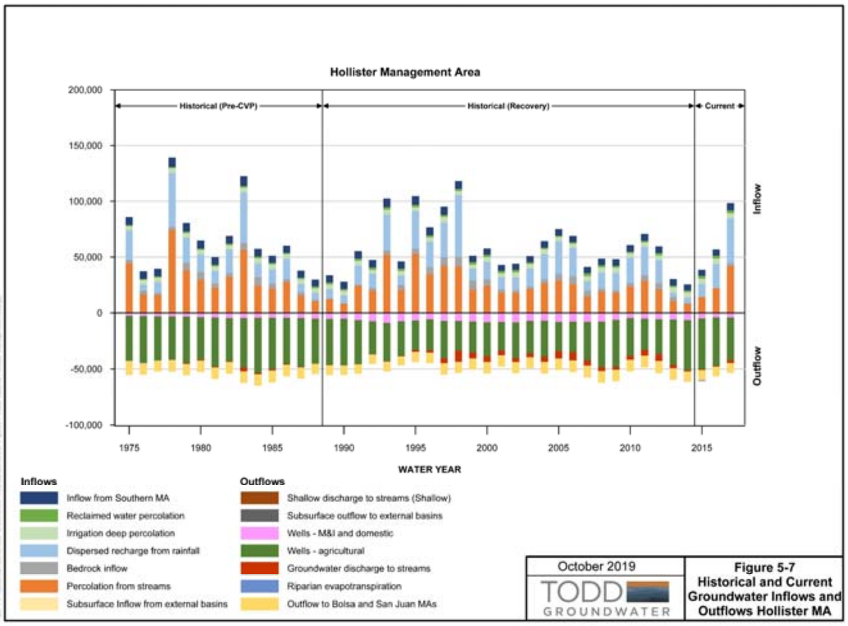
In the Hollister MA, dispersed recharge from rain and irrigation are about the same magnitude as percolation from streams.

The decrease in percolation from streams during the Recovery period was because GW levels were relatively high, so some stream recharge was rejected. Water levels were generally lower during the Historical and Current periods.

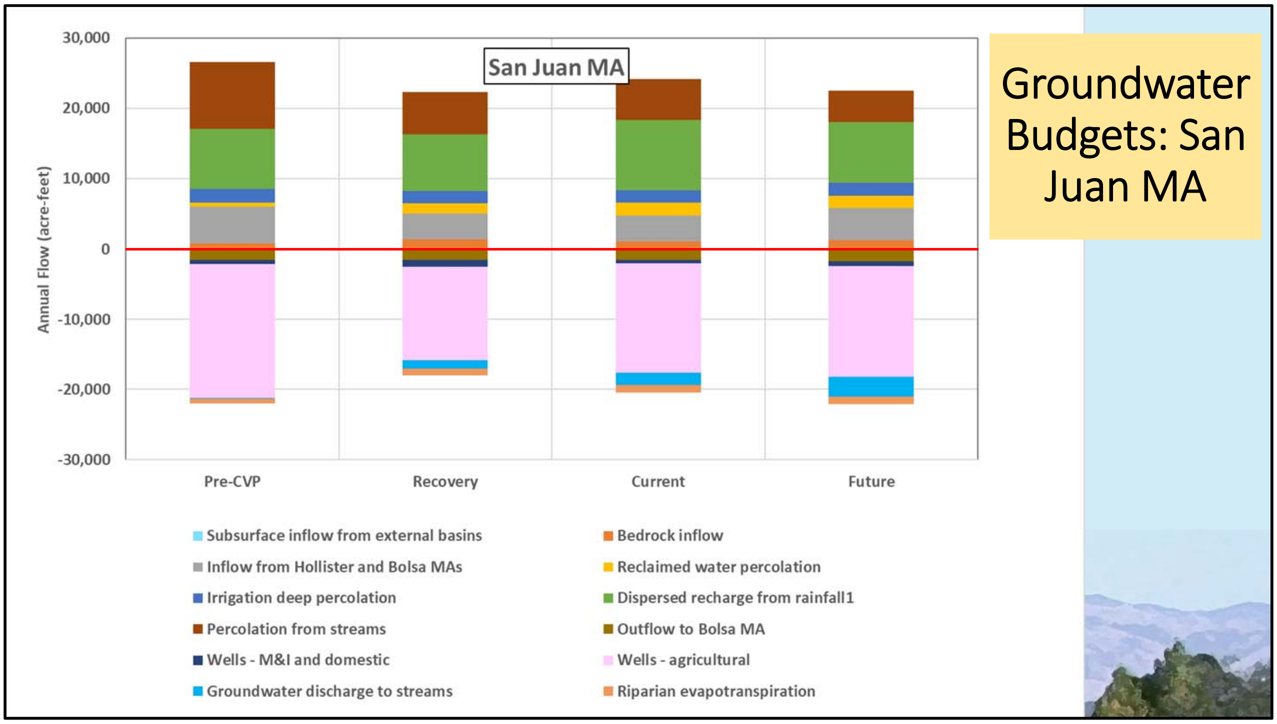
Ag pumping was relatively low during the Recovery period because of relatively high CVP availability. It was higher during the pre-CVP Historical period and during the Current period (due to drought reduction in CVP availability). The Future baseline simulation assumes agricultural users take all available CVP ag water.

The decrease in M&I pumping from the Recovery to Current periods is due to increased use of CVP water.

Groundwater Budgets: Hollister MA



The annual water budgets for the Hollister MA show that percolation from streams and rainfall deep percolation vary greatly from year to year. Irrigation deep percolation and GW inflow from bedrock and from the Southern MA are much steadier.
GW discharge to streams did not become significant until GW levels recovered from historical overdraft.
Ag pumping varies somewhat from year to year (inversely correlated with CVP availability), and GW outflow to Bolsa and San Juan MAs are relatively steady.



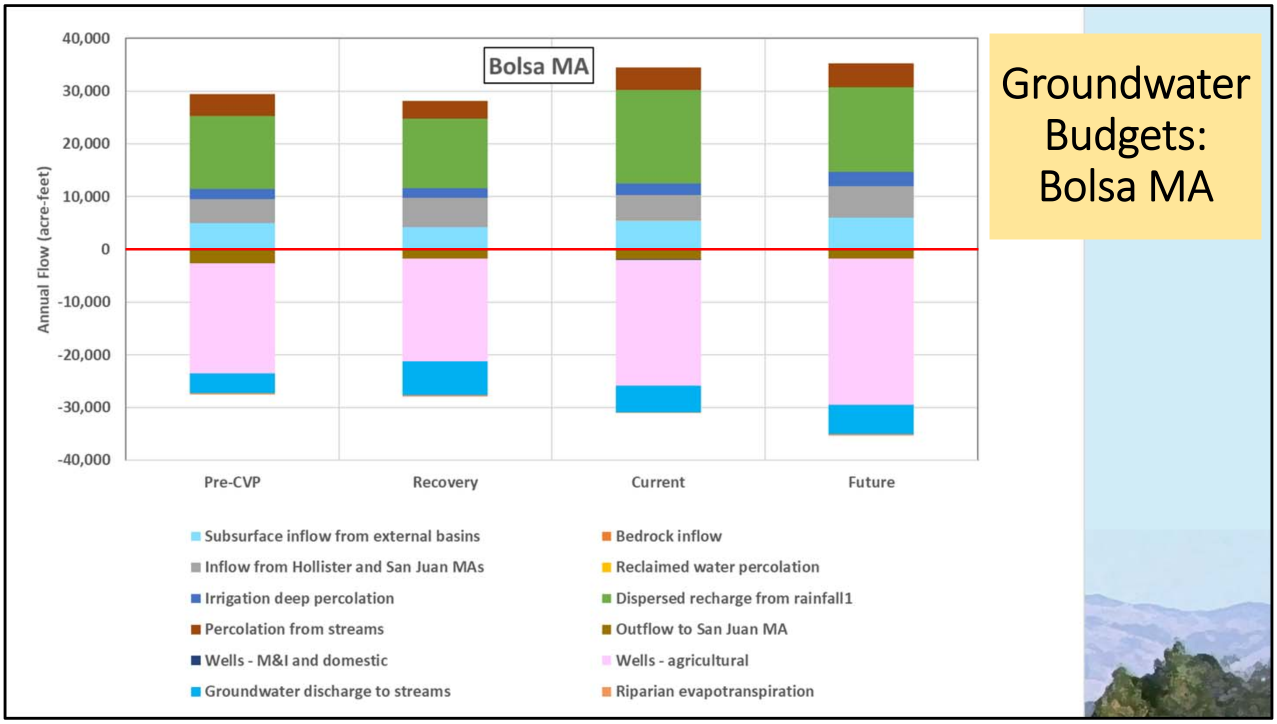
In the San Juan MA, percolation from the San Benito River is relatively high when GW levels are relatively low (Historical and Current periods). The gradual increase in GW discharge to streams reflects the recovery of GW levels.

The relatively high rainfall recharge during the Current period is because one of the three years was quite wet (2017).

Ag pumping went down during the Recovery period because CVP water became available. It went up again during the Current period because CVP ag allocations were low.

Groundwater Budgets: San Juan MA

The San Juan water budget consists mostly of highly variable rainfall and stream recharge balanced by relatively steady agricultural pumping.



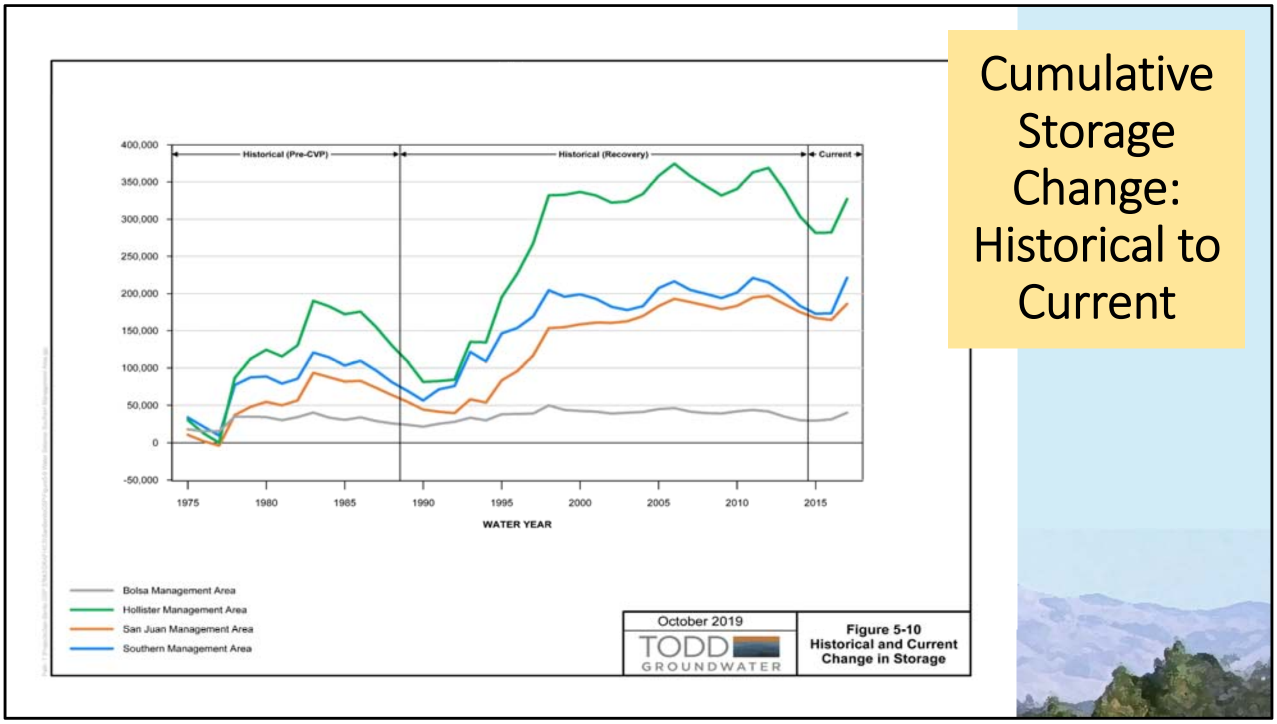
Subsurface inflow from other MAs is a larger percentage of total inflow to Bolsa than to the other three MAs. The slight trend toward increasing GW inflow is because of long-term increases in GW levels in the source MAs.
The relatively high amount of rainfall recharge during the Current period was because one of the three years was exceptionally wet (2017).
The increase in ag pumping from the Recovery to the Current period reflects an increase in irrigated acreage. That increase was carried forward to the Future Baseline simulation.

Groundwater Budgets: Bolsa MA

As in other MAs, rainfall recharge varies widely from year to year, and stream percolation a bit less so.

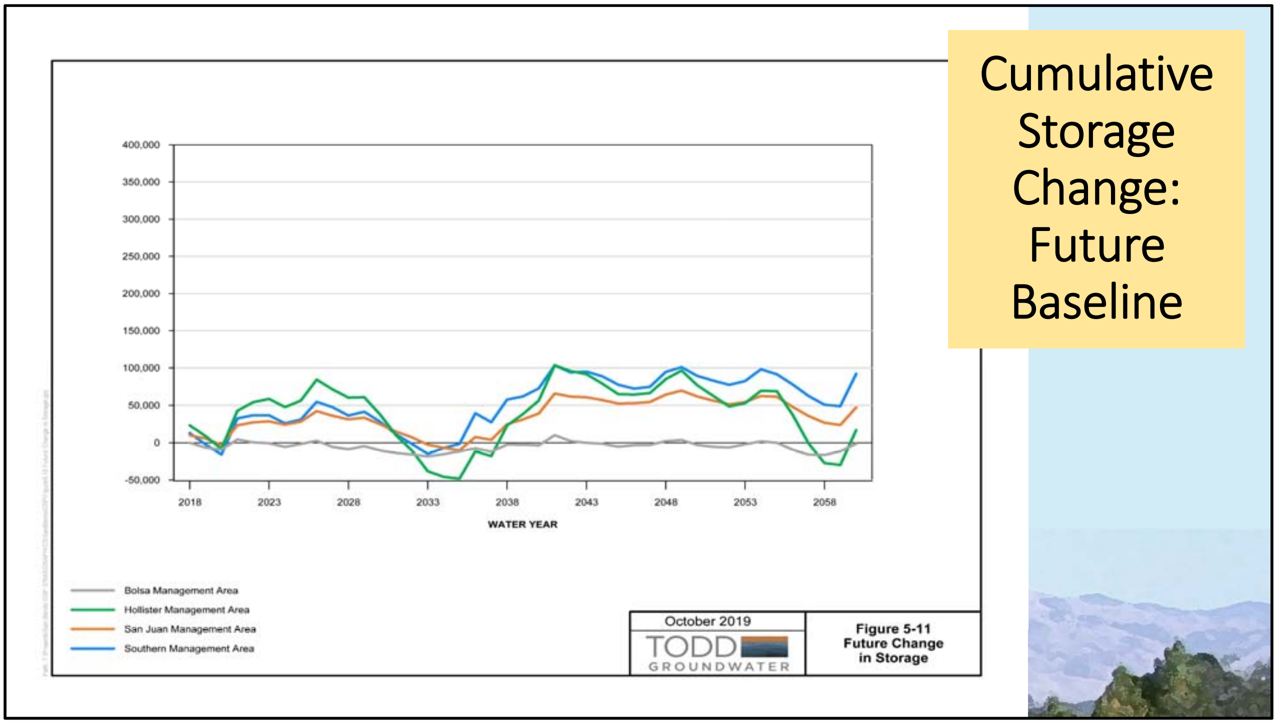
GW discharge to streams also increases considerably in wet years.

Agricultural pumping accounts for almost all outflow every year.



Notable patterns:

- Some recovery during wet periods even pre-CVP (1977 to 1983).
- Huge recovery during 1992-1998 was due to 1) onset of widespread ag CVP use, 2) percolation of CVP water in streams, and 3) several wet years.
- Storage declines in Hollister, San Juan and Bolsa during the recent 2013-2015 drought were much smaller than historical cumulative overdraft during the pre-CVP period.
- Southern MA storage is relatively steady because pumping is relatively small compared to the recharge capacity of the San Benito River. Southern storage is tricky to simulate because much of it is in upland areas where water level data are unavailable.



This hydrograph has the same Y axis scale as the previous graph. It shows that future storage fluctuations are expected to be smaller than historical ones because of the long-term benefit of conjunctive use of CVP imported water and local groundwater.
Storage still declines during droughts in the Hollister, San Juan and Bolsa MAs, but not by as much as occurred historically.

Sustainable Yield

- Sustainable yield is not a fixed, inherent characteristic of the Basin.
- It is affected by land use, water and wastewater management, imported water, and even the locations of wells with respect to streams.
- For planning purposes, a “forward looking” estimate of sustainable yield based on the future baseline simulation is most useful.

Examples of human activities affecting yield:

- Irrigation affects rainfall recharge
- Wastewater recycling vs. percolation can affect its consumptive use and discharge to streams.
- Some imported water becomes deep percolation.
- A well near an interconnected stream increases percolation from the stream (or decreases GW discharge to the stream).

Sustainable Yield—2

- Estimation method: Yield = simulated pumping + simulated net storage change
- Net storage change in Hollister, San Juan and Bolsa MAs during future baseline simulation was about zero, so yield ≈ pumping
- HOWEVER, sustainable yield can be constrained by the occurrence of undesirable results, separate from this water balance approach.

Sustainable Yield—3

Sustainable Yield estimated from groundwater pumping

	Future Baseline 2018-2060		
Management Area	**Agricultural Pumping**	**M&I Pumping**	**TOTAL**
Southern	6,598	142	6,740
Hollister	35,587	5,724	41,311
San Juan	15,797	652	16,449
Bolsa	27,724	24	27,748
TOTAL	**85,706**	**6,542**	**92,248**

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Water Balance Uncertainty

Table 5-7. Average Annual Groundwater Balances in the Hollister Management Area

Water Balance Items	Historical 1975-1988	Recovery 1989-2014	Current 2015-2017	Future[2] 2018-2060
Groundwater inflow				
Subsurface inflow from external basins	0	0	0	0
Percolation from streams	30,681	24,404	26,025	20,962
Bedrock inflow	4,075	4,116	426	3,977
Dispersed recharge from rainfall[1]	18,801	18,733	24,529	20,275
Irrigation deep percolation	4,270	4,260	4,831	4,371
Reclaimed water percolation	1,250	1,841	2,603	2,486
Inflow from Southern MA	6,975	6,203	5,837	5,756
Total inflow	66,052	59,556	64,251	57,827
Groundwater Outflow				
Subsurface outflow to external basins	0	0	0	0
Wells - M&I and domestic	-3,885	-6,905	-4,424	-5,724
Wells - agricultural	-41,703	-32,817	-41,960	-35,587
Groundwater discharge to streams	-727	-3,307	-1,313	-5,019
Riparian evapotranspiration	-167	-175	-140	-194
Outflow to Bolsa and San Juan MAs	-10,274	-9,676	-8,659	-10,762
Total outflow	-56,756	-52,879	-56,497	-57,285
Net Change in Storage	9,296	6,677	7,754	542

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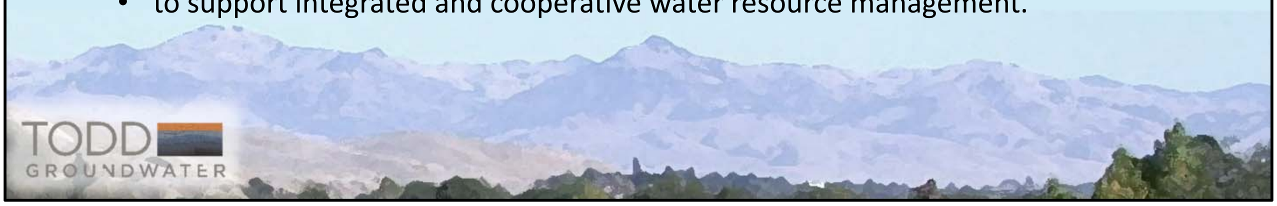
Tables in report show flows to the nearest 1 AFY. In reality, the estimates are probably no more accurate than two significant digits, which would be to the nearest 1,000 AFY for large items.
All of the thousands of numbers that go into the model have uncertainty associated with them.
The model calibration process has uncertainty: some wells calibrated much better than others.
Measured data such as rainfall, stream flow, pumping and water levels have uncertainty, too, not just simulated or estimated data.
There is no single “percent accuracy” number for the overall analysis.
Water management must proceed with the best available information, in spite of uncertainty.

Water Balance Discussion

Draft Definition of Sustainability Goal

To sustain groundwater resources now and in the future for the beneficial uses of the North San Benito Basin community and environment in a manner that is adaptive and responsive to the following objectives:

- to provide a long-term, reliable and affordable groundwater supply
- to provide reliable storage for water supply resilience during droughts and shortages
- to protect and improve groundwater quality
- to avoid subsidence
- to provide for connected surface water with associated beneficial uses, and
- to support integrated and cooperative water resource management.



This is a draft for discussion purposes. TAC comments and revisions invited.

Update on Outreach

- Ongoing outreach of Water Resources Association
- Anzar High School (San Juan Bautista) career talk including importance of SGMA
- County fair booth (Bolado Park) with SGMA literature and posters
- Booth at League of United Latin American Citizens (LULAC) Health Fair (downtown Hollister)
- Presentation at San Benito County Association of Realtors (Ridgemark Country Club)


2021
2020
2019
2018
GSP Overview, Workshops, and TAC Meetings
Plan Development
Management Actions / Monitoring
Sustainability Criteria
Management Areas / Water Budgets
Hydrogeologic Conceptual Model / Groundwater
Data Compilation / Data Management System
Plan Area / Institutional Setting
Adoption hearing
Draft GSP workshop
Implementation workshop
Actions workshop
Criteria workshop
Water budget workshop TBA February 2020
HCM-GW Conditions workshop #2 June 18 2019
Kickoff workshop Nov 7 2018

Next Steps

SBCWD Board of Director’s Meeting	October 30, 2019
TAC Meeting No. 7 Water Budget and Numerical Model	January 29, 2020
SBCWD Board of Director’s Meetings	January 13, 2020 January 29, 2020
Public Workshop No. 3 Water Budget	TBA February 2020