WMA

Santa Ynez River Valley Groundwater Basin
Western Management Area
Groundwater Sustainability Agency

April 14 2021

Stakeholder Workshop

STETSON ENGINEERS INC.

DUDEK

Geosyntec consultants

engineers | scientists | innovators

Housekeeping

- Recording the meeting for the purpose of capturing public feedback
- Recording can be made available upon request
- Opportunities for public feedback and questions throughout the workshop
- Website for additional information:

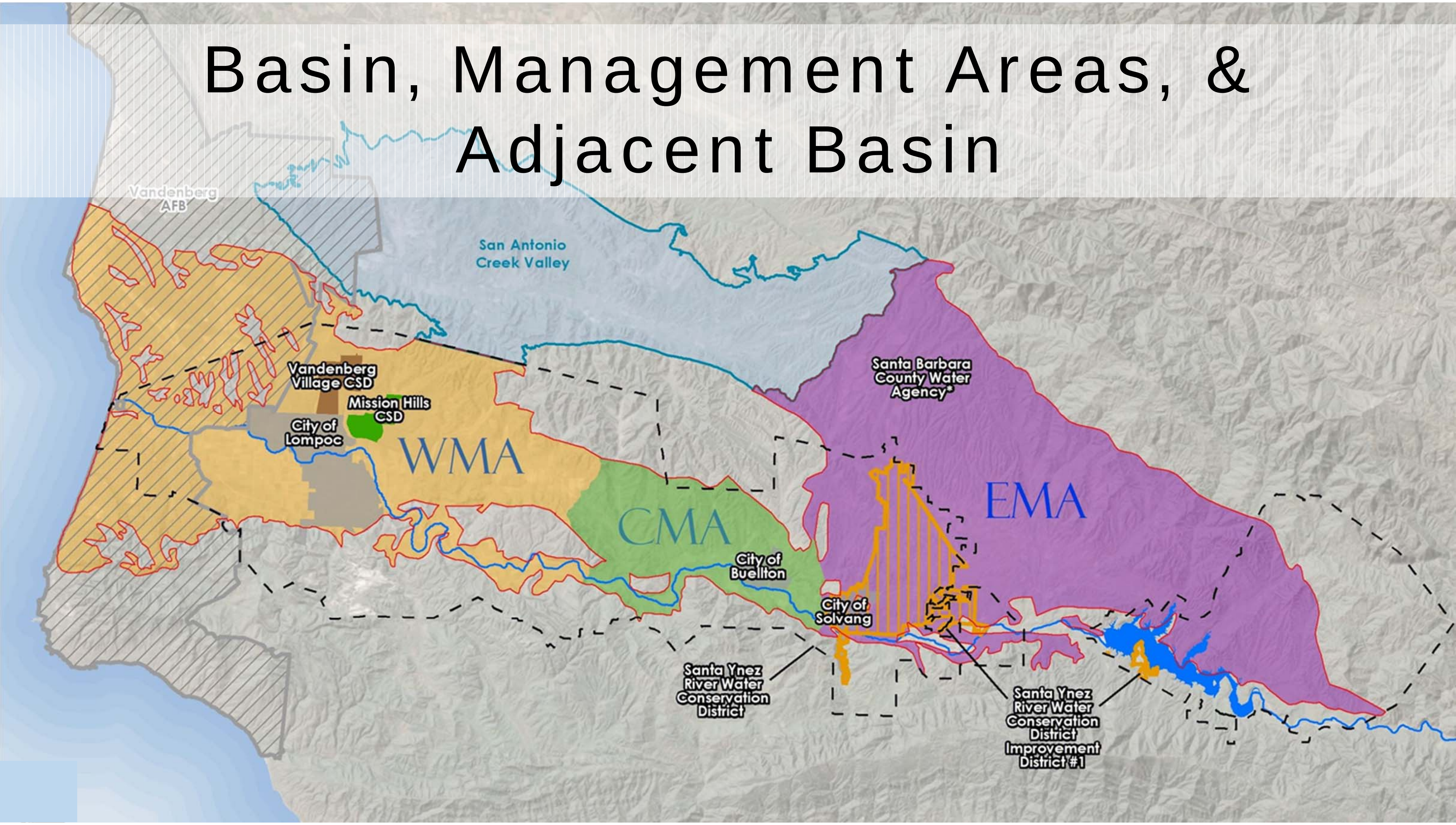
  www.santaynezwater.org

- Slide numbers in lower right

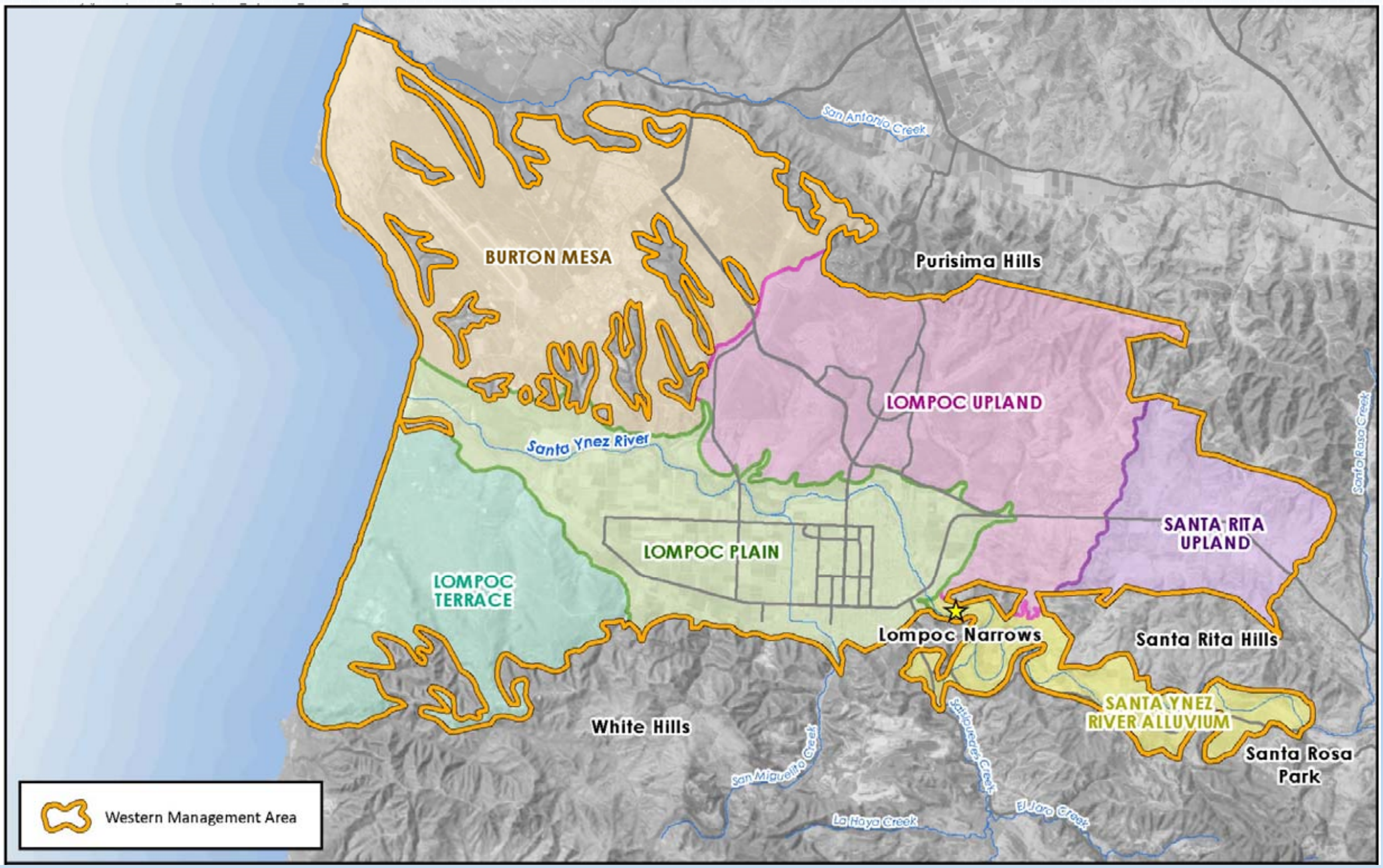
Agenda

1. Water Budget and Sustainable Yield Preliminary Determination and Discussion
    1. Time periods and data sources
    2. Historical and Current Analysis Results
    3. Future Period Assumptions and Analysis Results
2. Way Ahead/ Schedule

Basin, Management Areas, & Adjacent Basin



WMA Subareas



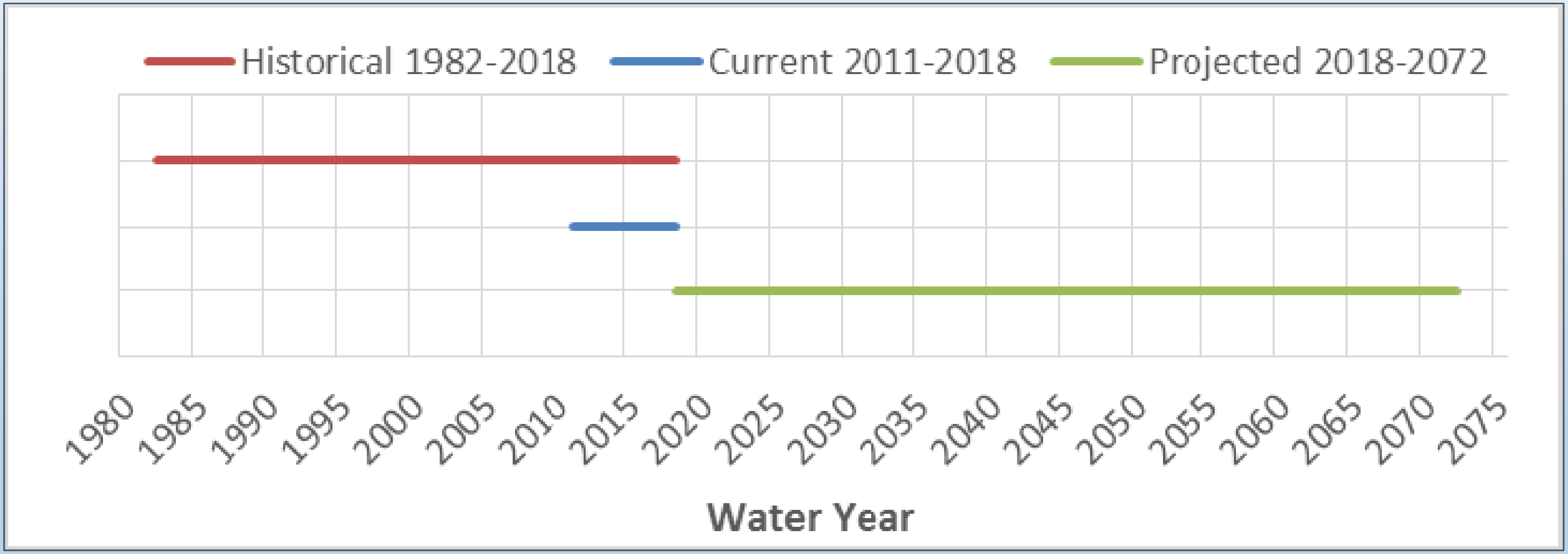
Water Budget and SGMA – Background/ Goals

- SGMA requires that the GSP water budget include: “the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored.” (GSP Regulations 23 CCR 354.18.)
- Other requirements:
  - Coordinated water budget for the entire basin (WMA, CMA, and EMA)
  - The water year type associated with the annual supply, demand, and change in groundwater stored.
  - If overdraft conditions occur, as defined in Bulletin 118, quantification of overdraft over average conditions.
  - An estimate of sustainable yield for the basin.

Definitions for Groundwater Planning and Sustainable Management

- "Perennial Yield" (Stetson, 1992) = Determined from water budget. **<u>Average Annual Pumping + Average Annual Change in Storage</u>**; Over long-term average conditions. Also referred to as safe yield.
- "Overdraft" (DWR Bulletin 118): "Condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions. **<u>Overdraft can be characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years</u>**."
- "Sustainable yield" (SGMA) = "Maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing **<u>an undesirable result" (UR)</u>**. Absence of URs are determined based on interpretation of the sustainable management criteria (SMCs).

Water Budget Time Periods



Historical Time Period - Baseline

- **Historical – 1982 -2018**
  - **37 years, with two major drought periods**

    Meets SGMA requirement of extending back at least 10 years.
  - **Average Hydrologic Conditions**

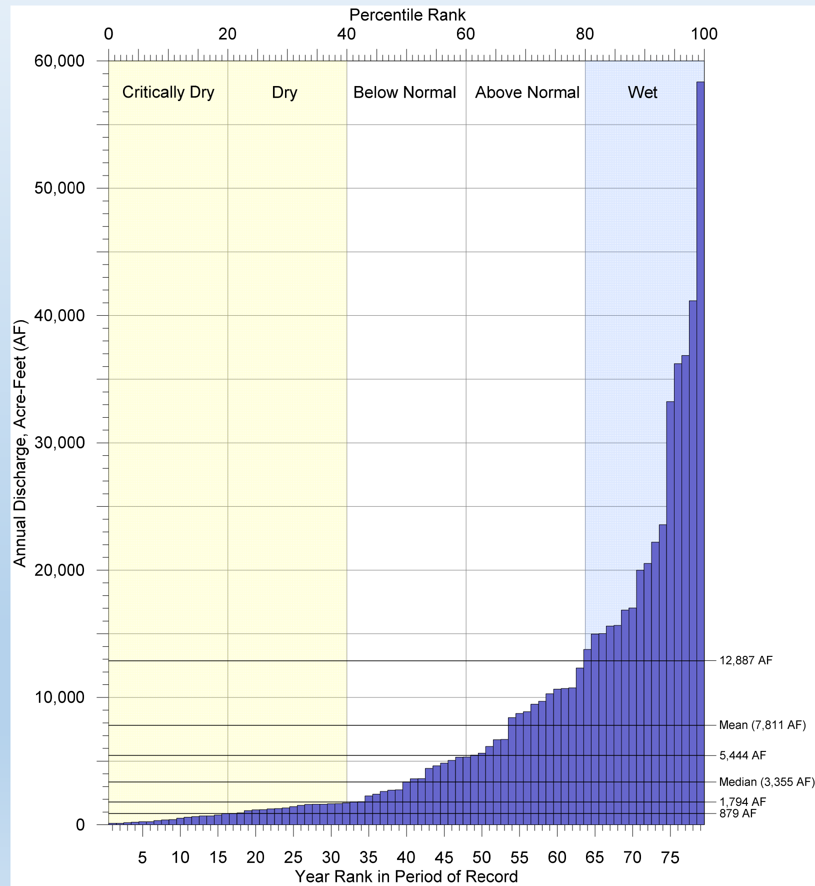
    Average precipitation at Lompoc City Hall is 14.6 inches per year for the period of 1955–2020 and 14.7 inches for the period of 1982–2018 (<1% difference).
  - **Pumping and Diversion records reported to District starting early 1980s**
  - **Coordinated with CMA and WMA**

Water Year Types

			Hydrologic Year Type Classification [1]		
	Lompoc City Hall		WMA	Upper Santa Ynez River	
Water Year	Precipitation (in/year)	% of Average [2]	USGS Gage 11132500 (Salsipuedes Creek)	SWRCB WRO 2019-148	Climatic Trends [3]
1982	11.9	81%	Dry	Below normal	Wet
1983	34.0	231%	Wet	Wet	Wet
1984	8.0	54%	Below normal	Above normal	Dry
1985	9.8	67%	Dry	Dry	Dry
1986	19.3	131%	Above normal	Above normal	Dry
1987	11.2	76%	Dry	Critically Dry	Dry
1988	15.4	105%	Dry	Dry	Dry
1989	6.6	45%	Critically Dry	Critically Dry	Dry
1990	6.6	45%	Critically Dry	Critically Dry	Dry
1991	15.0	102%	Below normal	Above normal	Dry
1992	15.8	107%	Above normal	Wet	Wet
1993	17.7	120%	Wet	Wet	Wet
1994	12.8	87%	Below normal	Below normal	Wet
1995	33.8	229%	Wet	Wet	Wet
1996	12.2	82%	Below normal	Below normal	Wet
1997	12.0	82%	Above normal	Above normal	Wet
1998	34.3	233%	Wet	Wet	Wet
1999	15.2	103%	Above normal	Below normal	Normal
2000	15.1	103%	Above normal	Above normal	Normal
2001	17.8	121%	Wet	Wet	Normal
2002	7.5	51%	Dry	Dry	Normal
2003	11.7	79%	Below normal	Below normal	Normal
2004	8.6	58%	Dry	Dry	Normal
2005	24.9	169%	Wet	Wet	Normal
2006	16.8	114%	Above normal	Above normal	Normal
2007	5.3	36%	Critically Dry	Critically Dry	Normal
2008	13.6	92%	Above normal	Above normal	Normal
2009	10.4	71%	Critically Dry	Dry	Normal
2010	19.5	132%	Below normal	Above normal	Normal
2011	26.8	182%	Wet	Wet	Normal
2012	10.6	72%	Dry	Dry	Dry
2013	7.2	49%	Critically Dry	Critically Dry	Dry
2014	7.2	49%	Critically Dry	Critically Dry	Dry
2015	8.0	55%	Critically Dry	Critically Dry	Dry
2016	11.7	79%	Critically Dry	Dry	Dry
2017	22.5	153%	Above normal	Above normal	Normal
2018	8.3	56%	Critically Dry	Dry	Normal

Water Year Type (1942-2020)

- Wet
- No Data
- Above/Below Normal
- Dry / Critically Dry



Water Year Ranking

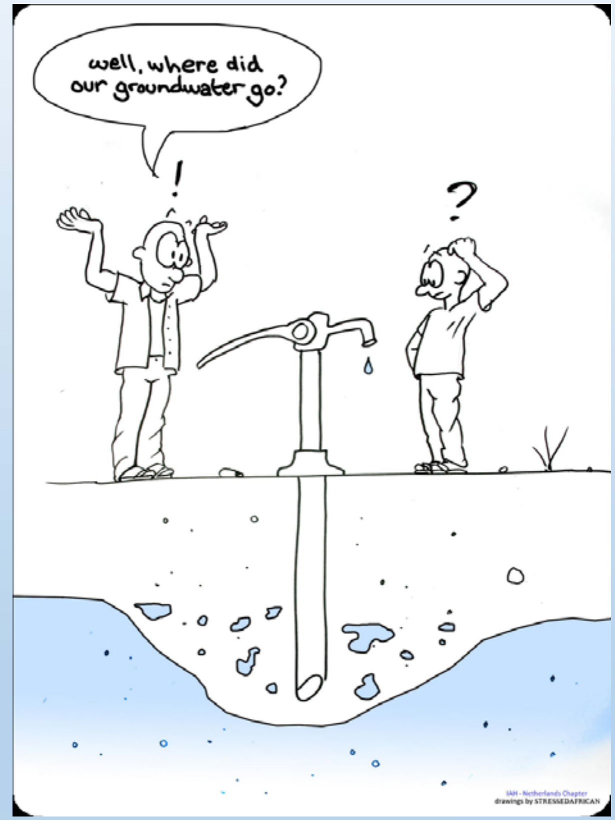
Current and Future Time Periods

- **Current – 2011-2018 (8 years)**
  - **Includes water year 2015- SGMA's benchmark year for current conditions**
  - **Includes "most recent hydrology, water supply, water demand, and land use information" (GSP Regulations); used to project the future baseline**
  - **Critical Drought period 2012-2018. Does not represent long-term average conditions.**
- **Future – 2018 -2072 (55 years)**
  - **2042: Meet sustainability goal in 20 years**
  - **2072: "Projected hydrology shall utilize 50 years"**

Water Budget Keys

Basic Equation for Groundwater Storage:

Inflows – Outflows = Change in Storage



More inflow than outflow:

Groundwater levels and Storage increase

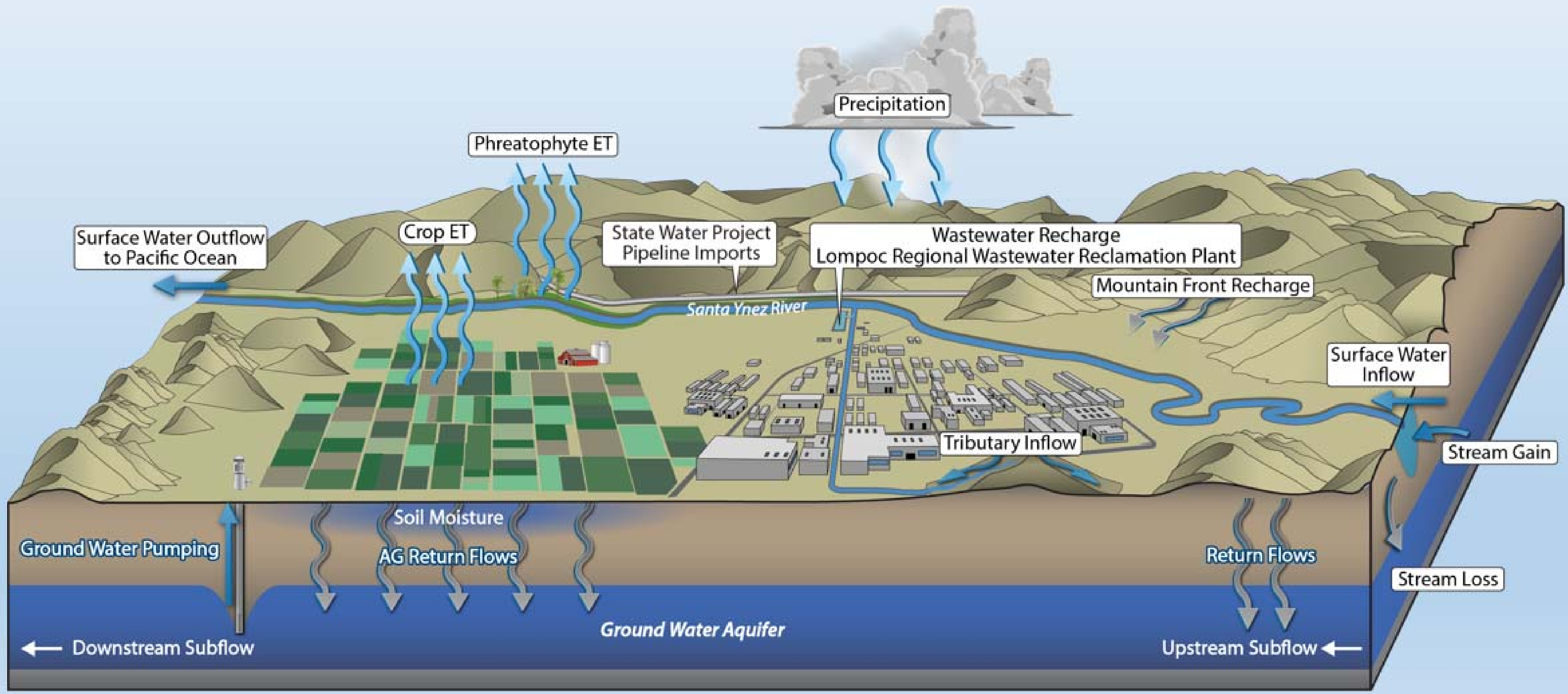
More outflow than inflow:

Groundwater levels and Storage decrease

Water Budget will address variability:

- **Hydrologic- Droughts 1987-1991, 2012-2018; Floods i.e. 1998**
- **Changes in Land Use/Demands, quantity and timing**
- **Climate Change, quantity and timing**
- **Changes in land use, demands, climate, etc. are considered by the regulations as uncertainty in the projected future water budget, which is based on current conditions.**

WMA Water Budget



WMA Water Budget Data Sources

TABLE 1-2 WATER BUDGET DATA SOURCES

Water Budget Component	Data Source(s)	Comment(s)	Qualitative Data Rating
Surface Water Inflow Components			
Santa Ynez River Inflow	USGS	Narrows Gauge	Gauged – High
Tributary Inflow	Correlation with gauged data	Methods described in text	Calibrated Model – Medium
Lompoc Regional Wastewater Reclamation Plant	City of Lompoc	Methods described in text	Metered – High
Imported: SWP	Central Coast Water Authority	—	Metered – High
Groundwater Inflow Components			
Deep Percolation of Precipitation: Overlying and Mountain Front Recharge	USGS BCM Recharge	BCM calibrated to Basin precipitation station data	Calibrated Model – Medium
Streamflow Percolation	Santa Ynez RiverWare Model, USGS BCM	Collaborative Modeling effort: Stetson and GSI	Calibrated Model – Medium
Subsurface inflow	Darcian flux calculation	Collaborative Modeling effort: Stetson and GSI	Estimated – Medium
Irrigation Return Flows	Land use surveys, self-reported pumping data	Basinwide Collaborative Estimation: Stetson and GSI using Yates 2010	Estimated – Low
Percolation of Treated Wastewater	Mission Hills CSD and Lompoc Penitentiary	Received	Metered – High
Percolation from Septic Systems	SYRWCD self-reported data, Santa Barbara County Water Agency return estimates	Methods described in text	Estimated – Low

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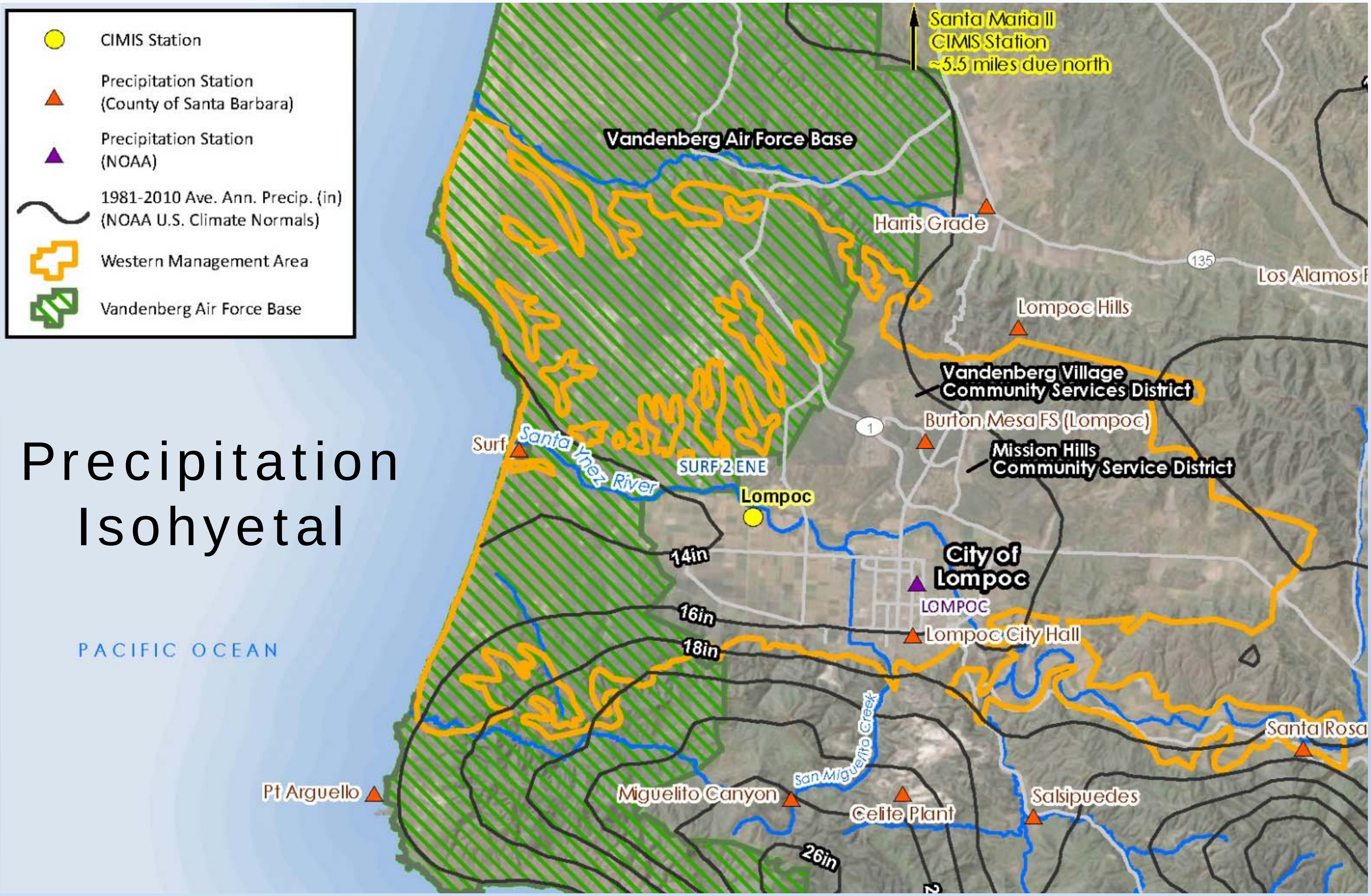
Surface Water Outflow Components			
Santa Ynez River Outflow	USGS	Methods described in text	Calibrated Model - Medium
Streamflow Percolation	Santa Ynez RiverWare Model, USGS BCM	Collaborative modeling effort: Stetson and GSI	Calibrated Model - Medium
Riparian Evapotranspiration	Aerial photography, NCCAG/NWI data sets, CIMIS weather station	Methods described in text	Estimated – Medium/Low
Groundwater Outflow Components			
Agricultural Irrigation Pumping	Land use surveys, self-reported pumping data	Methods described in text	Estimated – Medium/Low
Municipal Pumping	Self-reported pumping data	Methods described in text	High/Medium
Rural Domestic/Small Public Water Systems Pumping	SYRWCD self-reported data, DRINC	Methods described in text	Estimated – Medium/Low
Riparian Evapotranspiration	Aerial photography, NCCAG/NWI datasets, CIMIS weather station	Methods described in text	Estimated – Medium/Low
Subsurface Outflow	Darcian flux calculations, groundwater model	Methods described in text	Estimated – Medium

Notes: USGS = U.S. Geological Survey; SWP = State Water Project; BCM = Basin Characterization Model; Stetson = Stetson Engineers; GSI = GSI Water Solutions, Inc.; SYRWCD = Santa Ynez River Water Conservation District; NCCAG = The Natural Communities Commonly Associated with Groundwater (NCCAG) Wetland dataset; NWI = National Wetlands Inventory; CIMIS = California Irrigation Management Information System; DRINC = Drinking Water Information Clearinghouse.

Precipitation Isohyetal



WMA Tributaries

TABLE 1-3 TRIBUTARY CREEKS OF THE WMA

North of the Santa Ynez River	Drainage Area (mi^2)	Average Annual Precipitation (in/year)[1]
Santa Rita Creek	4.5	18.6
Cebada Canyon Creek	6.2	17.1
Purisima Canyon Creek	2.6	17.2
Davis Creek	4.6	16.1
Santa Lucia Canyon	9.5	15.1
Unnamed Tributaries	11.7	16.2
South of the Santa Ynez River		
Salsipuedes Creek	51.1	22.6
Miguelito Creek	10.4	22.4
Sloanes/ Le Salle Canyon	7.8	20.1
Lompoc Canyon	1.4	19.6
Bear Creek (La Honda watershed)	2.8	17.3
Unnamed Tributaries	4.75	21.2

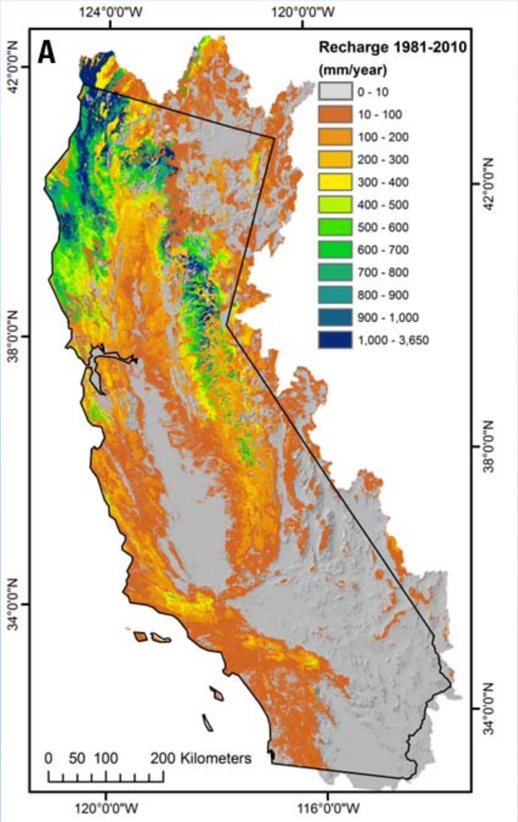
Notes: WMA = Western Management Area.

1 PRISM 2014.

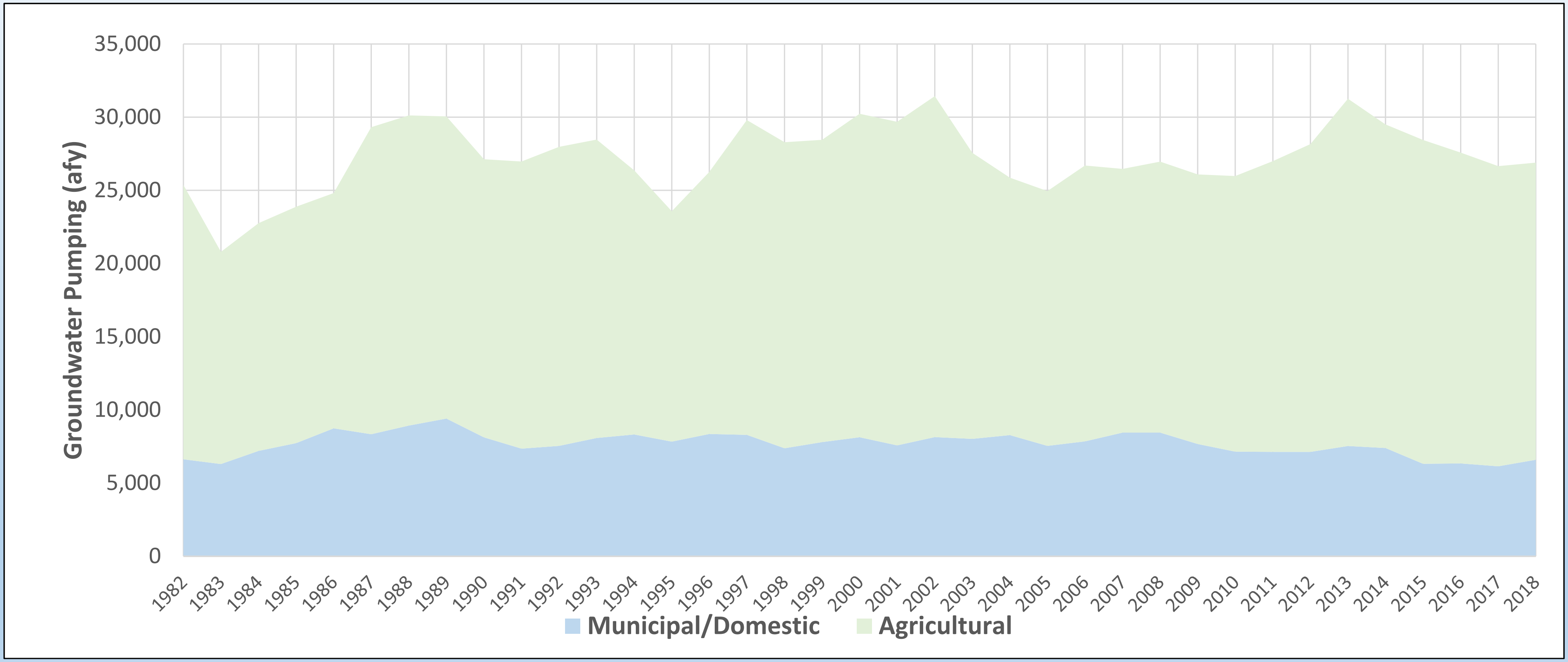
Recharge – USGS Basin Characterization Model

https://ca.water.usgs.gov/projects/reg_hydro/basin-characterization-model.html

- **Complex inputs to determine recharge**
  - **Precipitation, Temperature, Solar Radiation, Soil Properties**
- **20-acre cells**
  - **Covers Santa Ynez Basin**
  - **Integrates State-wide findings (see recharge map on right)**
- **Monthly Timesteps**
- **1980-2018**
- **Coordinated and corrected with CMA and WMA**



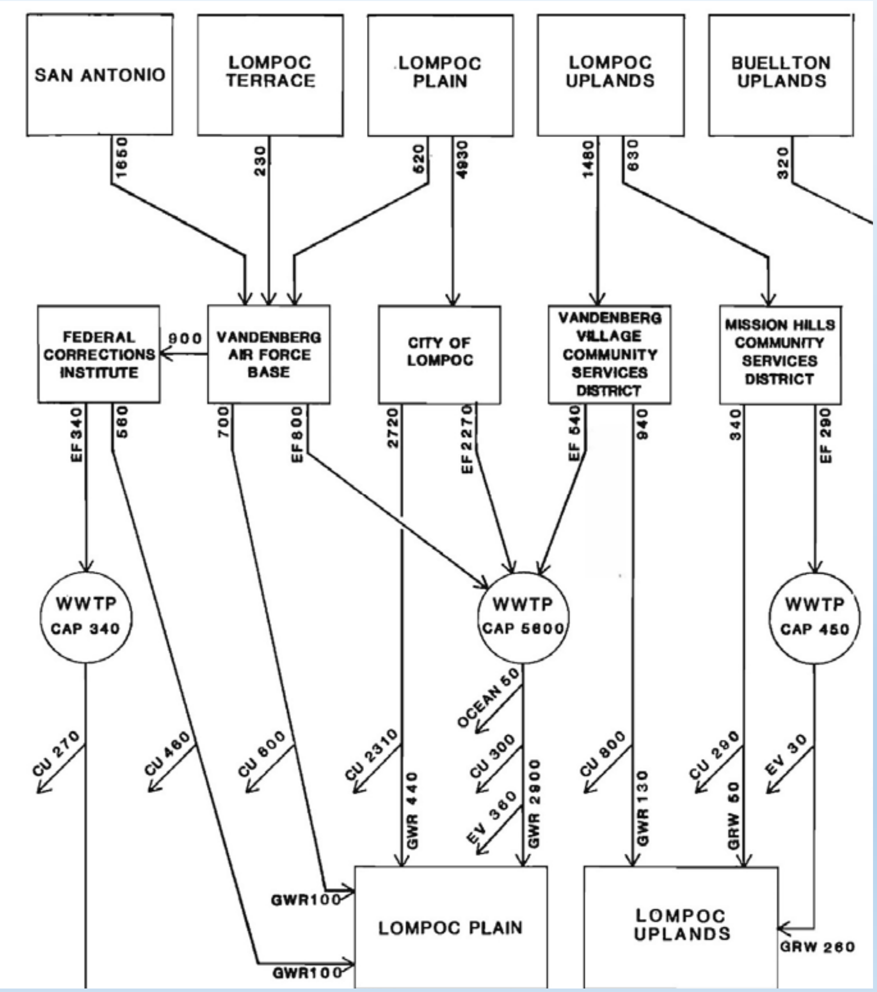
WMA Groundwater Pumping



Annual pumping based on reporting to SYRWCD. Total pumping ranges from about 21,000 to 31,00 afy.
Does not include Santa Ynez River underflow diversions (SWRCB).

RETURN FLOWS

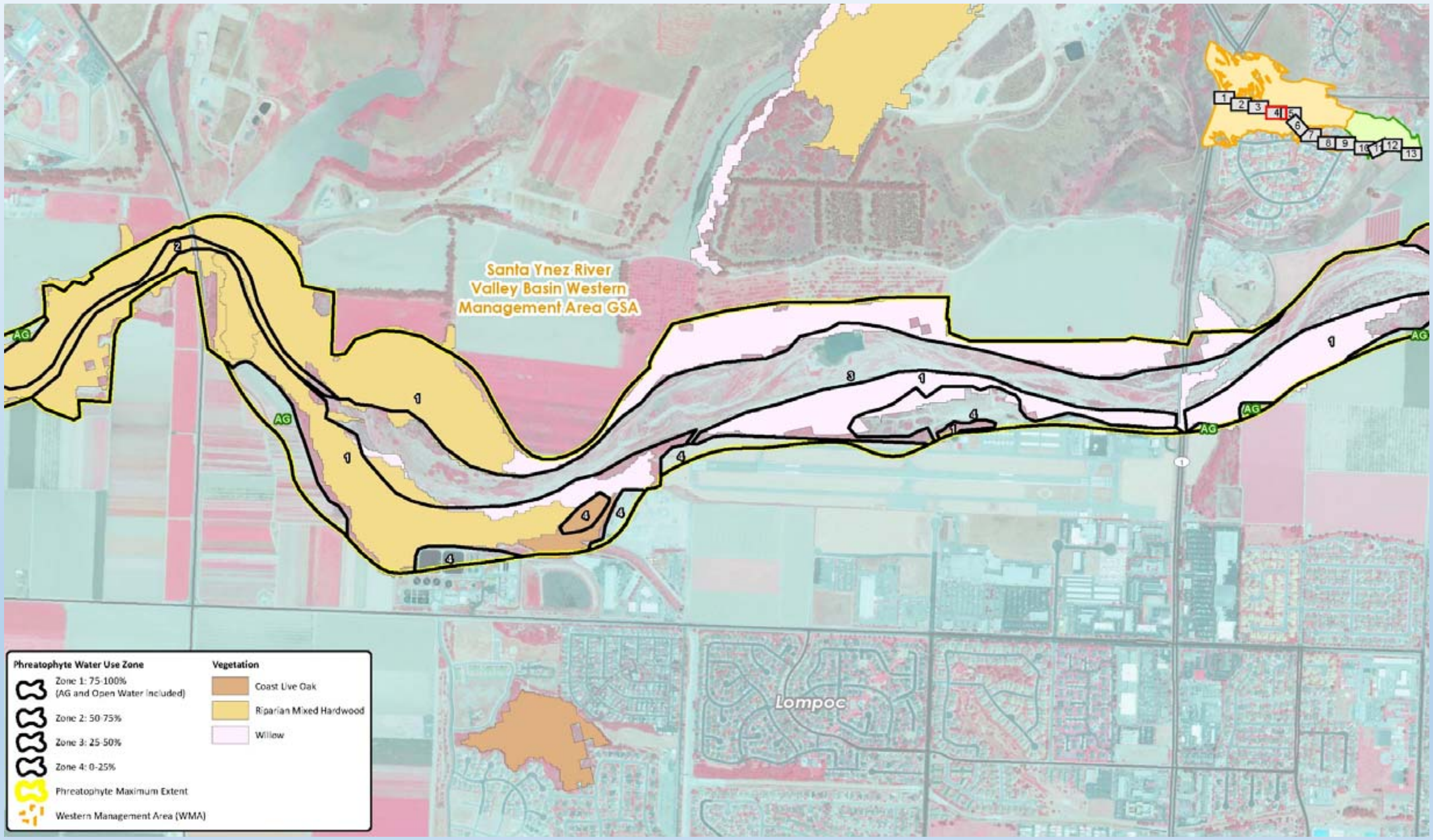
- City of Lompoc and Mission Hills Wastewater Treatment- historical inflow records available; Penitentiary estimated based on Lompoc
- Agricultural Return Flows
  - 20% Assumed for all crops except vineyards
    - 5% Assumed for vineyards
- Urban Return Flows
  - Net 44% Assumed
    - Based on 60% Outdoor/ 40% Indoor
- Agrees with available literature and used in CMA and WMA (i.e. District's Water Resources Management Plan, 1992; excerpt of return flow accounting shown in figure on right)



SYRWCD Water Resources Management Plan 1992

Phreatophytes

- Phreatophyte acres reviewed with color infra-red aerial photography
- Consumptive Use based on CIMIS station climate data (California Irrigation Management Information System)



Water Budget – Time Periods and Sources

Questions?

Surface Water Inflow

1982-2018

Surface Water Inflow Component	Average AFY
Santa Ynez River Inflow from CMA	91,320
Santa Ynez River Tributary Inflow	16,130
Lompoc Regional Wastewater Treatment Plant	3,790
Imported SWP	1,470
Santa Ynez River Alluvium Subarea	
Subflow	800
Recharge from Precipitation (Overlying and Mountain Front)	1,900
Recharge from Agricultural Return Flows to Underflow	860
Recharge from Domestic Return Flows to Underflow	20
TOTAL	**116,290**

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Surface Water Outflow

1982-2018

Surface Water Outflow Component	Average
	AFY
Santa Ynez River Outflow to Pacific Ocean	89,150
Net Channel Percolation to Groundwater	14,340
Santa Ynez River Alluvium Subarea	
Santa Ynez River Underflow Out	1,200
River well pumping – Agriculture	4,510
River well pumping – Domestic	50
Riparian Vegetation Evapotranspiration	3,170
TOTAL	**112,420**

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Ground Water Inflow

1982-2018

Groundwater Inflow Component	Average
	AFY
Subflow	1,200
Recharge from Precipitation – Overlying	7,990
Recharge from Precipitation – Mountain Front	2,730
Net Channel Percolation from Surface Water	14,300
Agricultural Return Flows	3,820
Municipal Return Flows	880
Domestic Return Flows	110
TOTAL	**31,030**

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Ground Water Outflow

1982-2018

Groundwater Outflow Component	Average
	AFY
Pumping – Agriculture	19,570
Pumping – Municipal	7,480
Pumping – Domestic	240
Riparian Vegetation Evapotranspiration	4,630
Subflow	100
TOTAL	**32,020**

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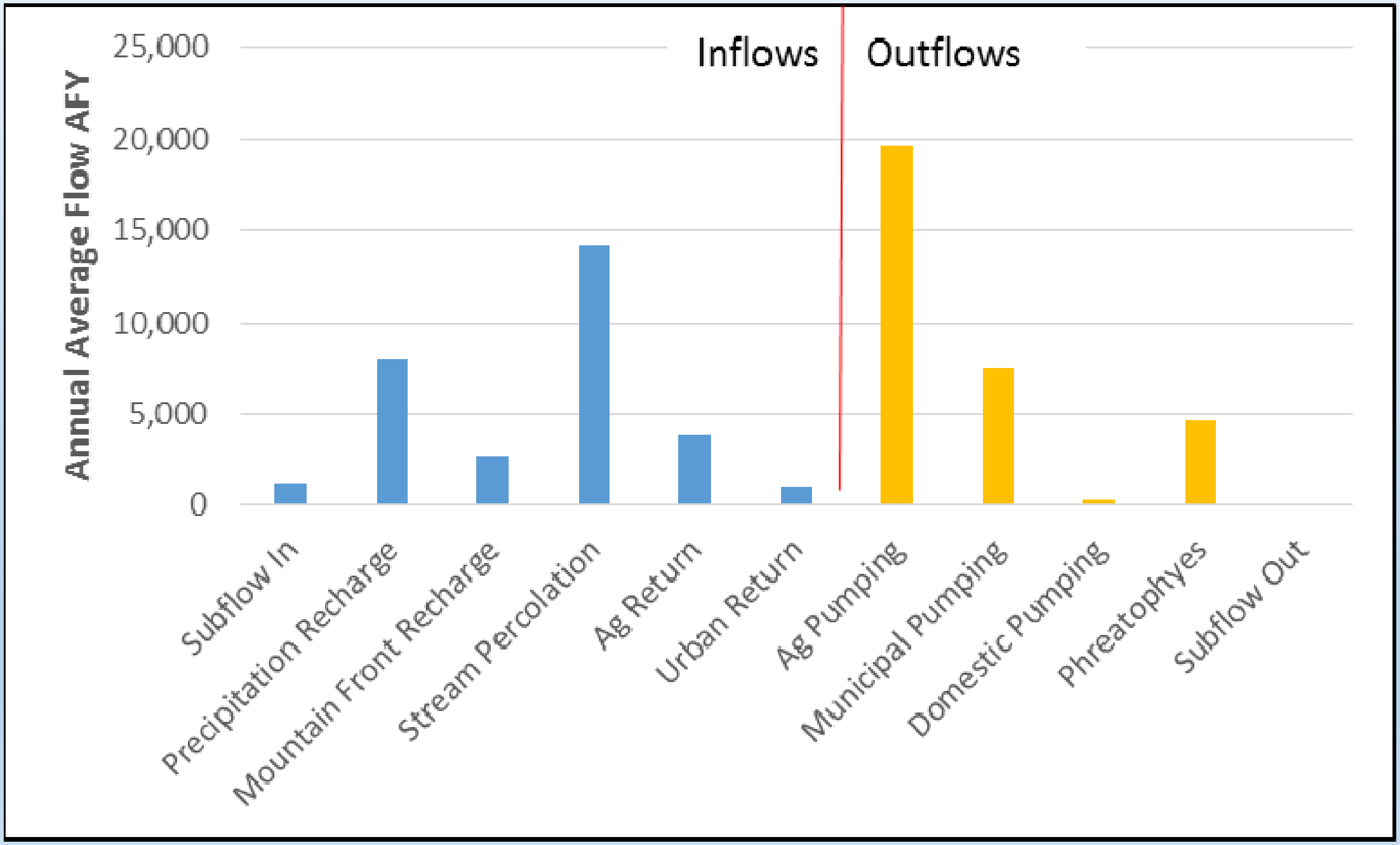
Key Groundwater Fluxes - Average 1982-2018



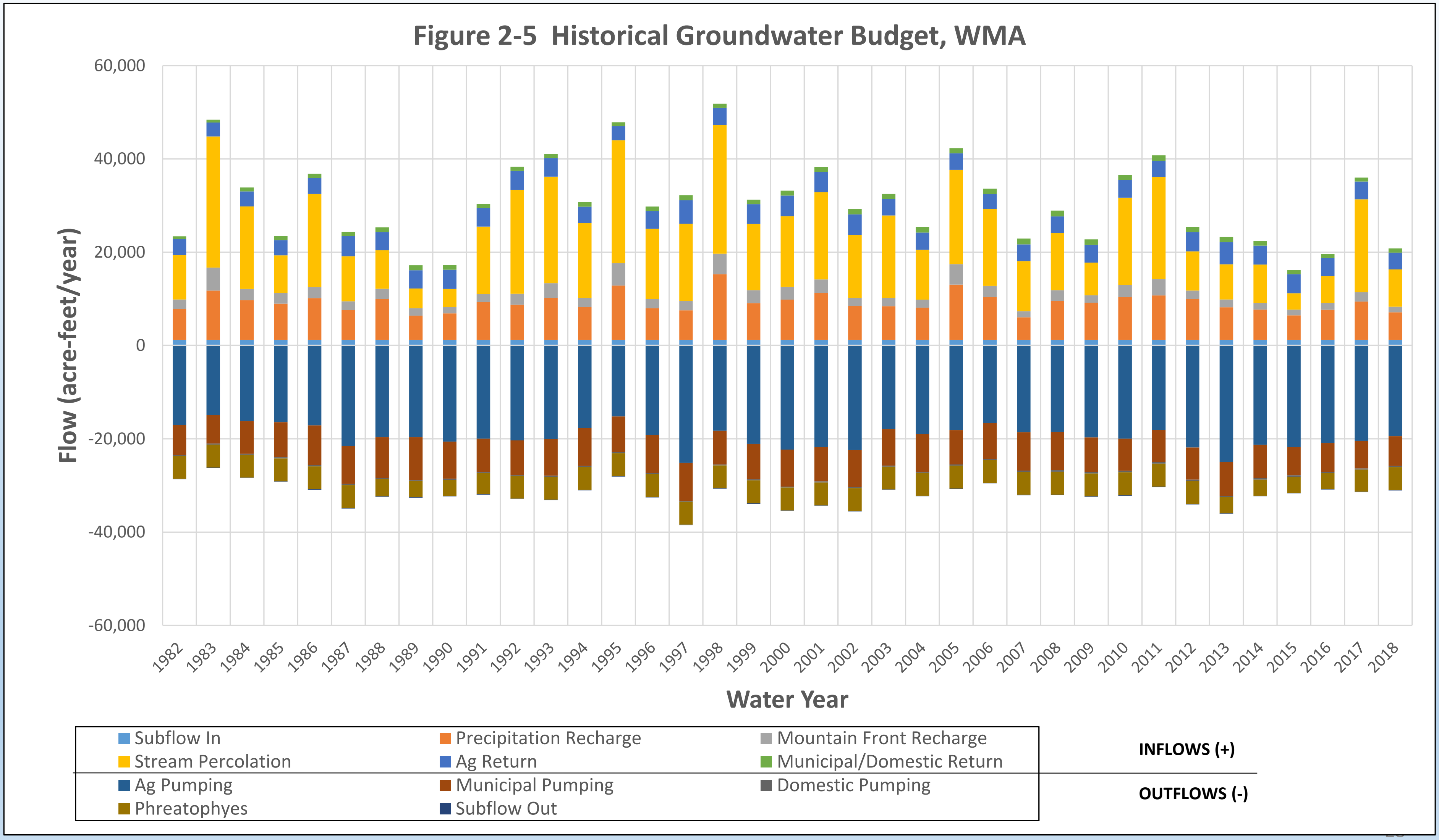


Figure 2-5 Historical Groundwater Budget, WMA
Flow (acre-feet/year)
60,000
40,000
20,000
0
-20,000
-40,000
-60,000
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
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2007
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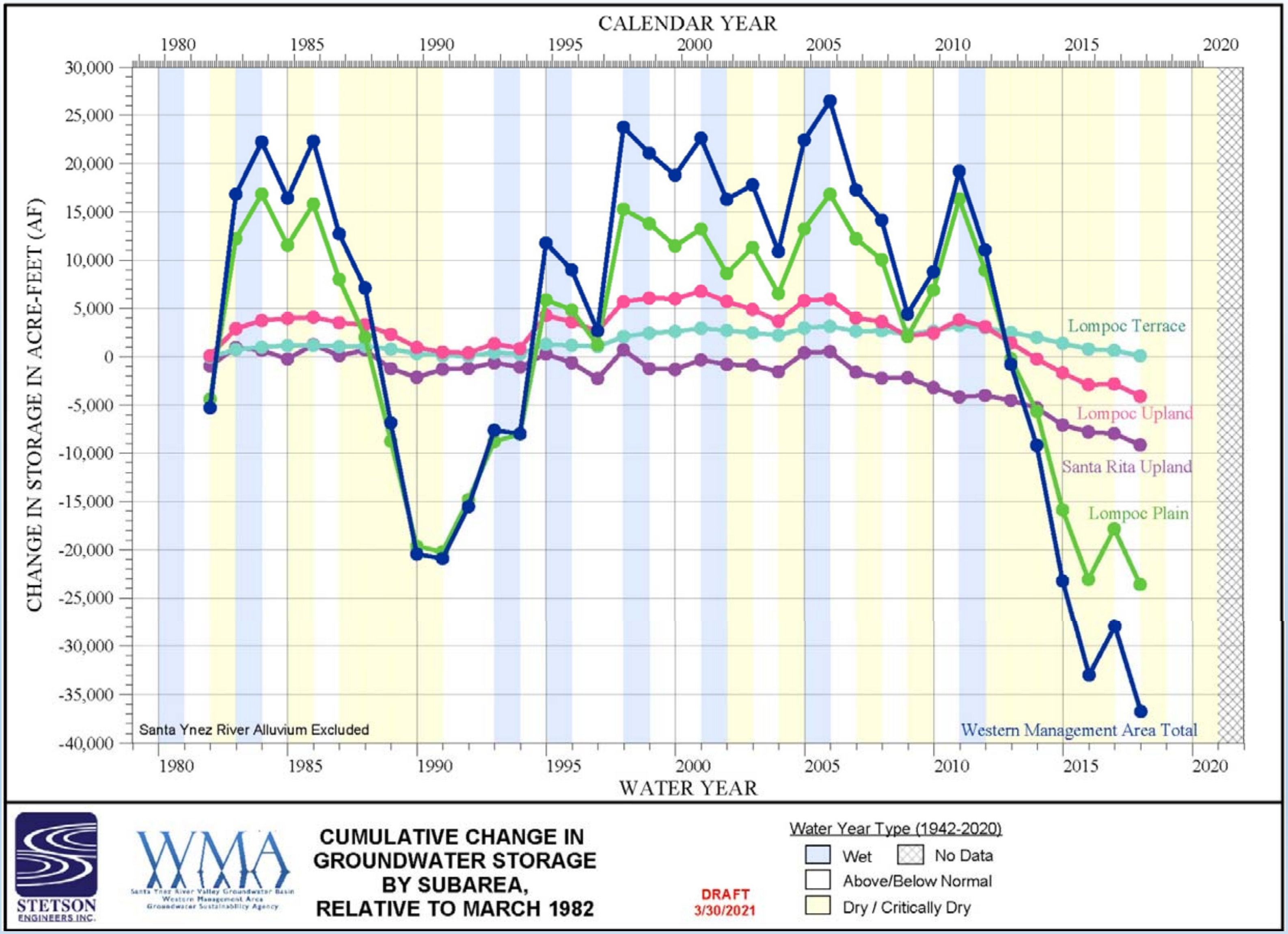
2010
2011
2012
2013
2014
2015
2016
2017
2018
Water Year
Subflow In
Precipitation Recharge
Mountain Front Recharge
Stream Percolation
Ag Return
Municipal/Domestic Return
Ag Pumping
Municipal Pumping
Domestic Pumping
Phreatophyes
Subflow Out
INFLOWS (+)
OUTFLOWS (-)


CALENDAR YEAR
WATER YEAR
CHANGE IN STORAGE IN ACRE-FEET (AF)
Santa Ynez River Alluvium Excluded
Lompoc Terrace
Lompoc Upland
Santa Rita Upland
Lompoc Plain
Western Management Area Total
STETSON ENGINEERS INC.
WMA
CUMULATIVE CHANGE IN GROUNDWATER STORAGE BY SUBAREA, RELATIVE TO MARCH 1982
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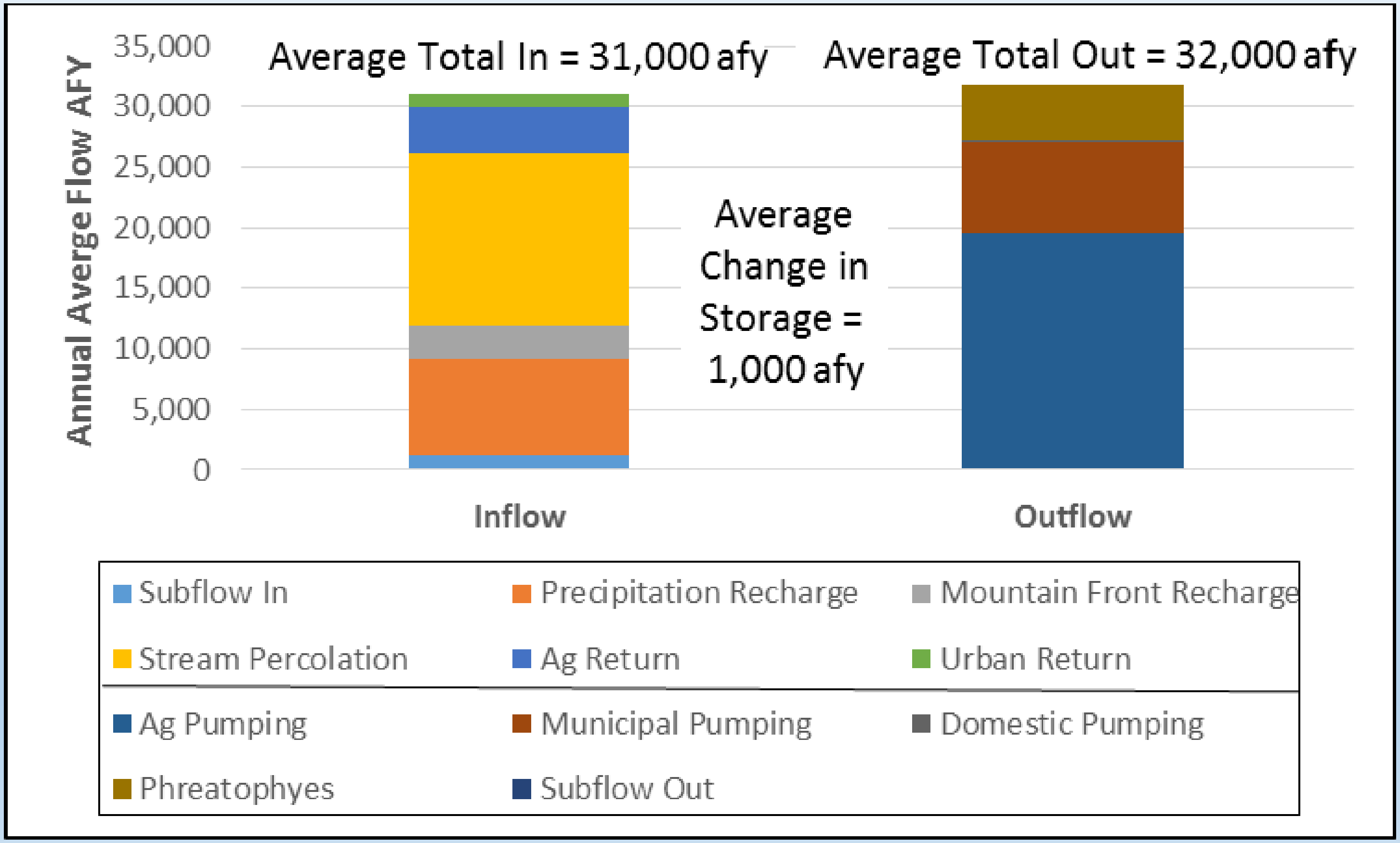
3/30/2021
Water Year Type (1942-2020)
Wet
No Data
Above/Below Normal
Dry / Critically Dry

Inflows versus Outflows 1982-2018



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Perennial Yield Estimates from Water Budget Analysis in Average Hydrologic Conditions

	Average 1982-2018			Average 2002-2011		
Groundwater Subarea	Annual Pumping (AFY)	Annual Change in Storage (AFY)	Pumping + Change in Storage (AFY)	Annual Pumping	Annual Change in Storage (AFY)	Pumping + Change in Storage (AFY)
Lompoc Plain	22,800	-600	22,200	21,700	300	22,000
Lompoc Upland	3,100	-100	3,000	3,400	-300	3,100
Santa Rita Upland	1,400	-300	1,100	1,700	-400	1,300
Lompoc Terrace	0	0	0	0	0	0
TOTAL WMA:	**27,300**	**-1,000**	**26,300**	**26,800**	**-400**	**26,400**

Lompoc City Hall Precipitation- Average 1955–2020 is 14.6 inches per year. Average 1982-2018 is 14.7 inches per year. Average 2002-2011 is 14.5 inches per year.

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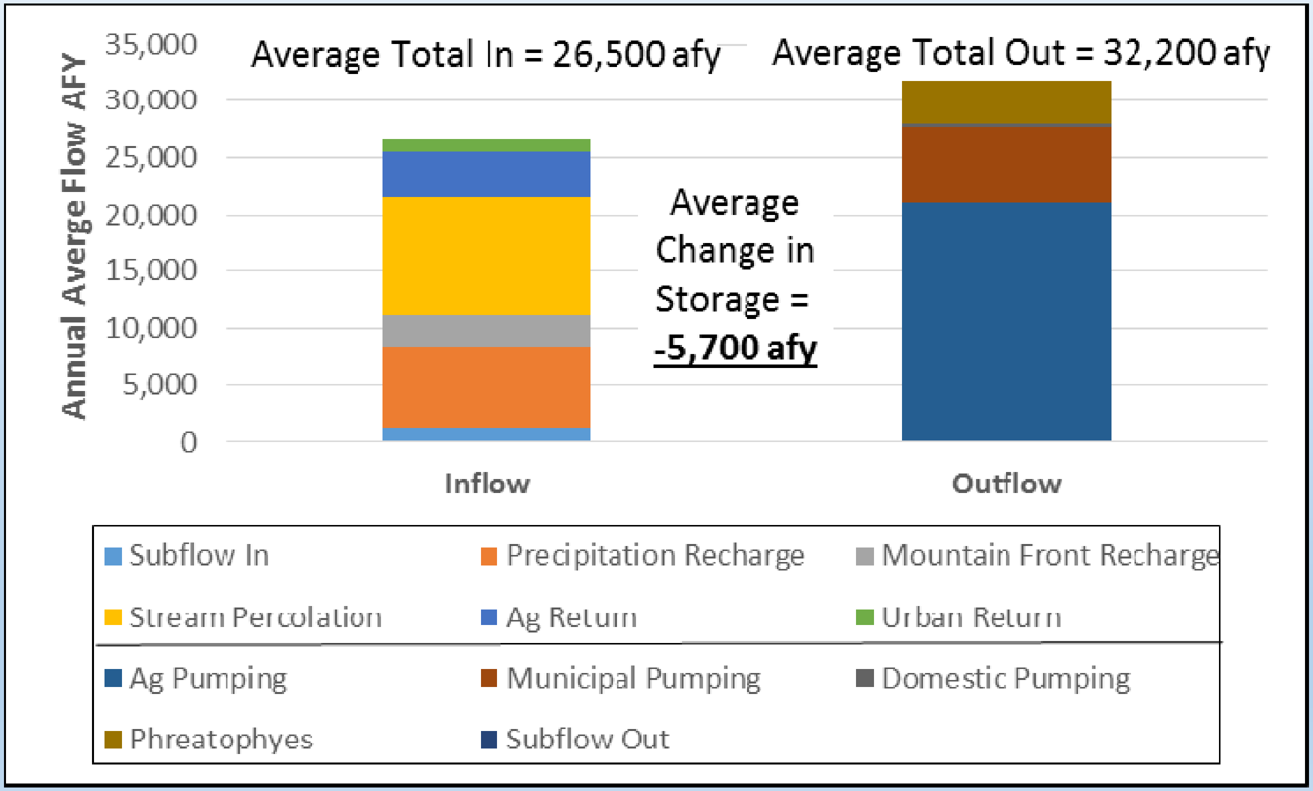
Inflows versus Outflows 2011 - 2018



Total groundwater storage decreased by 45,600 AF over eight year current period (average -5,700 AFY). This negative storage change is due to critical drought conditions.

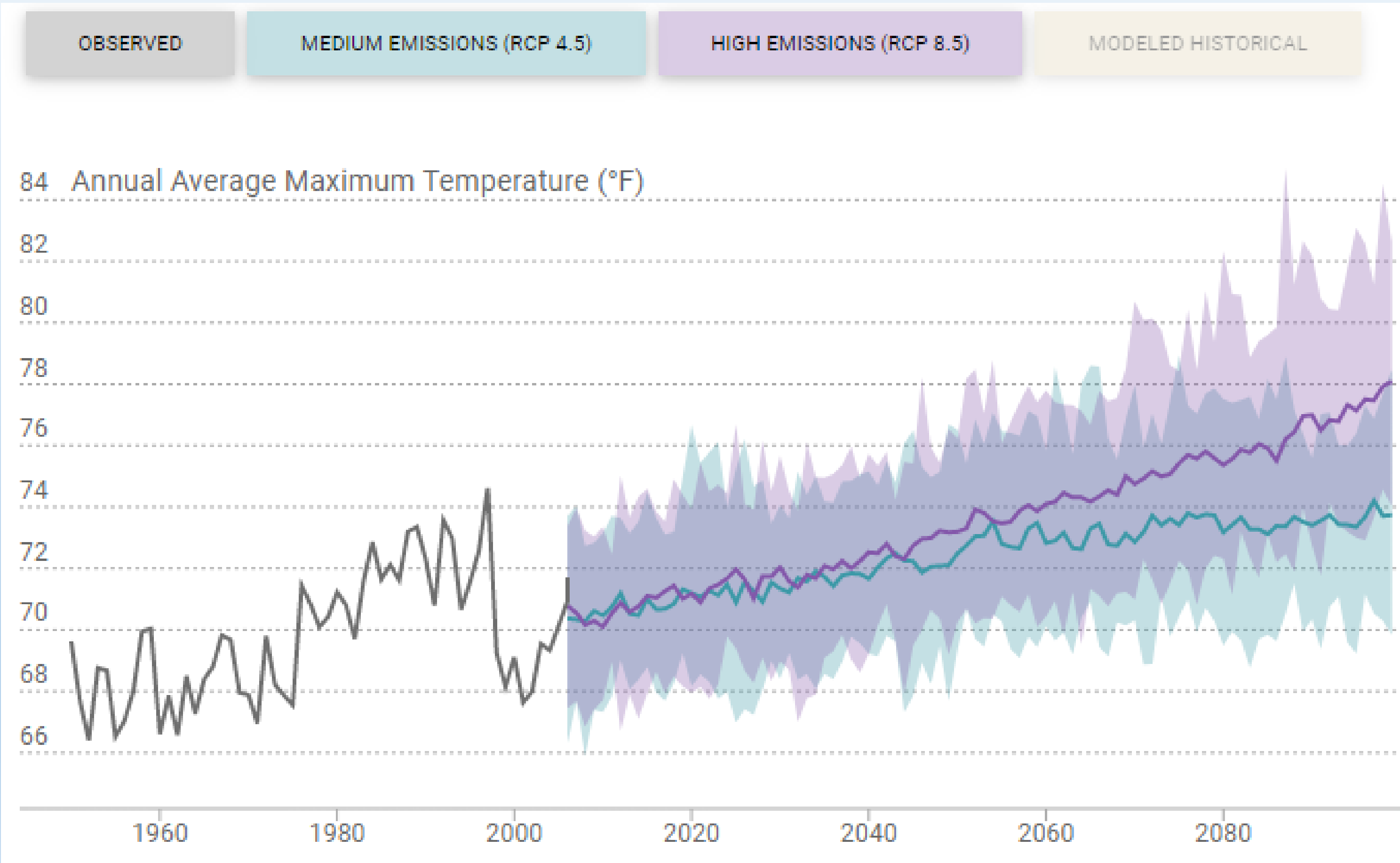
Water Budget – Historical and Current

Questions?

Climate Change and the Santa Ynez River Valley Groundwater Basin 2018 - 2072

- DWR's Climate Change Technical Advisory Group has identified the most applicable and appropriate global circulation model (GCMs) out over 30 models for water resource planning and analysis in California.
- GSP must include the "Central Tendency" Scenario for future hydrologic projections.
  - Reflects the mean of the 20 climate projections.
    - 10 selected GCMs are combined with two emission scenarios for a total of twenty scenarios utilized. The two emissions scenarios include a "middle" scenario (RCP 4.5) with emissions peaking around 2040 and a "business as usual" scenario with emission peaking around 2080 (RCP 8.5).
- Drier/Extreme Warming (2070DEW) and Wetter/Moderate Warming (2070WMW) conditions in GSPs is optional.

Future Projected Hydrology 2018-2072



Lompoc CA; https://cal-adapt.org/tools/local-climate-change-snapshot/

DWR has provided summaries of climate change.

The 2030 and 2070 precipitation and ET climate change factors are available on 6-kilometer resolution grids.

Implications for WMA Hydrology

- Crop Water Use - Greater ET due to higher temperatures. By 2040, 3.2 percent increase relative to the baseline period. By 2070 conditions, 7.9 percent relative to the baseline period.
- Precipitation –
  - Seasonal timing changes
    - Sharp decreases are projected early fall and late spring
    - Increases in winter and early summer precipitation.
  - The WMA is projected to experience minimal changes in total annual precipitation.
    - 2030 – no change; 2070 conditions, 3 percent decrease in annual precipitation
- Streamflow - projected to increase slightly by 0.5 percent in 2030 and 3.8 percent in 2070
- Recharge- Assume same changes as precipitation

Assumptions for Future Demand

- Agriculture
  - No change in acres/ crop types assumed.
  - Consumptive use increases 3.2 percent relative to the baseline period due to higher ET rates under climate change. By 2070 conditions, 7.9 percent relative to the baseline period.
- Urban
  - Santa Barbara County Association of Governments' Regional Growth Forecasts estimate increases in population for the Lompoc area: 10% by Year 2040
  - This analysis assumes 10% by 2042 and 15% by 2072 for the City of Lompoc. For the remaining municipal and rural domestic demands, more modest growth is assumed at 5% by 2042 and 10% by 2072.

PROJECTED WATER DEMAND FOR WMA

	2018 Demand	Estimated 2042 Demand	Estimated 2072 Demand
	(Acre-Feet per Year)		
Groundwater Demand			
Pumping – Agriculture	19,500	20,125	21,040
Pumping – Municipal	6,350	6,890	7,205
Pumping – Domestic	250	265	275
TOTAL Groundwater Demand	26,100	27,280	28,520
Surface Water Demand			
Santa Ynez River Alluvium Upstream of Narrows - Agriculture	6,500	6,710	7,015
Santa Ynez River Alluvium Upstream of Narrows - Domestic	60	65	65
VAFB SWP Imports	2,300	2,415	2,530
TOTAL Surface Water Demand	8,860	9,190	9,610
TOTAL	34,960	36,470	38,130

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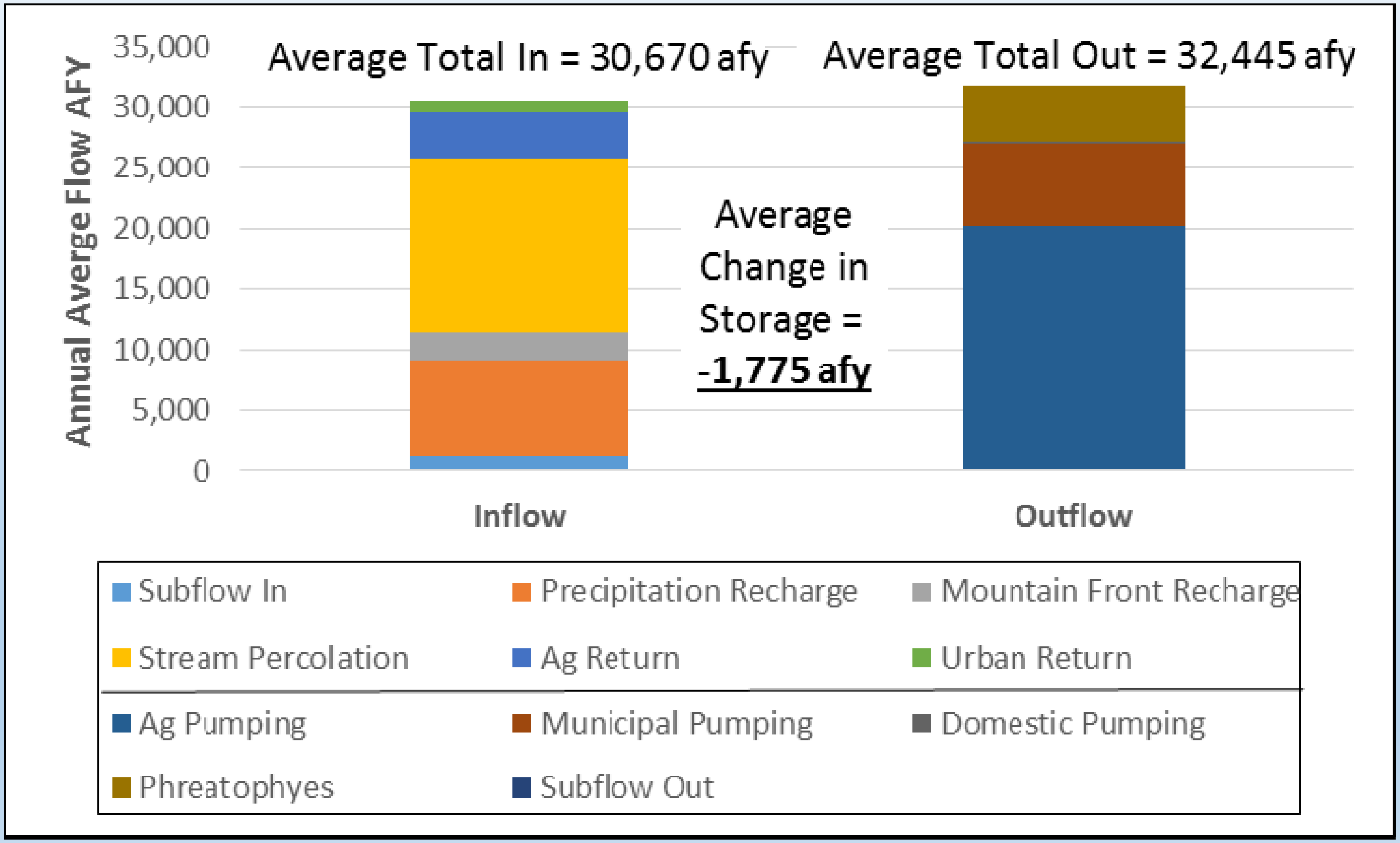
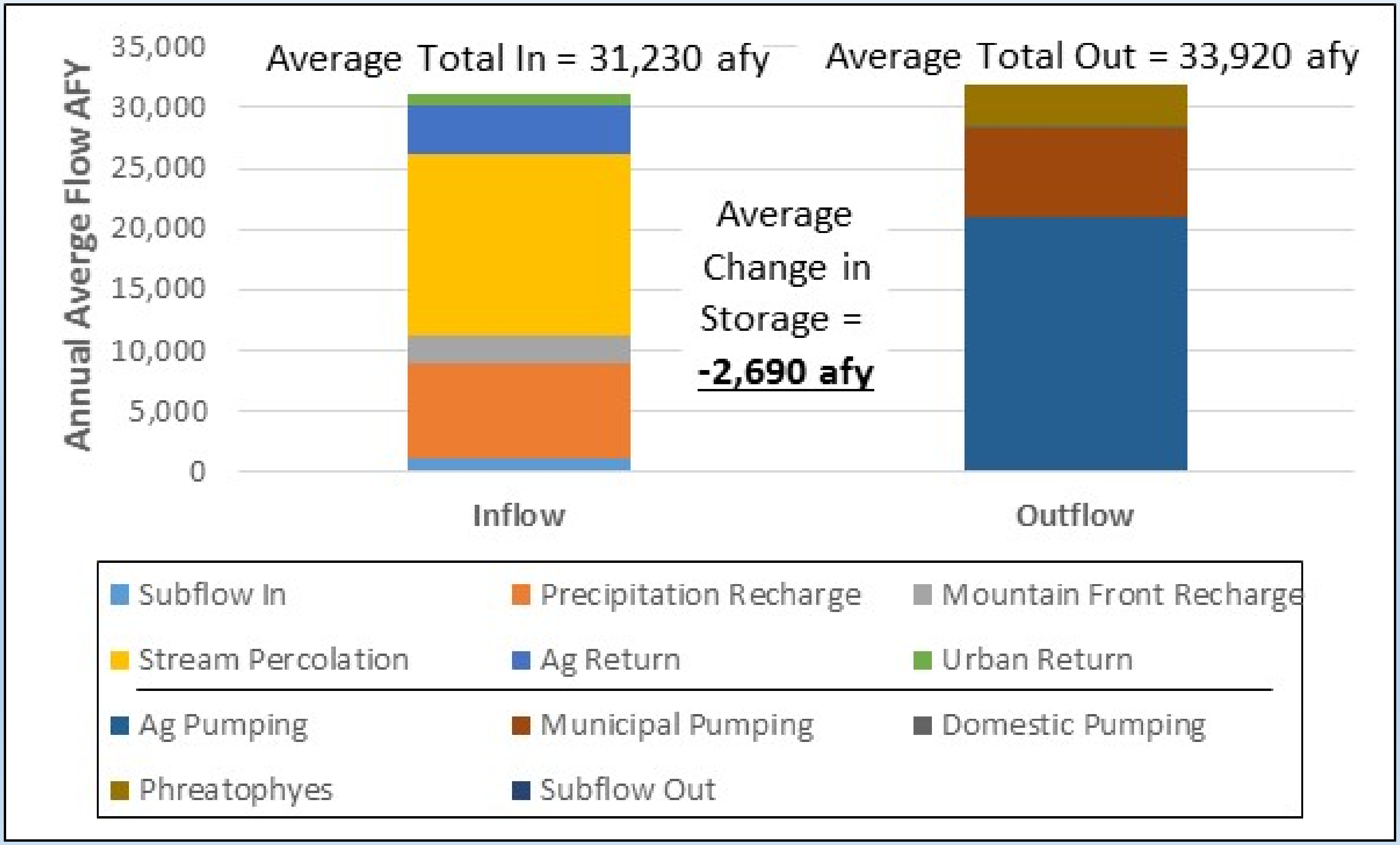
Inflows versus Outflows 2042



Inflows versus Outflows 2072



D R A F T

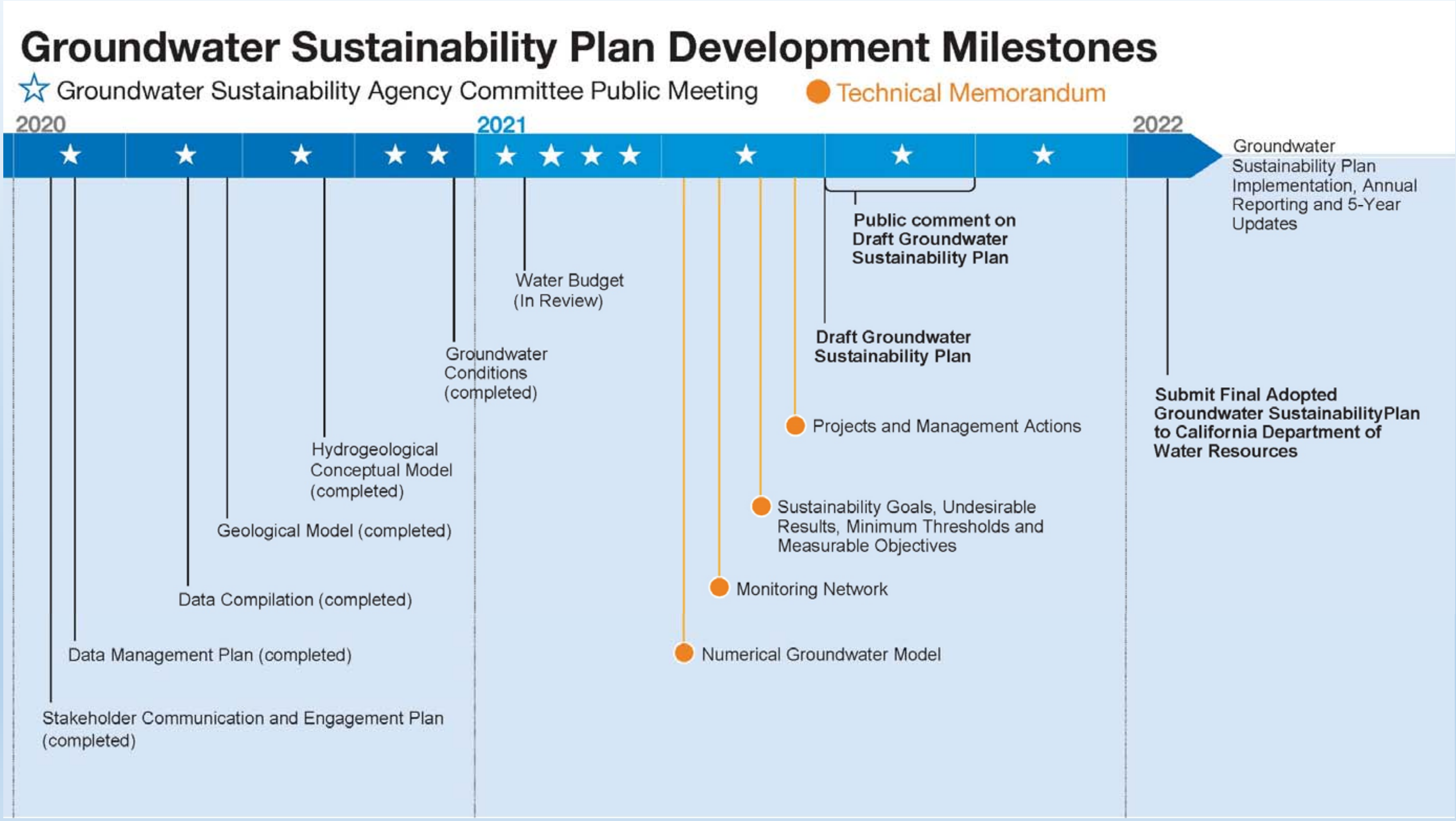
Water Budget – Future

Questions?

The Way Ahead

- ~~Complete the Groundwater Conditions Tech Memo~~
- ~~Complete the Water Budget~~
- Complete the Groundwater Model
- Establish Monitoring Network
- Establish Sustainable Management Criteria Thresholds
- Identify Projects and Management Actions
- Release DRAFT GSP

The Way Ahead



Questions?

Comments can be submitted to the website:

www.santaynezwater.org