Pleasant Valley Subbasin

Stakeholder Workshop

Groundwater Sustainability Plan

PVGSA

THE CITY OF COALINGA 1906

THE COUNTY OF FRESNO 1856

July 27, 2021
On Site – Harris Ranch &
Remote via Microsoft Teams

Presented by: Kenneth D. Schmidt & Associates

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Sustainable Groundwater Management Act

The Sustainable Groundwater Management Act (SGMA) requires governments and water agencies of high and medium priority basins to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge. Under SGMA, these basins should reach sustainability within 20 years of implementing their sustainability plans. For critically over-drafted basins, sustainability should be reached by year 2040. For the remaining high and medium priority basins (like Pleasant Valley), 2042 is the deadline.

Funding – DWR Grant Prop 68

- Grant totals $981,000
  - Funds can be used for
    - Administration of the grant with DWR
    - Technical analysis regarding defining the basin condition
    - Writing the GSP
    - Engaging with stakeholders
    - Coordination with adjacent groundwater basins
    - Developing projects
  - Disadvantaged community allowed for no cost share requirements

Groundwater Sustainability Plan

GSP Tasks	GSP Chapter	July 27th, 2021
Notice of Intent	-	Completed
Stakeholder Outreach & Engagement	C&E Plan	Ongoing, Draft C&E Plan Completed
Basin Setting	2	Completed Draft
Hydrologic Groundwater Modeling/Water Budget	3	Draft complete and will submit to PAC
Sustainable Management Criteria	4	Draft to be completed by end of July
Monitoring and Data Management	5	Draft to be completed by end of July
Projects & Management Actions	6	Draft to be completed by end of July
Coordination and Interbasin Agreements	-	Planned 2021
GSP due	-	February 28, 2022

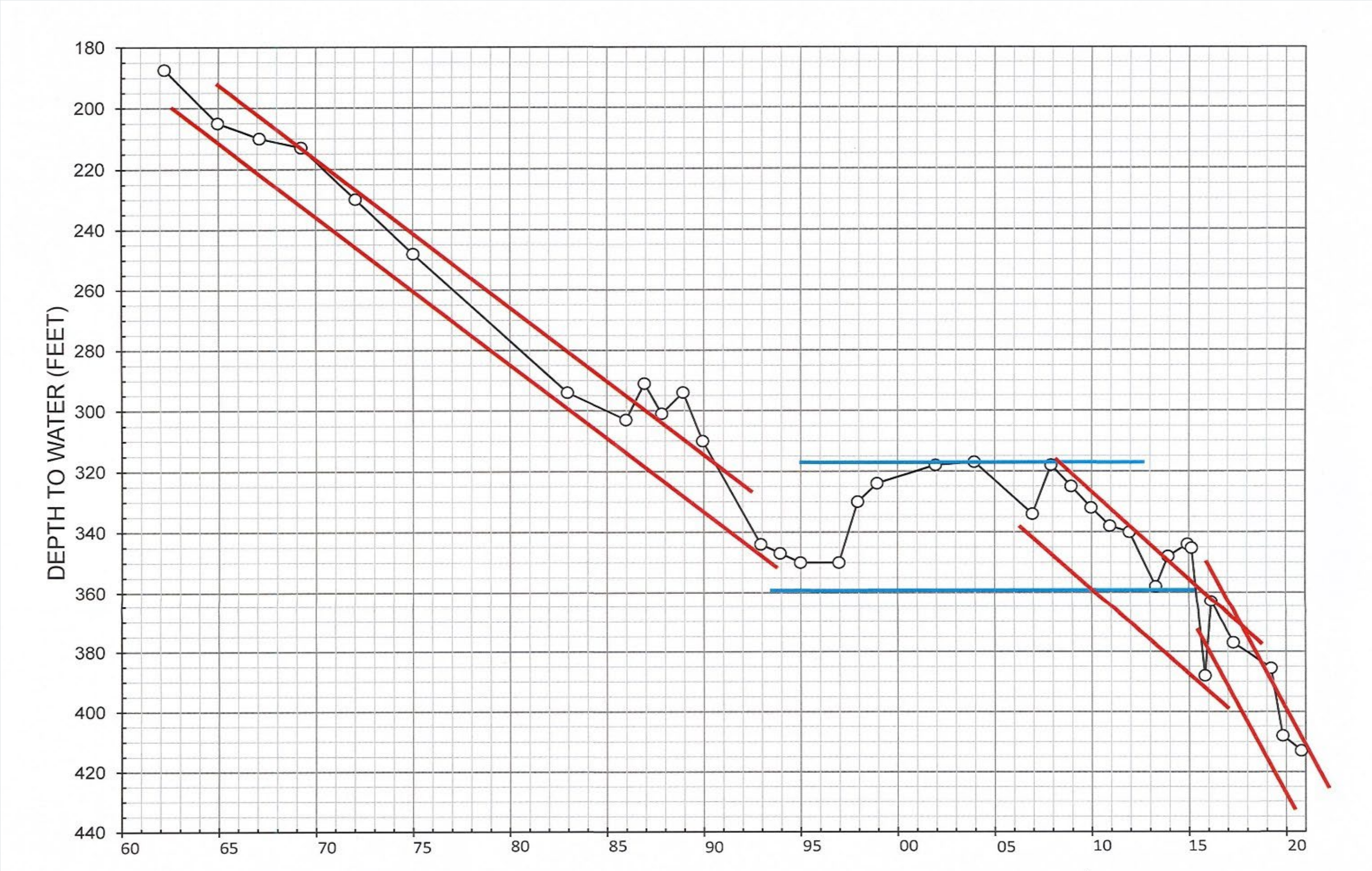
Agenda

- Groundwater Sustainability Plan (GSP):
  - Basin Setting
    - Water Budgets
    - Hydrographs
    - Deep Percolation

Water Budgets for Pleasant Valley GSP

- Sources of Groundwater Recharge
  - Streamflow Seepage
  - Groundwater Inflow
  - Deep Percolation from Irrigation
- Sources of Groundwater Discharge
  - Pumpage
  - Groundwater Outflow
- Change in Groundwater Storage
  - Change in Annual Shallowest Water Level
  - X Specific Yield

Historical Water-Level Hydrograph



Historic Water Budget Periods

Period	Pumpage (AF/yr)	Streamflow Recharge (AF/yr)	Deep Percolation Reaching GW (AF/yr)	Ave Water-Level Decline (ft/yr)	Change in Storage **(AF/yr)**
1937-45	28,000	22,000	6,000	0	**0**
1945-51	35,000	0	8,500	5.3	**-26,500**
1960 toMid-1980s	55,000	16,000	17,000	6.2	**-28,000**
Early 1980s-Early 2005	35,000	23,000	12,000	0	**0**
2006-17	40,000	0	12,000	5.3	**-24,000**
2017-21	**56,000**	**8,000**	**20,000**	**10.0**	**-28,000**

Rate of Downward Flow of Deep Percolation

There are two basic situations to consider when evaluating the rate of downward flow of deep percolation beneath irrigated lands.

- One is in an area that has been irrigated for many decades, perhaps up to a century or more. In this case, the subsurface deposits above the water level are expected to be at field capacity. When more water is added, such as from deep percolation, this added water will tend to move downward.

Rate of Downward Flow of Deep Percolation

- A second case is in areas not previously irrigated, such as arid lands that were newly developed for irrigation on the west side of the San Joaquin Valley, once aqueduct water became available. In this case, the subsurface deposits away from streams were indicated to be moisture deficient. When a source of water such as deep percolation is added, this moisture deficiency must first be satisfied, before downward movement can occur. That is, the moisture content would have to be raised from near the wilting point to the field capacity, before downward flow of deep percolation could occur. This situation results in longer travel time before the deep percolation reaches the groundwater level, than in areas that have been irrigated for many decades.

Rate of Downward Flow of Deep Percolation

- Field capacity is a soil scientist term, that is probably
- nearly equivalent to the specific yield, a term used by hydro geologists. The wilting point is another soil scientist term, that is probably nearly equivalent to specific retention, a term used by hydrogeologists.

Rate of Downward Flow of Deep Percolation

<u>East Side of the San Joaquin Valley</u>

- In much of this area, fairly permeable deposits are present above the water level, which are often less than about 100 feet deep.
- The average specific yield of these deposits is about 15 percent. This means there is a storage space of about seven feet for each foot of downward percolating water. If the deposits above the water level are not saturated, then one foot per year of deep percolation would have to move downward at least seven feet. Thus the downward low rate of deep percolation would be at least about 10 feet per year.

Rate of Downward Flow of Deep Percolation

East Side of the San Joaquin Valley

- There are two constituents in the deep percolation that can be used as tracers as part of the eastside areas. These are nitrate and DBCP. Fertilizer sources of nitrogen, such as anhydrous ammonia, began to be used by the early 1950's.
- DBCP was used to control nematodes, and began to be used by the late 1950's. Both of these constituents reached the groundwater. By the late 1970s, both of those that reached the groundwater, and were primarily present above a depth of about 250 feet. Thus for nitrate, a rate of downward flow of deep percolation was at least 250 feet divided by 25 years, or 10 feet per year. For DBCP, a rate of downward flow of about 250 feet in 20 years, or 12.5 feet per year was apparent.

Rate of Downward Flow of Deep Percolation

East Side of the San Joaquin Valley

- In summary, for the east side of the San Joaquin Valley in Fresno County, deep percolation beneath irrigated lands probably takes an average of about 7 years to move to a depth of about 50 feet, or an average of about 15 years to move to a depth of 100 feet.
- An interesting evaluation of deep percolation was done in 1968 by The California Department of Water Resources in the Delano-McFarland area. High nitrate concentrations in the groundwater as of the late 1960's were attributed to large water-level rises following the importation of Friant-Kern Canal water to the area, beginning in the 1950s. The increases in nitrate concentrations were attributed to the interception of downward moving deep percolation by the rising groundwater levels, which in some cases rose by more than 200 feet.

Rate of Downward Flow of Deep Percolation

Arizona Studies

- In central southern Arizona, water-level declines in basins where only groundwater was available for irrigation ranged from about 15 to 20 feet per year. Sampling of irrigation well water in these areas generally indicated no influence of deep percolation. The irrigation wells were generally perforated over intervals that exceeded 400 feet. However, sampling of cascading water (water entering the well from openings above the water level) indicated an influence of deep percolation (the salinity was about triple that of the water pumped from the well). This deep percolation many have moved only about half or two-thirds of the way to the water level since irrigation began. In this situation, the water level was apparently falling at a faster rate than the deep percolation was moving downward. Thus most of the deep percolation had not reached the groundwater level.

Rate of Downward Flow of Deep Percolation

Arizona Studies

- Monitoring of deep percolation was accomplished in the Salt River Valley of central Arizona in the mid 1970s. This area had been irrigated for more than a century, and a lot of deep percolation has reached the groundwater. Both samples of cascading water and samples from specially installed shallow moni tor wells were collected and analyzed. The deep percolation (away from canals) had TDS concentrations about three times greater than that of the applied water, consistent with an average irrigation efficiency at the time of about 67 percent. Notably, the primary chemical constituents in the applied water were sodium and chloride, neither of which tends to be removed from solution by precipitation.

Salt Concentration Due to Evapotranspiration

$$Irrigation\ Efficiency = \frac{Consumptive\ Use\ of\ Applied\ Water}{Applied\ Water}$$

- Furrow Irrigation 50%
- Sprinkler Irrigation 67%
- Drip Irrigation 85%
- If all of the salt constituents in the applied water are not subject to a net precipitation (removal from solution} in the topsoil and vadose zone, then the deep percolation would contain all of the salts in the applied water.

Salt Concentration Due to Evapotranspiration

- If all of the salt constituents in the applied water are not subject to a net precipitation (removal from solution} in the topsoil and vadose zone, then the deep percolation would contain all of the salts in the applied water.
- A salt concentration occurs because these salts then are in a smaller volume of water in the deep percolation, compared to in the applied water.
- For a 50% irrigation efficiency, the TDS concentration in the deep percolation would be double the TDS concentration in the applied water.
- For a 67% irrigation efficiency, the TDS concentration in the deep percolation would be triple the TDS concentration in the applied water.
- For an 85% irrigation efficiency, the TDS concentration in the deep percolation would be 8.5 times the TDS concentration in the applied water.

Salt Concentration Due to Evapotranspiration

- If the average TDS concentration in well water in Pleasant Valley is 1,500 mg/1, then the TDS concentration in deep percolation from sprinkler irrigated lands would be 4,500 mg/1. For drip irrigation, the TDS in the deep percolation would be almost 13,000 mg/1.
- However, not all of the cations and anions in the applied water are considered 100 percent mobile in the topsoil and vadose zone. In particular, calcium and bicarbonate can be precipitated from solution and become solid calcium carbonate.
- This could occur during drying out periods between irrigation periods. All of this removed calcium carbonate may not re-enter solution during subsequent irrigation events.

Salt Concentration Due to Evapotranspiration

- Calcium and sulfate can also precipitate from solution and become solid gypsum. This could also occur during drying out periods between irrigation periods. All of this gypsum may not re-enter solution during subsequent irrigation events.
- The U.S. Salinity Laboratory in Riverside has conducted a substantial amount of research on irrigation and deep percolation.
- Because of the expected eventual TDS increases in the groundwater, as more and more deep percolation reaches the groundwater, it is recommended that a monitoring program be developed to evaluate this process in more detail.
- It would appear that TDS concentrations of at least 4,500 mg/l would readily have occurred in deep percolation in Pleasant Valley. However, greater increases in TDS would at least partly be controlled by salt precipitation.

Mixing of Deep Percolation with Groundwater

- Most irrigation wells in Pleasant Valley are perforated oppo site at least several hundred feet of saturated deposits. Once the deep percolation reaches the groundwater, it is not expected to mix with all of this groundwater, but rather to reside in the upper part of the aquifer, probably within the uppermost 100 feet or so of the water level. Sampling of water from irrigation wells represents a mixture of water from many permeable layers of alluvium at different depths that are tapped by the wells. Because the deep percolation would be present only in the upper part of the aquifer, increases in TDS concentrations due to deep percolation would be difficult to detect by supply well sampling. However, information on deep percolation in the vadose zone (above the water table) can be obtained by analyzing water samples from cascading wells.

Mixing of Deep Percolation with Groundwater

- Cascading water occurs when water trapped above clay or other low permeability layers enters shallow perforations or other opening above the water level, then falls down inside the casing to the water level. Samples of this water can be obtained when the pump is removed by bailing water from the well below where the water enters the casing. In addition, shallow monitor wells can be installed, tapping groundwater within about 30 feet of the water level.

Comments - Questions