Sierra Valley Groundwater Management District

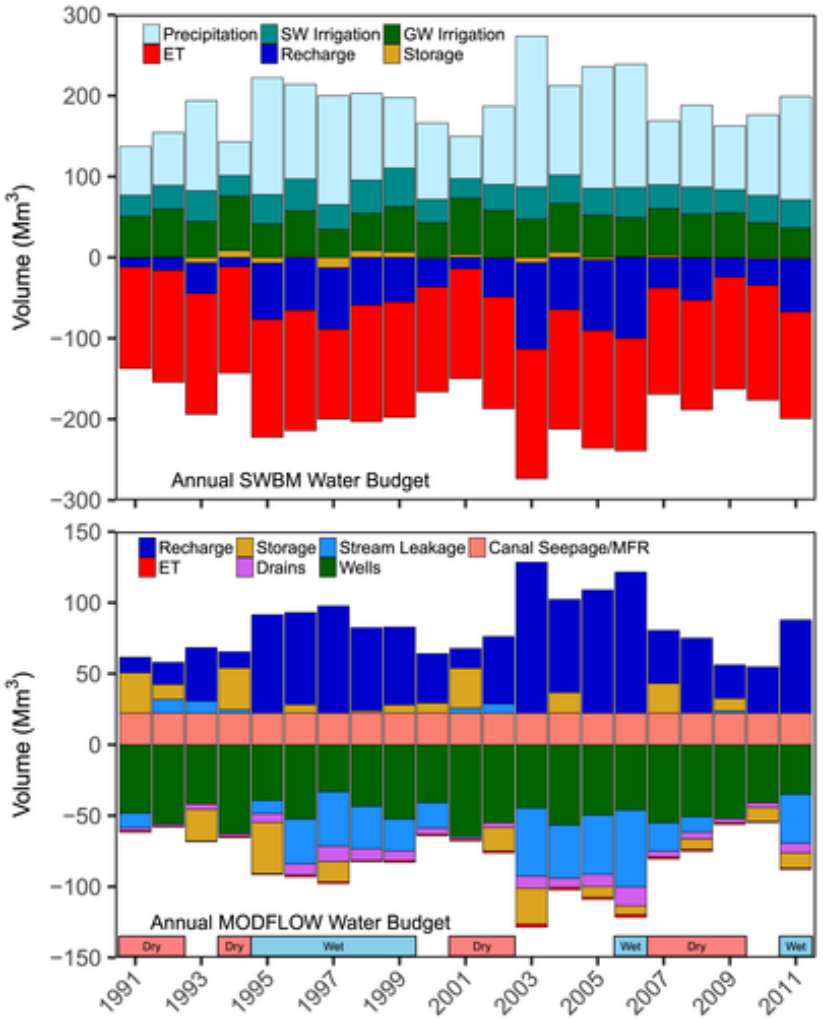
TAC Meeting

January 11, 2021

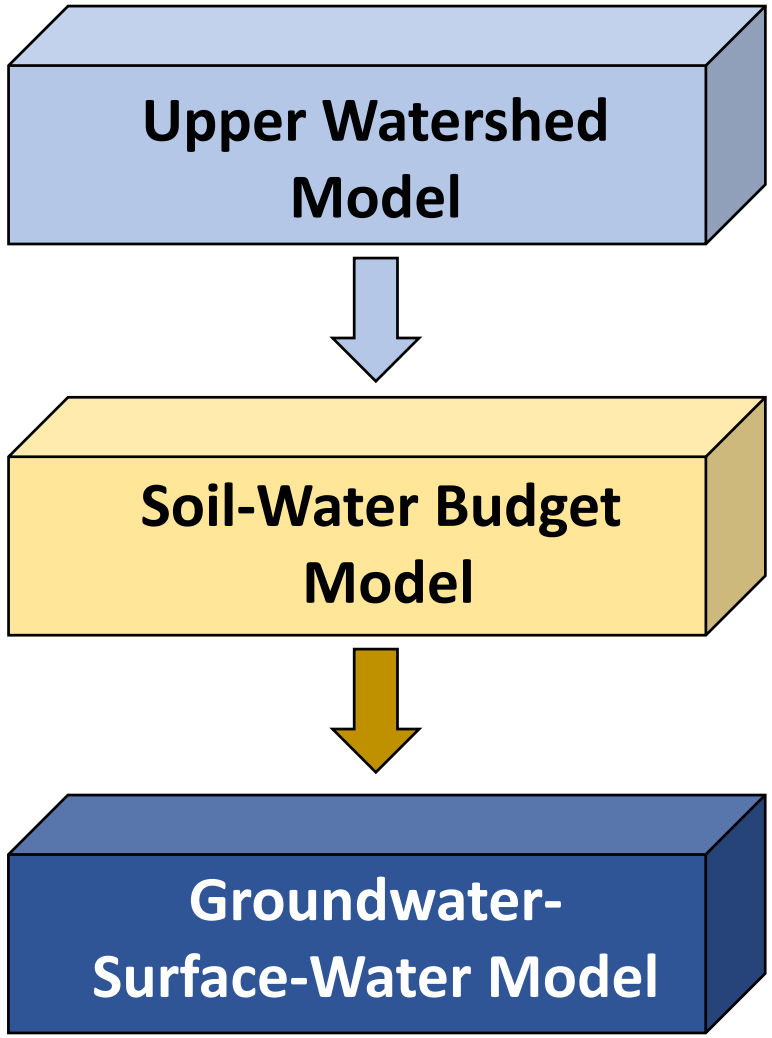
Why do we need a model?

- Models produce defensible water budgets (required under §354.18)
- Models can estimate future water budgets (required under §354.18)
- Models allow for exploration of alternative management scenarios
- Models can help build consensus around management decisions

Example Scott Valley Annual Water Budget



The Sierra Valley Integrated Hydrologic Model is the combination of three different models.



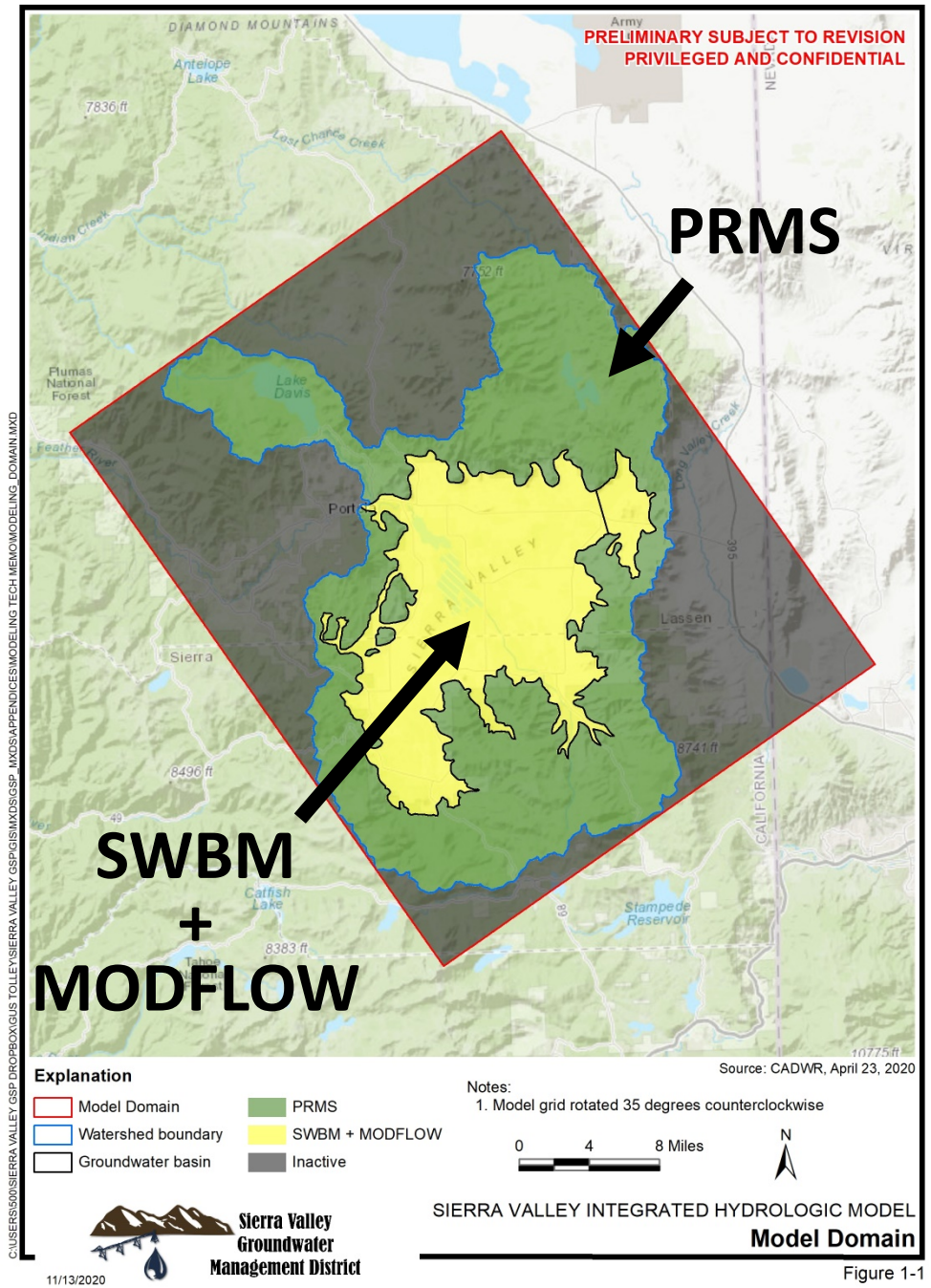
Streamflow entering Sierra Valley (PRMS)

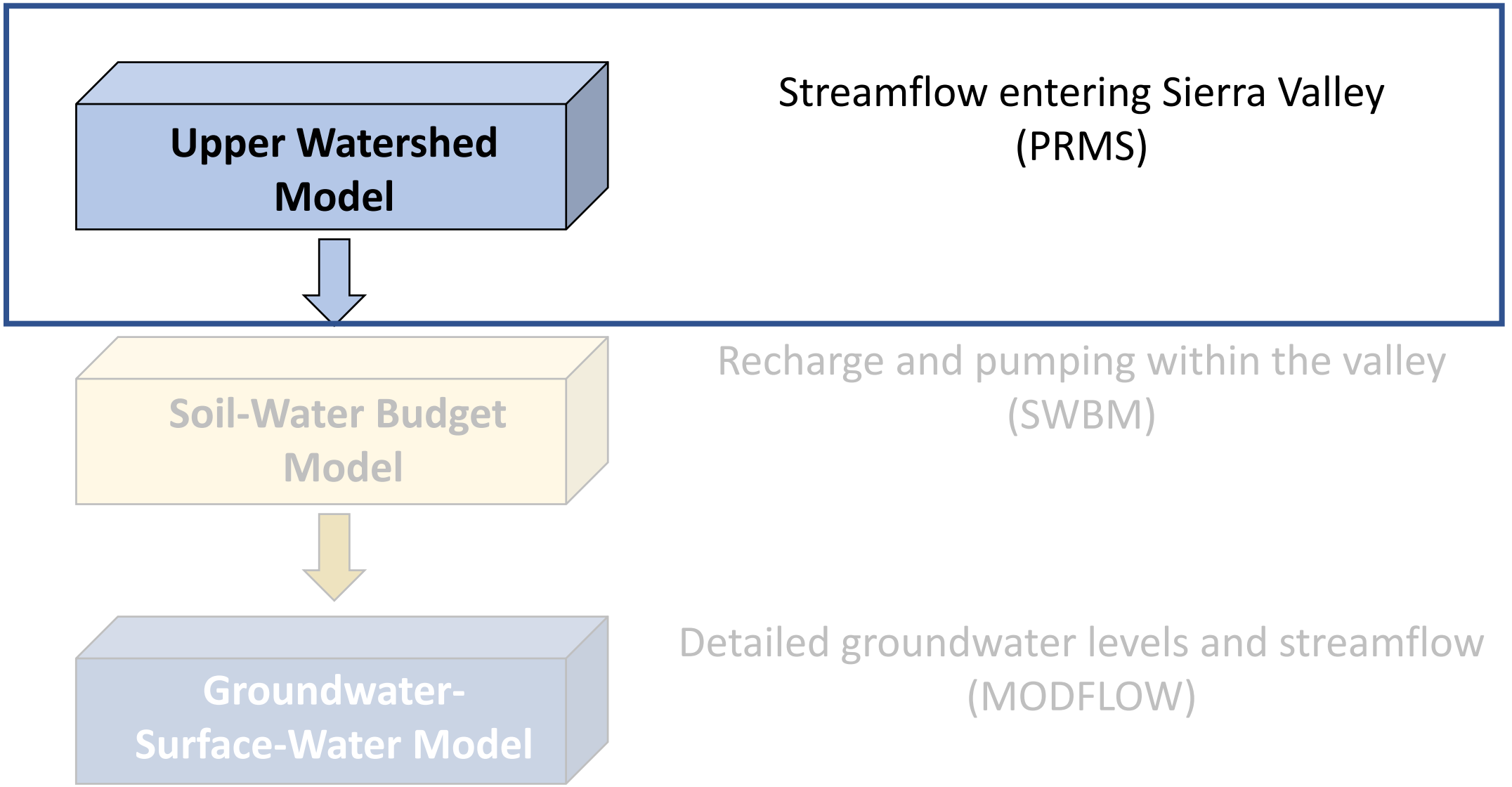
Recharge and pumping within the valley (SWBM)

Detailed groundwater levels and streamflow (MODFLOW)

Model Domain

- Same model grid for PRMS, SWBM, and MODFLOW.
- Currently 100m (may change depending on model runtimes)
- Rotated 35 degrees counter clockwise to accommodate Grizzly Valley Fault System




Upper Watershed Model
Streamflow entering Sierra Valley (PRMS)
Soil-Water Budget Model
Recharge and pumping within the valley (SWBM)
Groundwater-Surface-Water Model
Detailed groundwater levels and streamflow (MODFLOW)

Precipitation-Runoff Modeling System (PRMS)

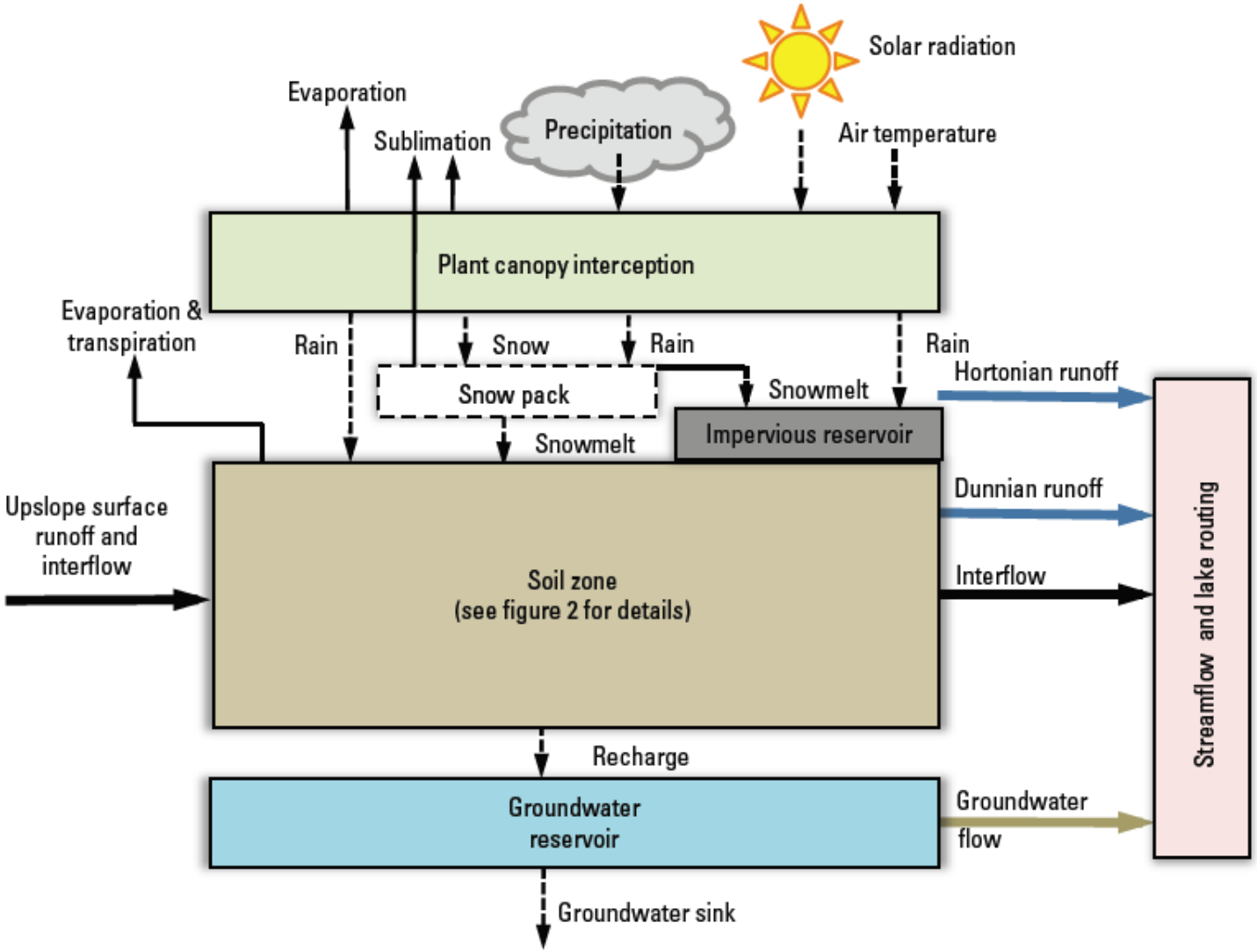


Figure 1. Hydrological processes simulated by the Precipitation-Runoff Modeling System (modified from Markstrom and others, 2008).

- PRMS simulates various components of the water budget.
- Two components/outputs are of primary interest
  - Runoff entering GWB
  - Mountain Front Recharge entering GWB

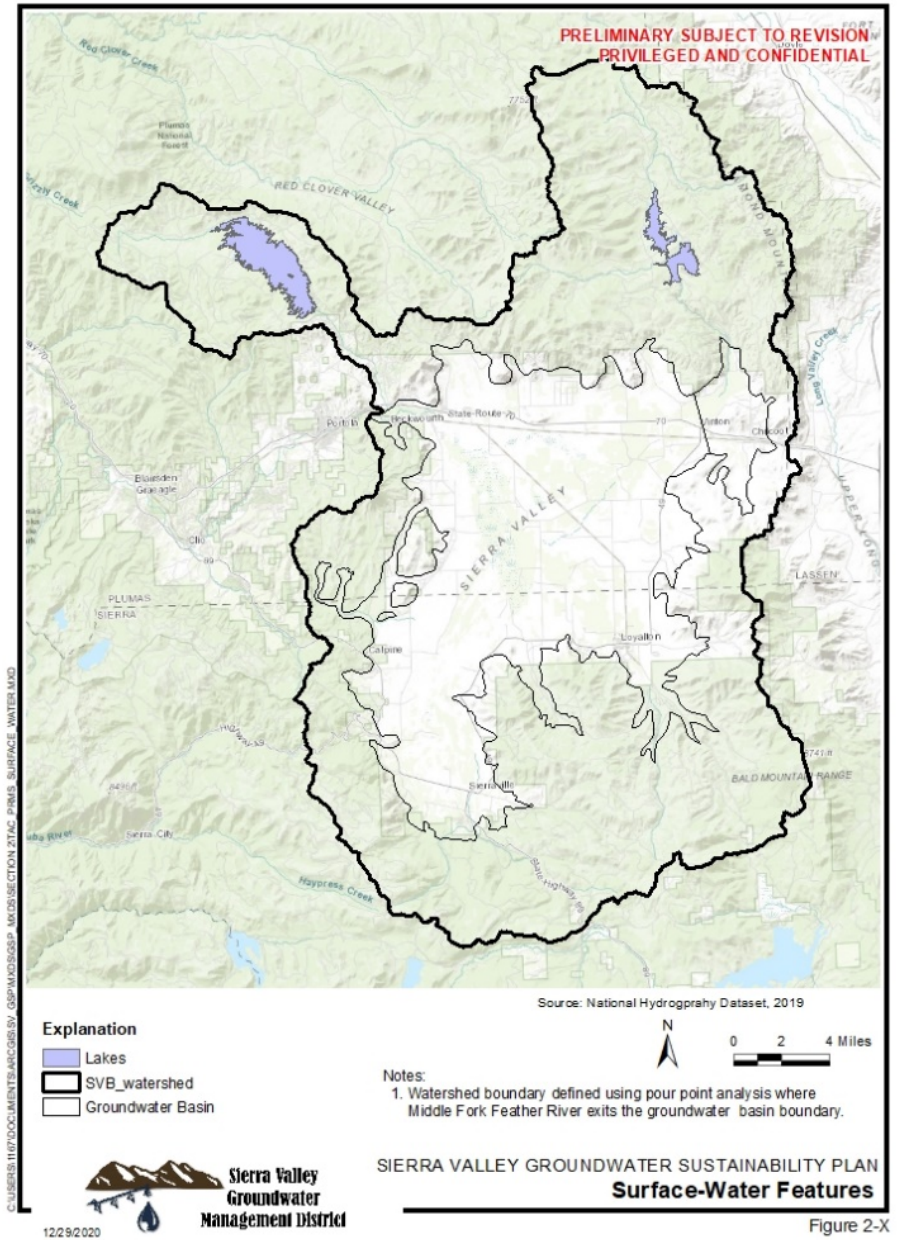
GWB: Groundwater Basin

Geospatial data for PRMS

- Elevation - 10m National Elevation Dataset
- Study area boundary - Geospatial Data Gateway
- Soil - STATSGO or SSURGO dataset from USDA
- Impervious Cover - National Land Cover Database (USGS)
- Climate - Western Regional Climate Center, CA-DWR, PRISM (OSU)
- Vegetation - LANDFIRE dataset
- Hydrography - National Hydrography Dataset

These geospatial data are transformed directly into model parameters.

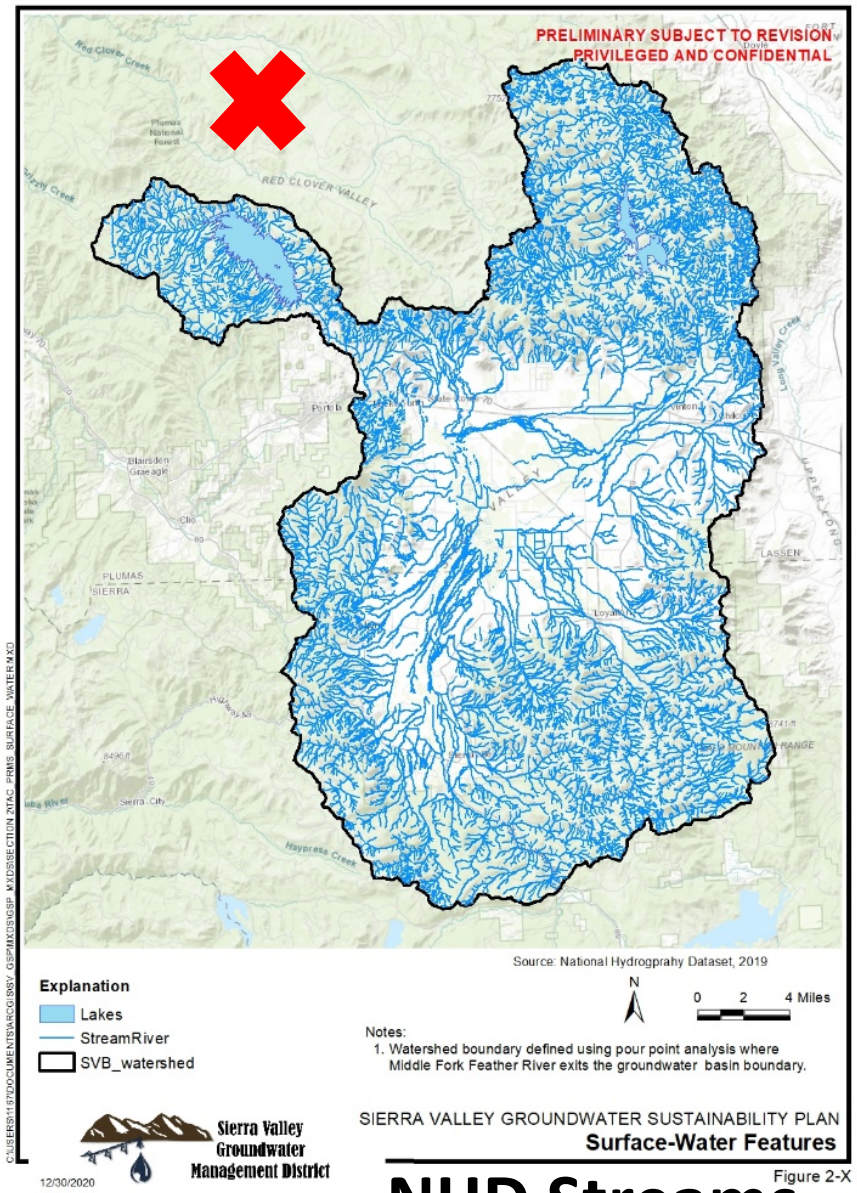
Surface Water Features - Lakes represented in PRMS



Frenchman Lake and Lake Davis are represented in the PRMS model.

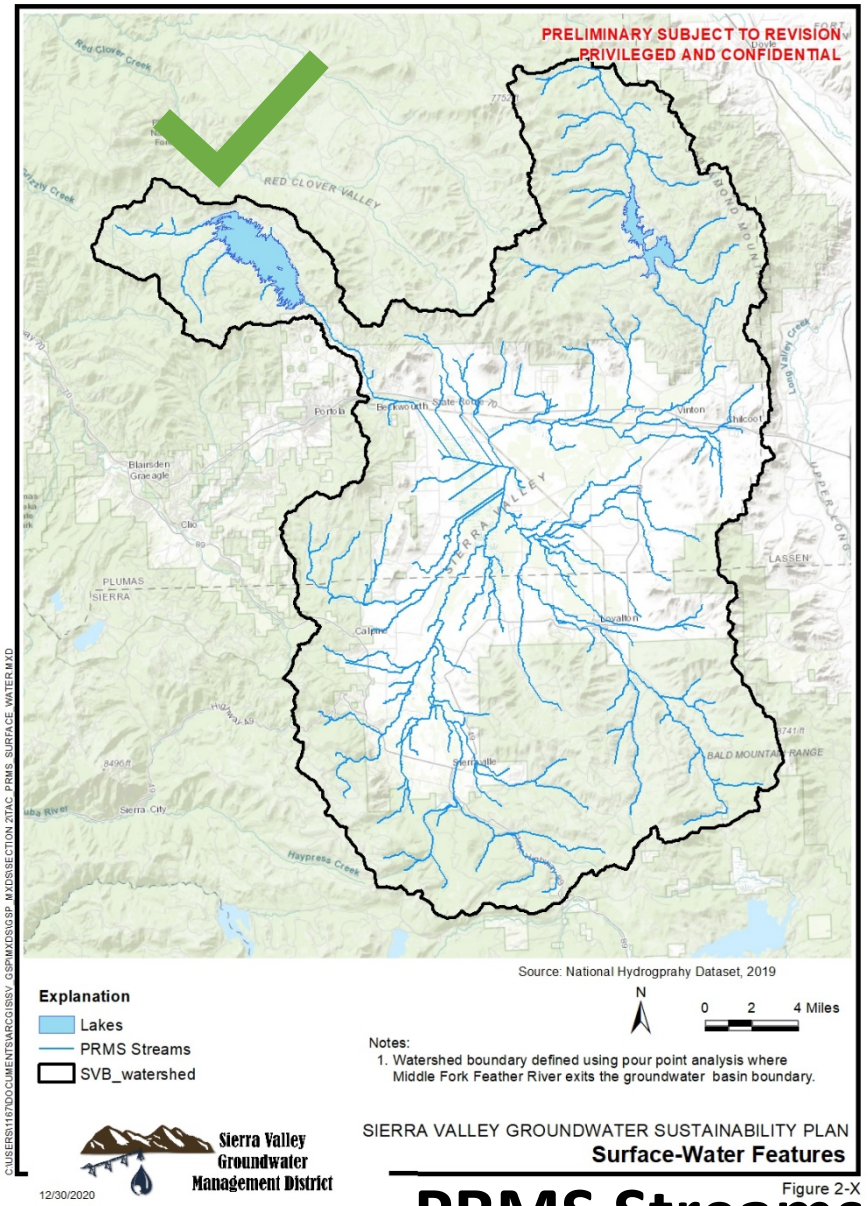
Are there any other reservoirs that hold significant amounts of water in the upper watershed?

Surface Water Features - Streams represented in PRMS

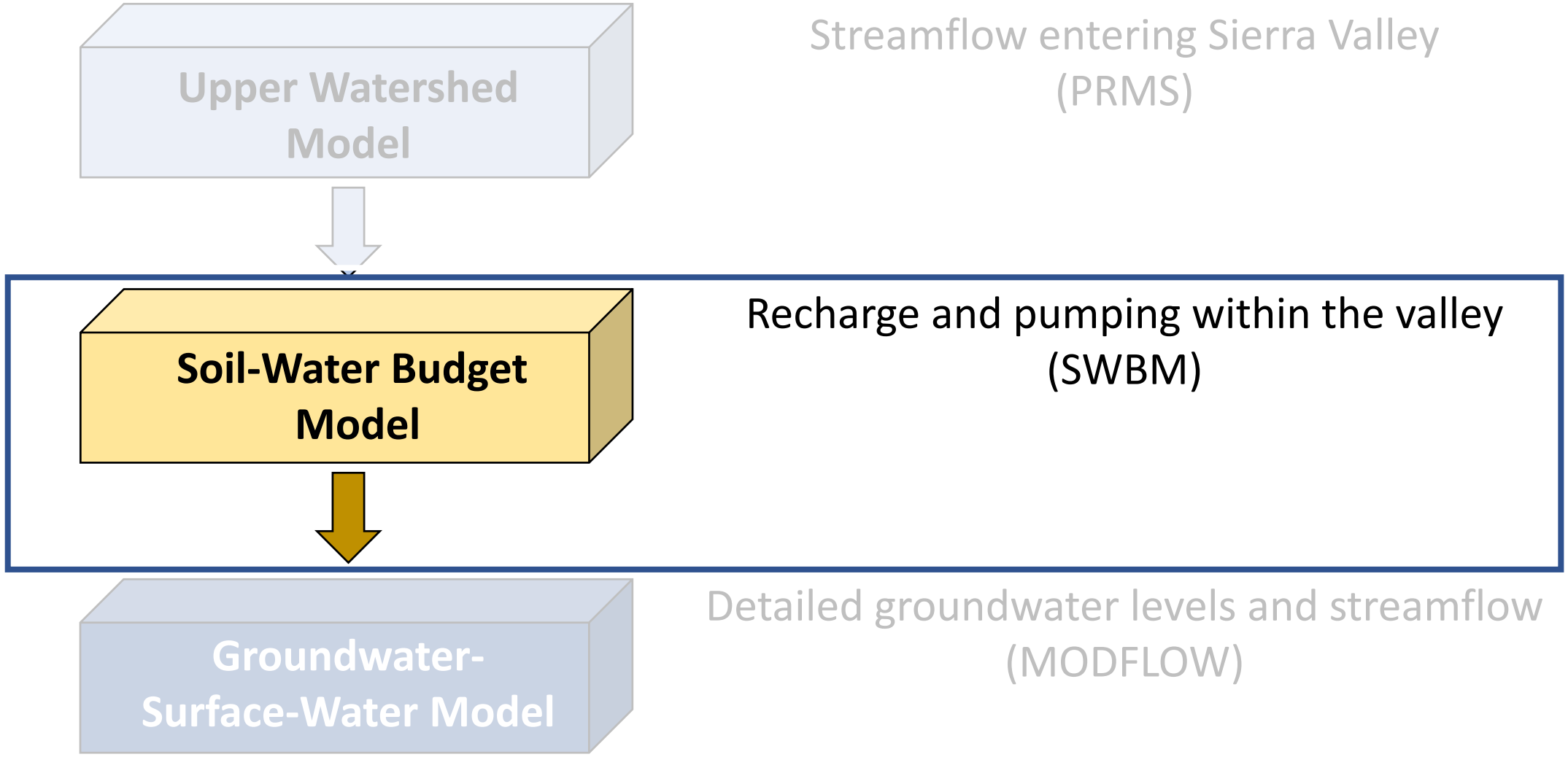


NHD Streams

Are all the perennial streams represented in PRMS?



PRMS Streams


Upper Watershed Model
Streamflow entering Sierra Valley (PRMS)
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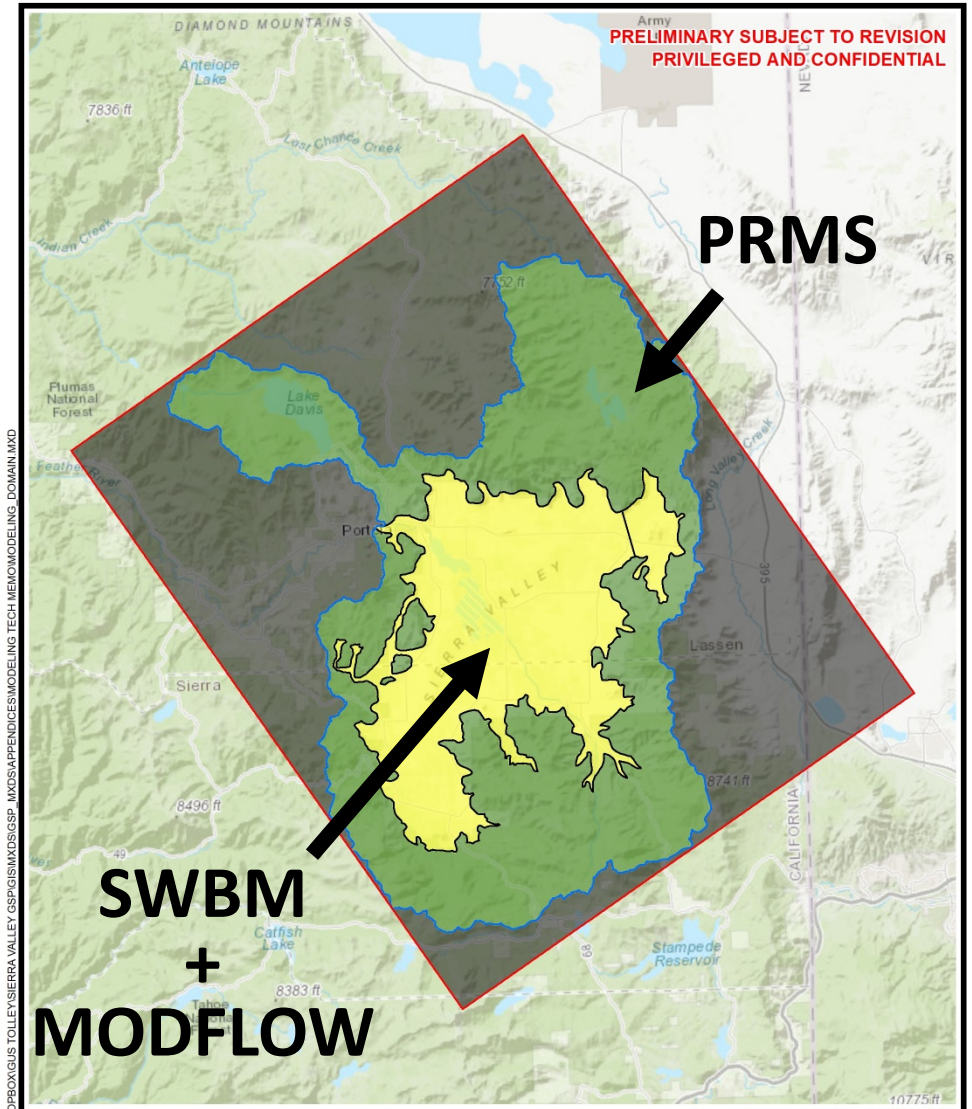
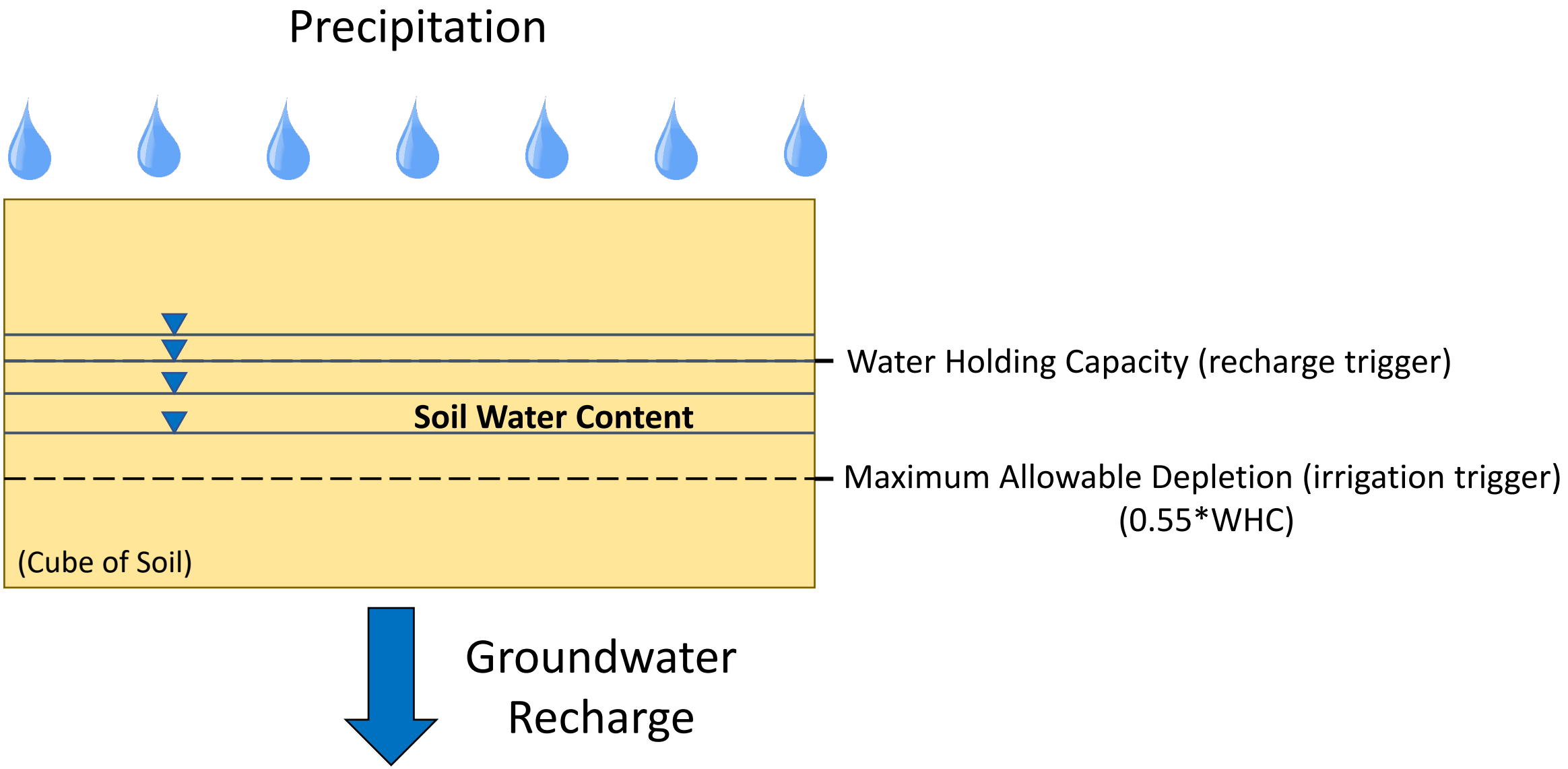
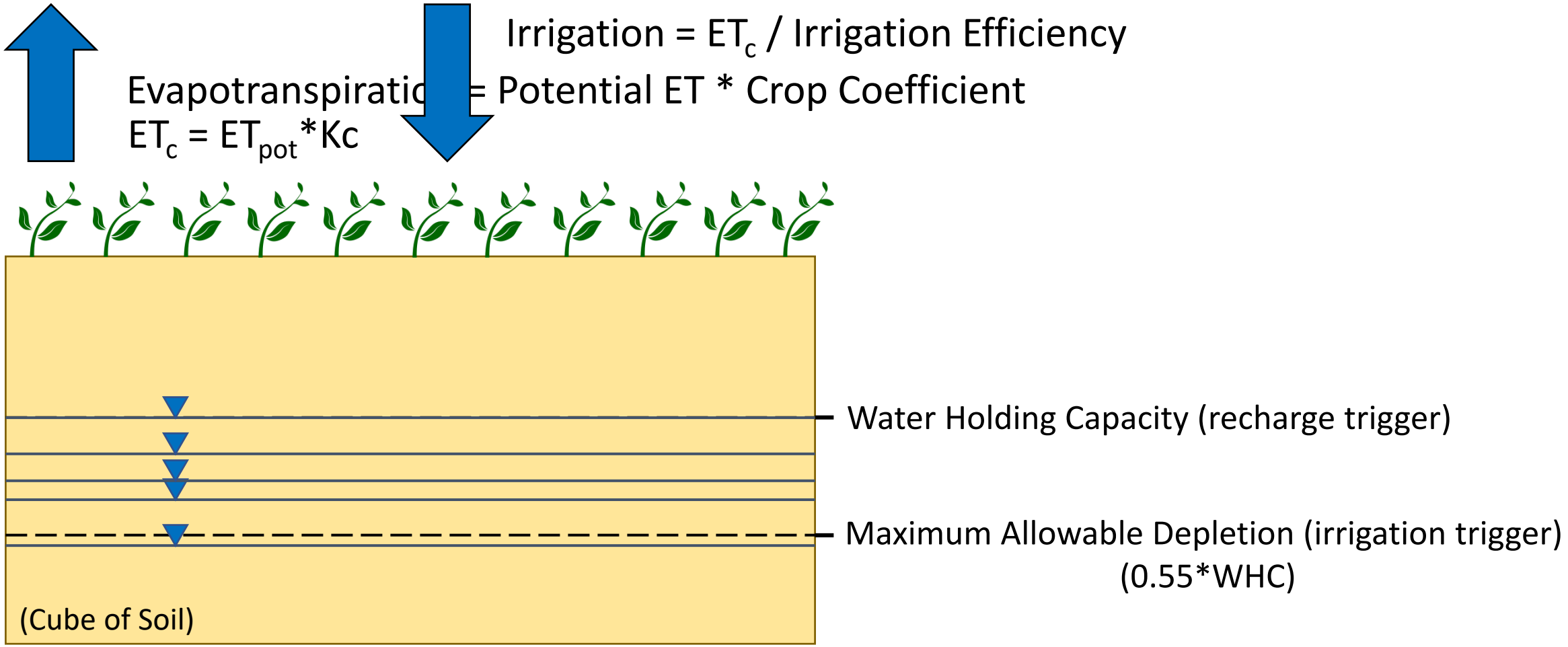

PRELIMINARY SUBJECT TO REVISION
PRIVILEGED AND CONFIDENTIAL
PRMS
SWBM
+
MODFLOW
DIAMOND MOUNTAINS
Antelope Lake
7836 ft
Lost Chance Creek
Indian Creek
7752 ft
Plumas National Forest
Lake Davis
Feather River
Long Valley Creek
Port
SIERRA VALLEY
Lassen
Sierra
8496 ft
8741 ft
CALIFORNIA
Catfish Lake
Stampede Reservoir
8383 ft
Tahoe
10775 ft
Source: CADWR, April 23, 2020
Explanation
Model Domain
Watershed boundary
Groundwater basin
PRMS
SWBM + MODFLOW
Inactive
Notes:
1. Model grid rotated 35 degrees counterclockwise
0
4
8 Miles
N
Sierra Valley Groundwater Management District
11/13/2020
SIERRA VALLEY INTEGRATED HYDROLOGIC MODEL
Model Domain
Figure 1-1
C:\USERS\500\SIERRA VALLEY GSP DROPBOX\GIUS TOLLEY\SIERRA VALLEY GSP\GIS\MXDS\GSP_MXDS\APPENDICES\MODELING TECH MEMO\MODELING_DOMAIN.MXD

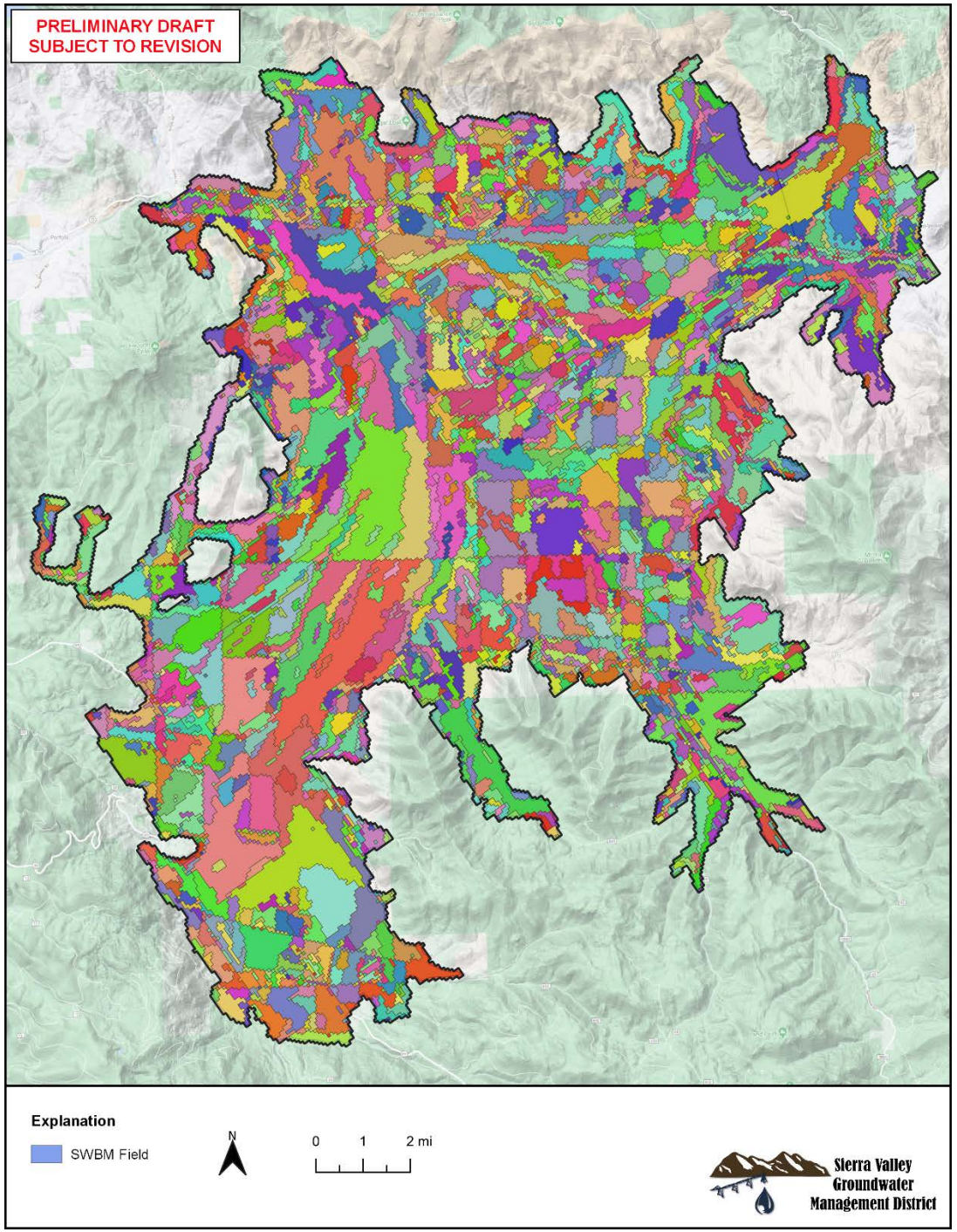
Soil-Water Budget Model - Example



Soil-Water Budget Model - Example



Calculated each day for each individual field



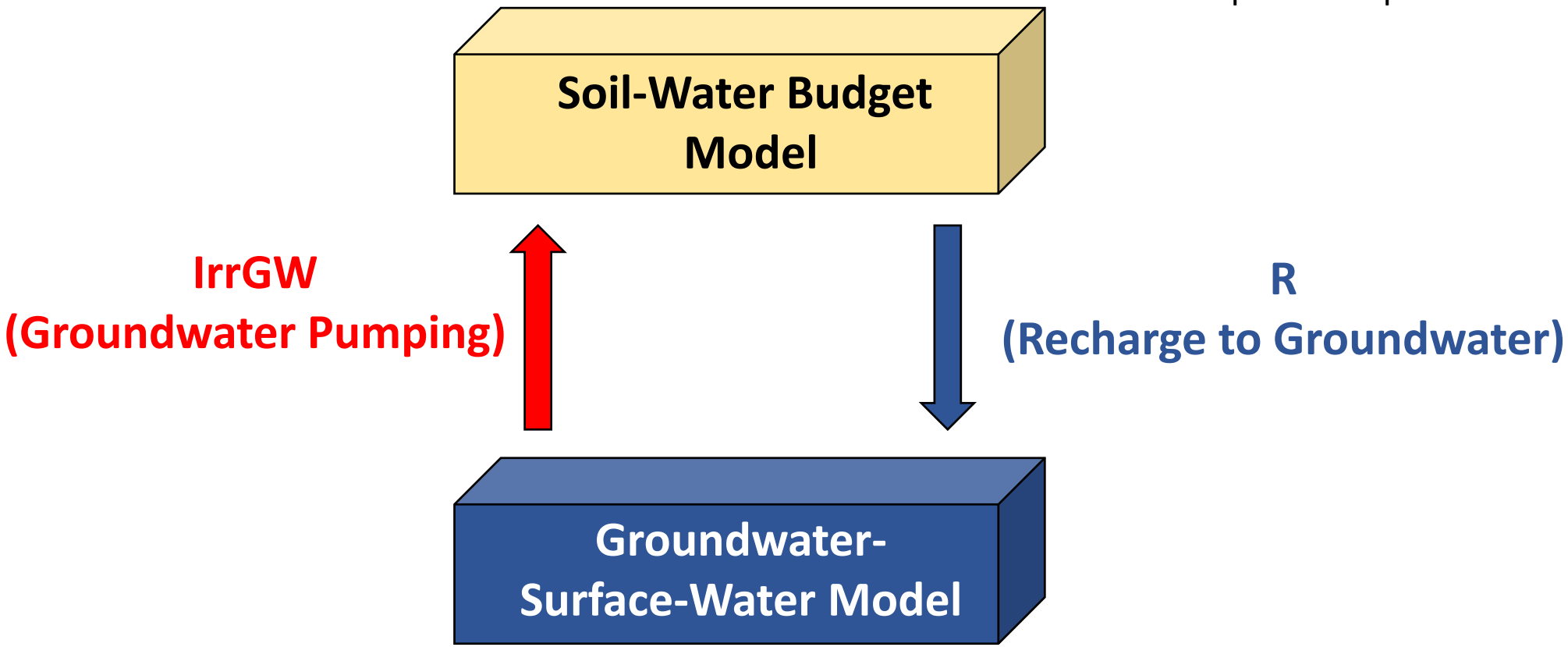
For each field we specify some combination of:

- Land use (water demand)
- Soil type (water holding capacity)
- Irrigation type/efficiency (applied water)
- Water source
- Irrigation trigger
- GW irrigation well
- SW irrigation stream
- Crop rotation
- Rooting depth
- Typical growing season dates
- Typical irrigation season dates

Key Soil-Water Budget Model Outputs

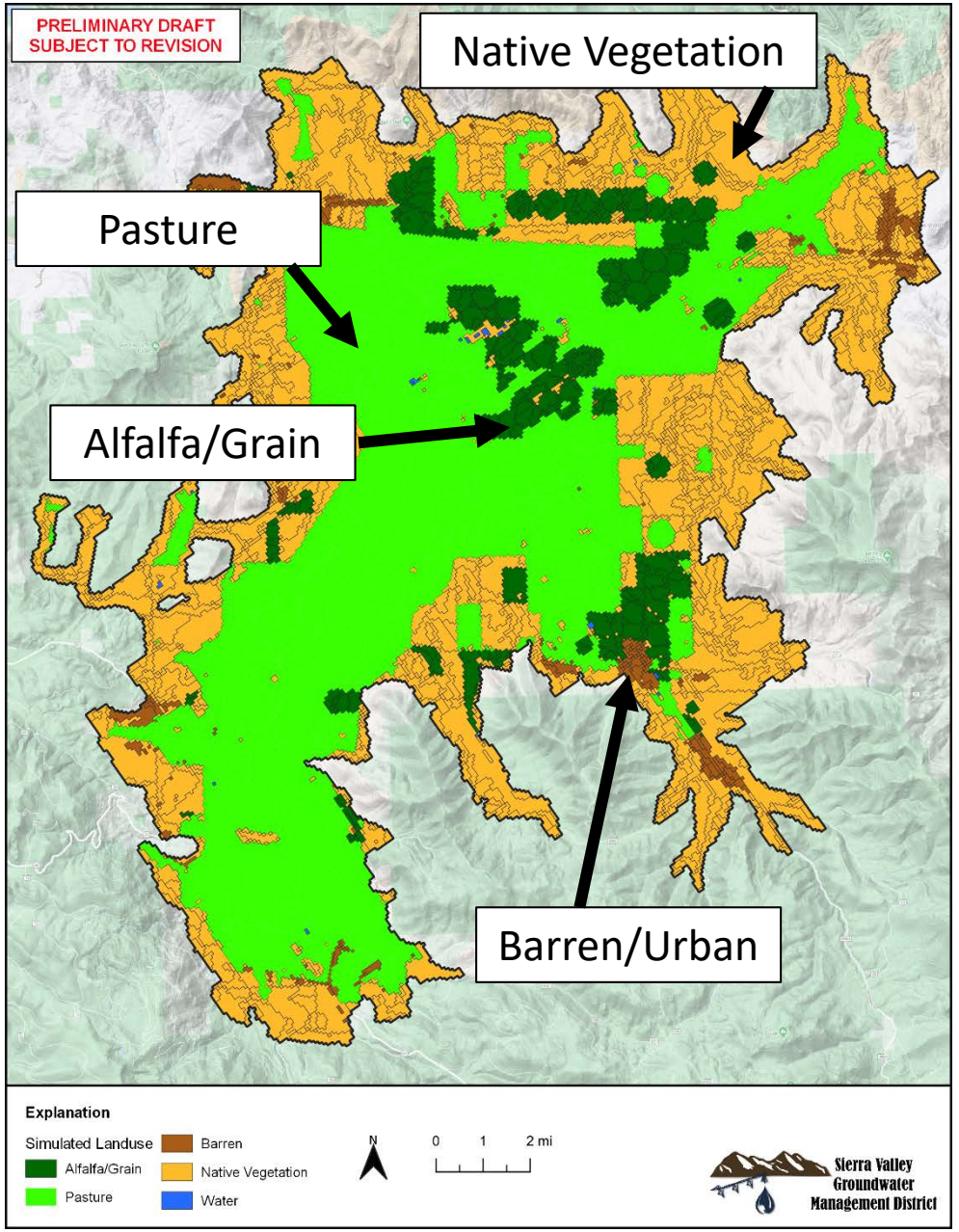
$$P + Irr_{GW} + Irr_{SW} - ET - R = \Delta S$$

Inputs - Outputs = Change in Storage



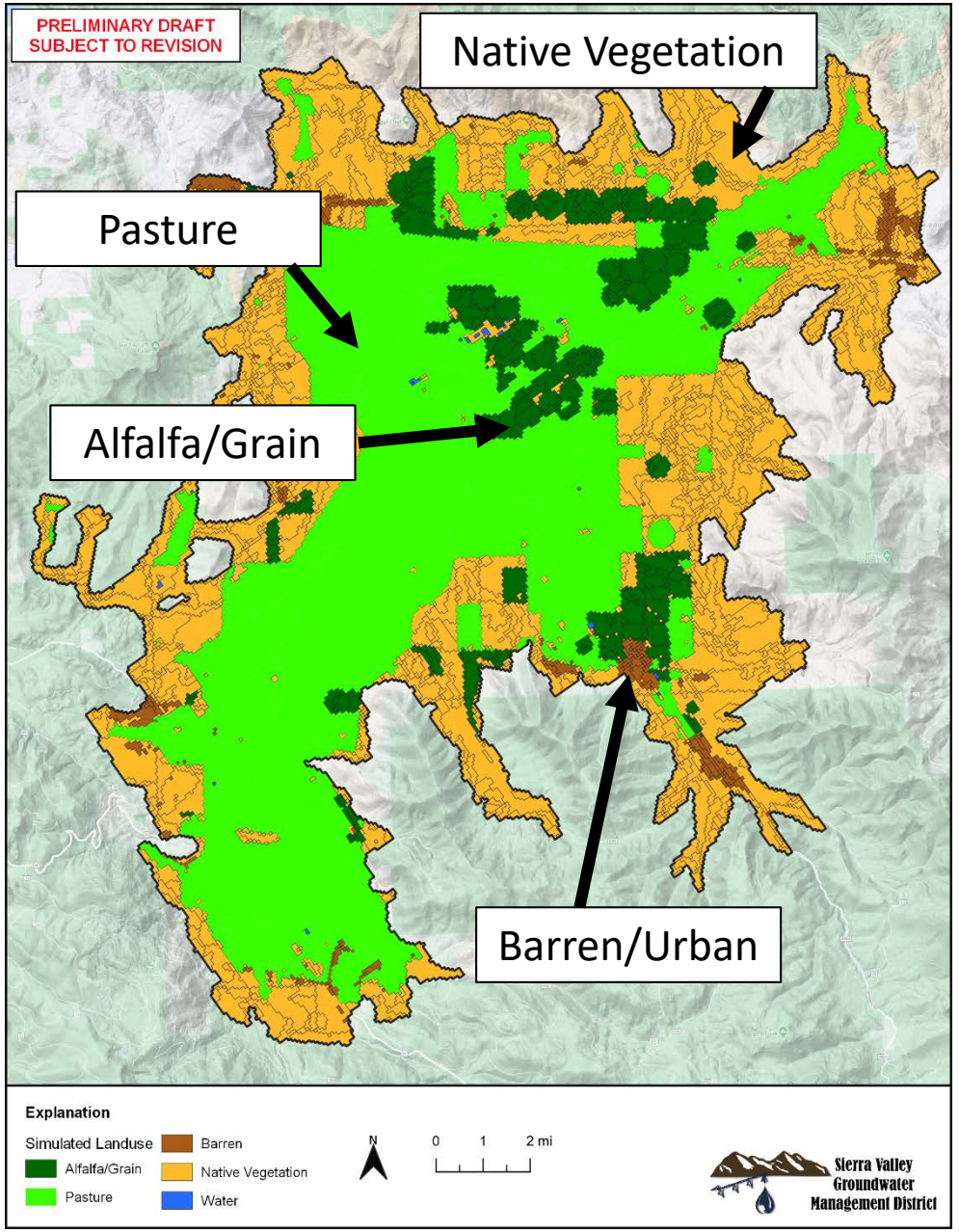
Soil-Water Budget Model - Land Use

Land Use	DWR Crop Mapping (acres)	SWBM/model (acres)	Percent Change
Alfalfa/Grain	10,990	11,189	1.79
Pasture	59,407	60,126	1.2
Native Vegetation	50,758	55,020	8.06
Barren	3,524	2,896	-19.56
Water	223	119	-60.82
Total	**124,902**	**129,350**	**3.5**



Soil-Water Budget Model - Land Use

- **Are these categories of land use sufficient for representing agricultural water usage in the valley?**
- **Is this distribution of land use categories accurate?**
- **Have there been any significant land use changes in the valley since October 1st, 1999?**



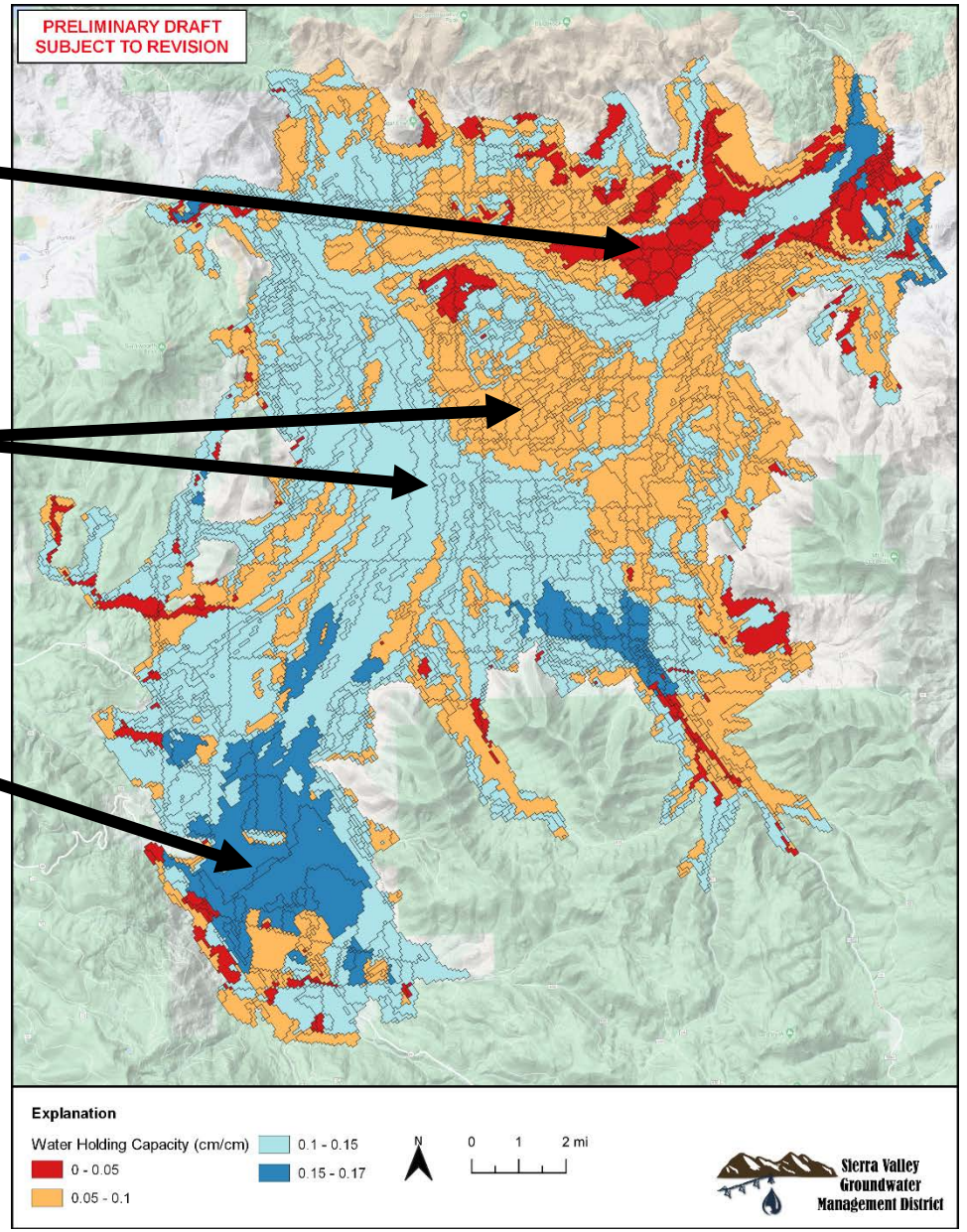
Soil-Water Budget Model - Water Holding Capacity

Red: generally coarse sandy soils

Orange and light blue: generally silty loams

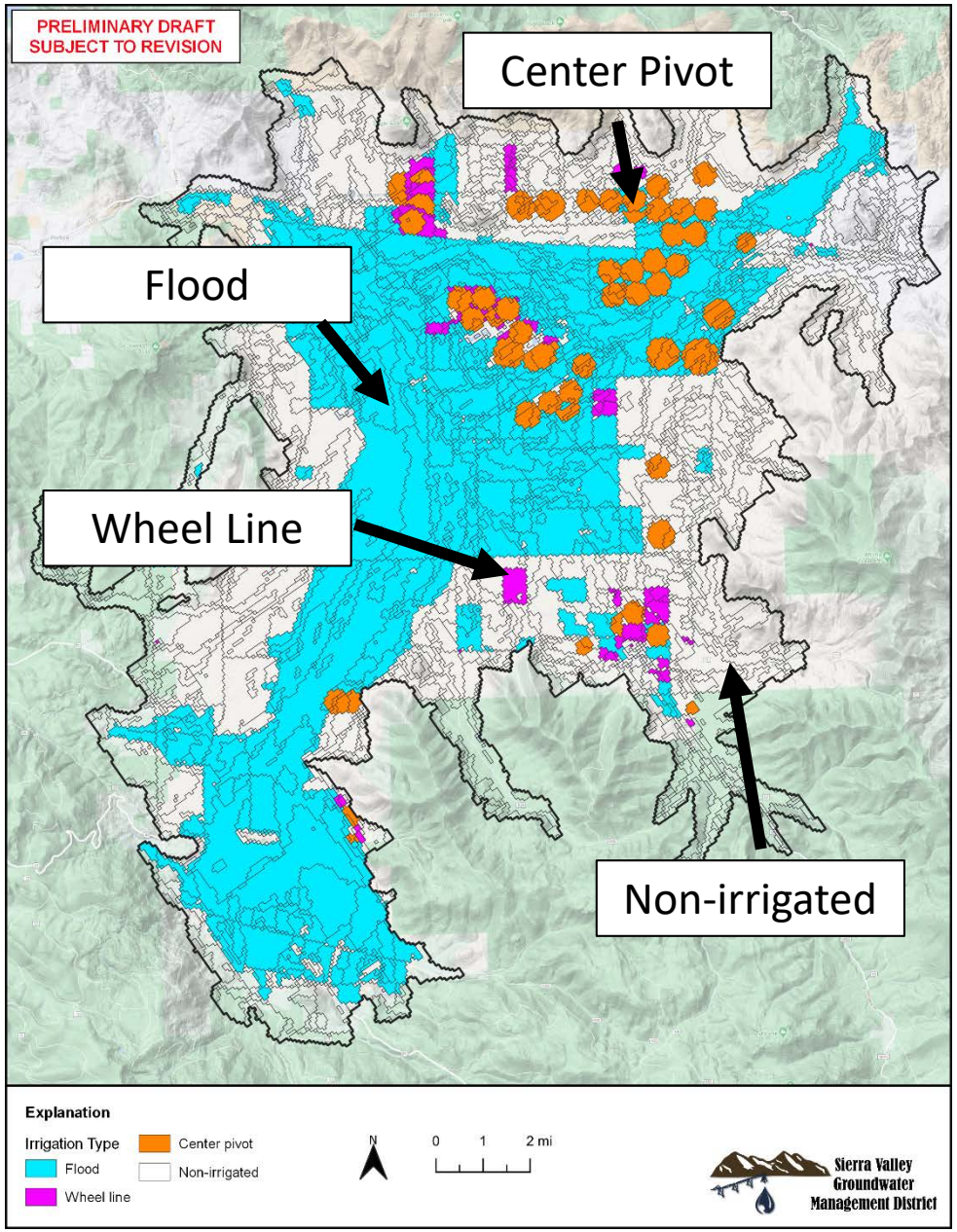
Dark blue: generally silts and clays

Is this soil distribution consistent with local knowledge?



Soil-Water Budget Model - Irrigation Type

Land Use	DWR Crop Mapping (acres)	SWBM/model (acres)	Percent Change
Flood	52,463	53,123	1.25
Wheel Line	1,894	1,940	2.4
Center Pivot	6,612	6,682	1.05
Non-Irrigated	63,933	67,605	5.58
Total	**124,902**	**129,350**	**3.5**

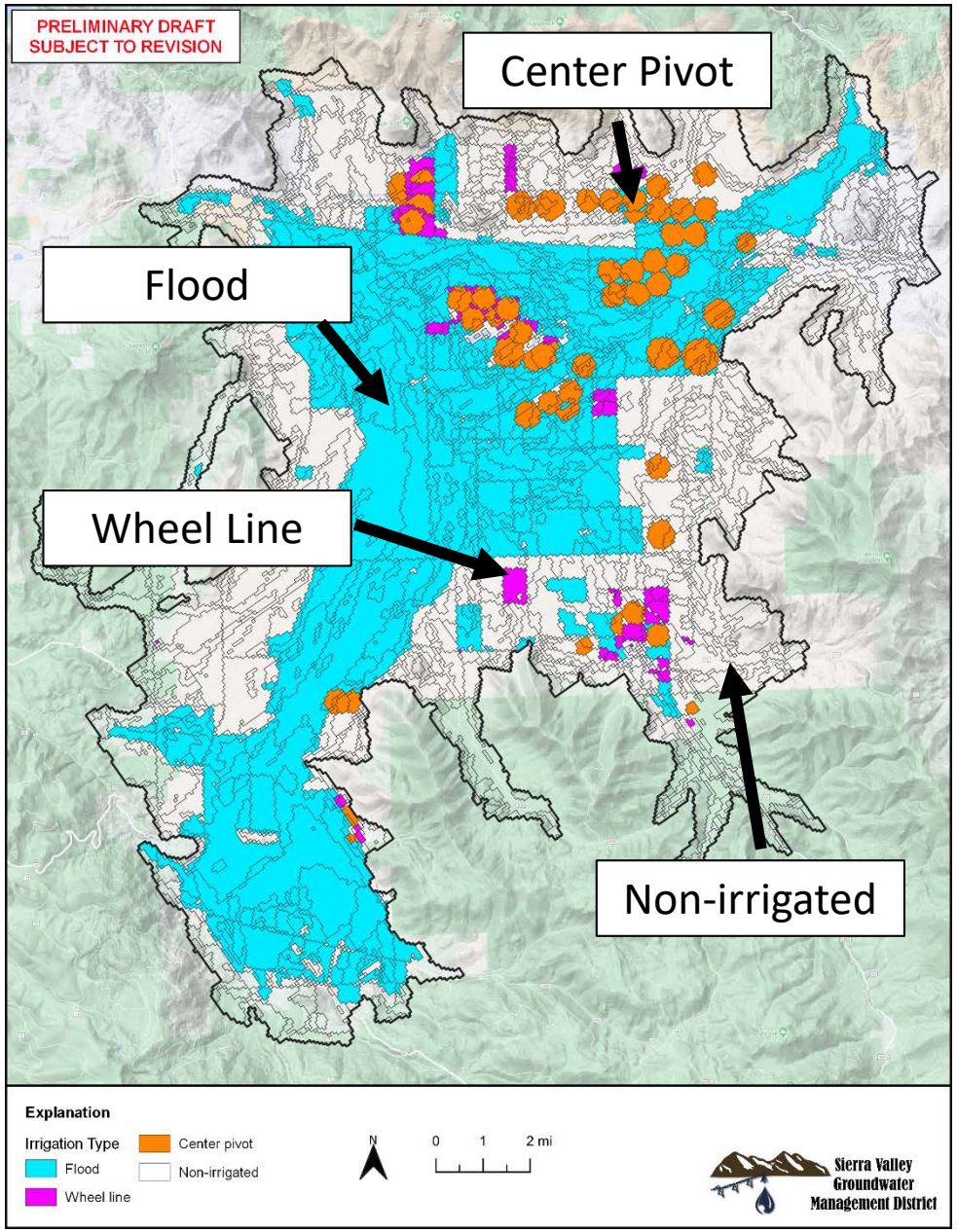


Soil-Water Budget Model - Irrigation Type

- Most alfalfa fields appear to use center pivot irrigation.
- Most pasture fields appear to be flood irrigated.

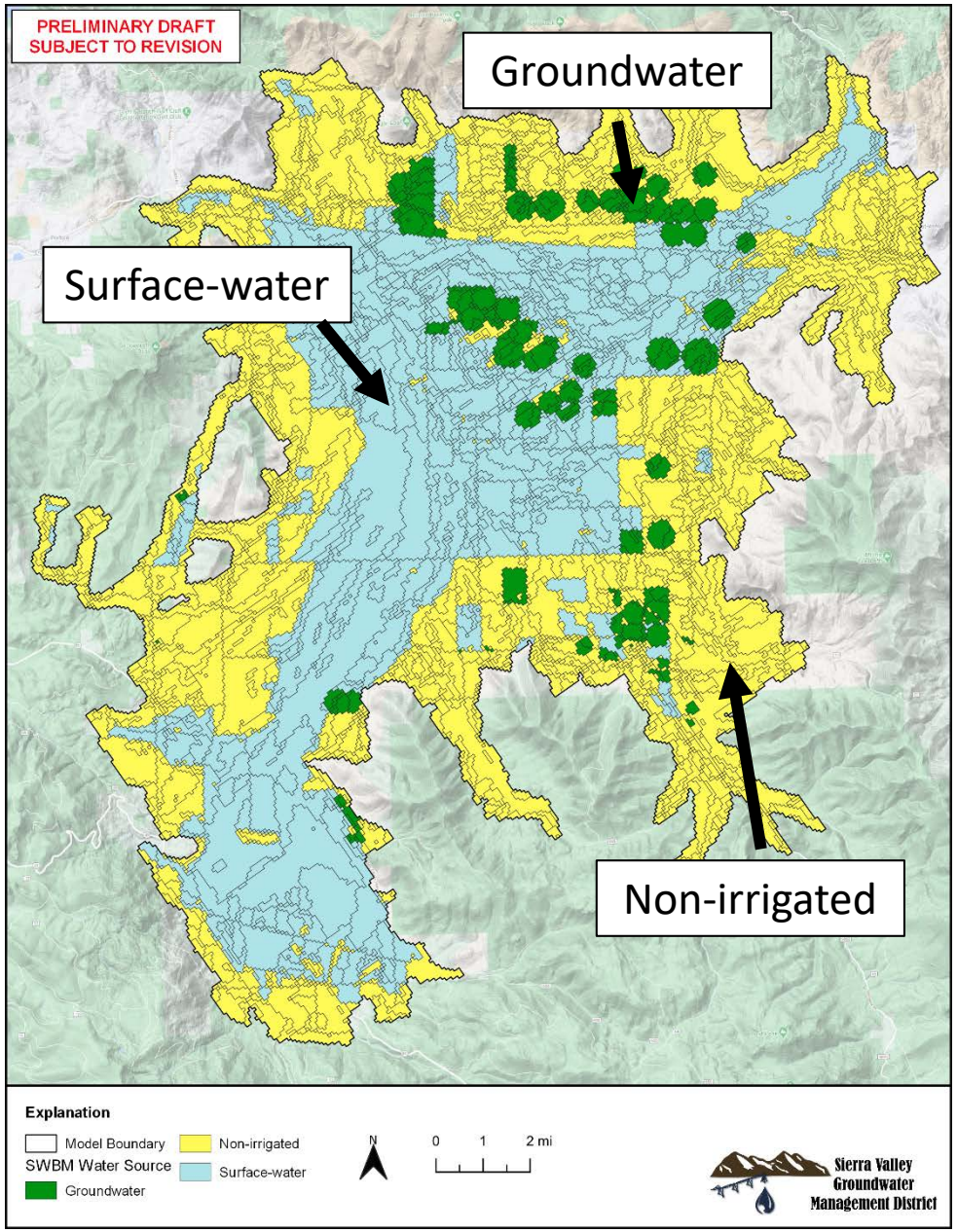
Is this distribution of irrigation methods consistent with local knowledge?

Are there other irrigation methods used in the valley?



Soil-Water Budget Model - Water Source

Land Use	DWR Crop Mapping (acres)	SWBM/model (acres)	Percent Change
Surface-water	53,093	53,760	1.25
Groundwater	7,877	7,984	1.35
Mixed	0	0	0
Non-Irrigated	63,933	67,605	5.58
Total	**124,902**	**129,350**	**3.5**

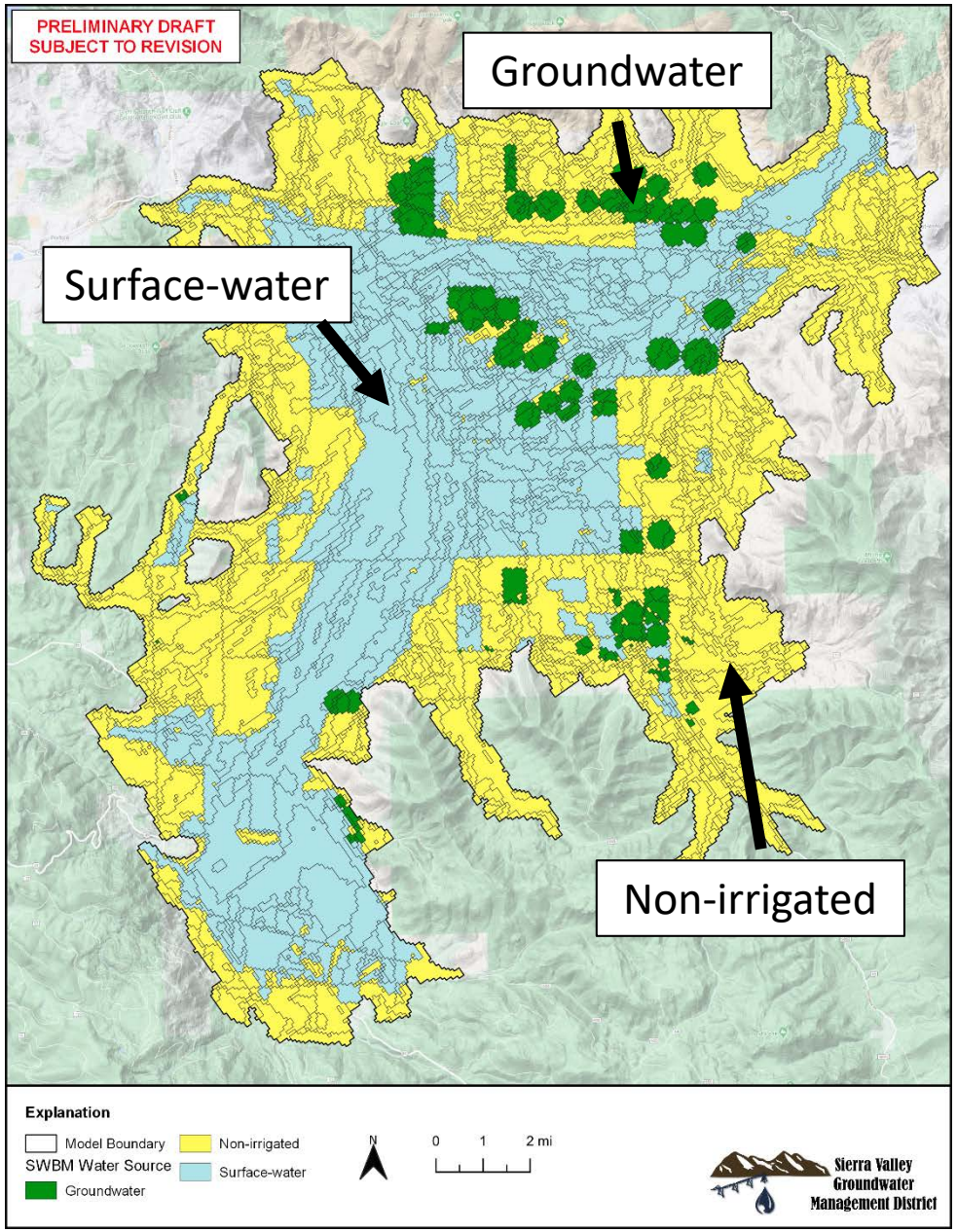


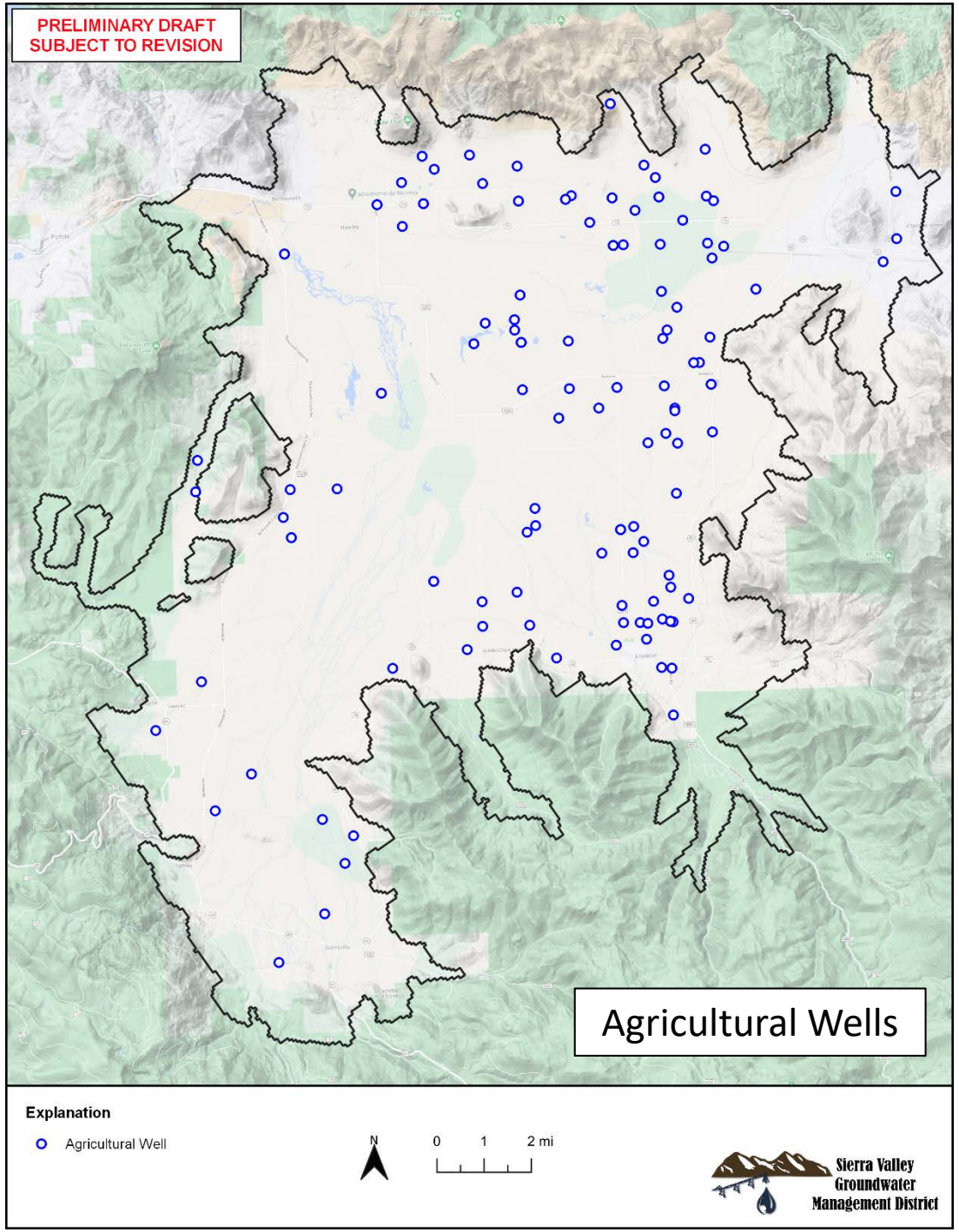
Soil-Water Budget Model - Water Source

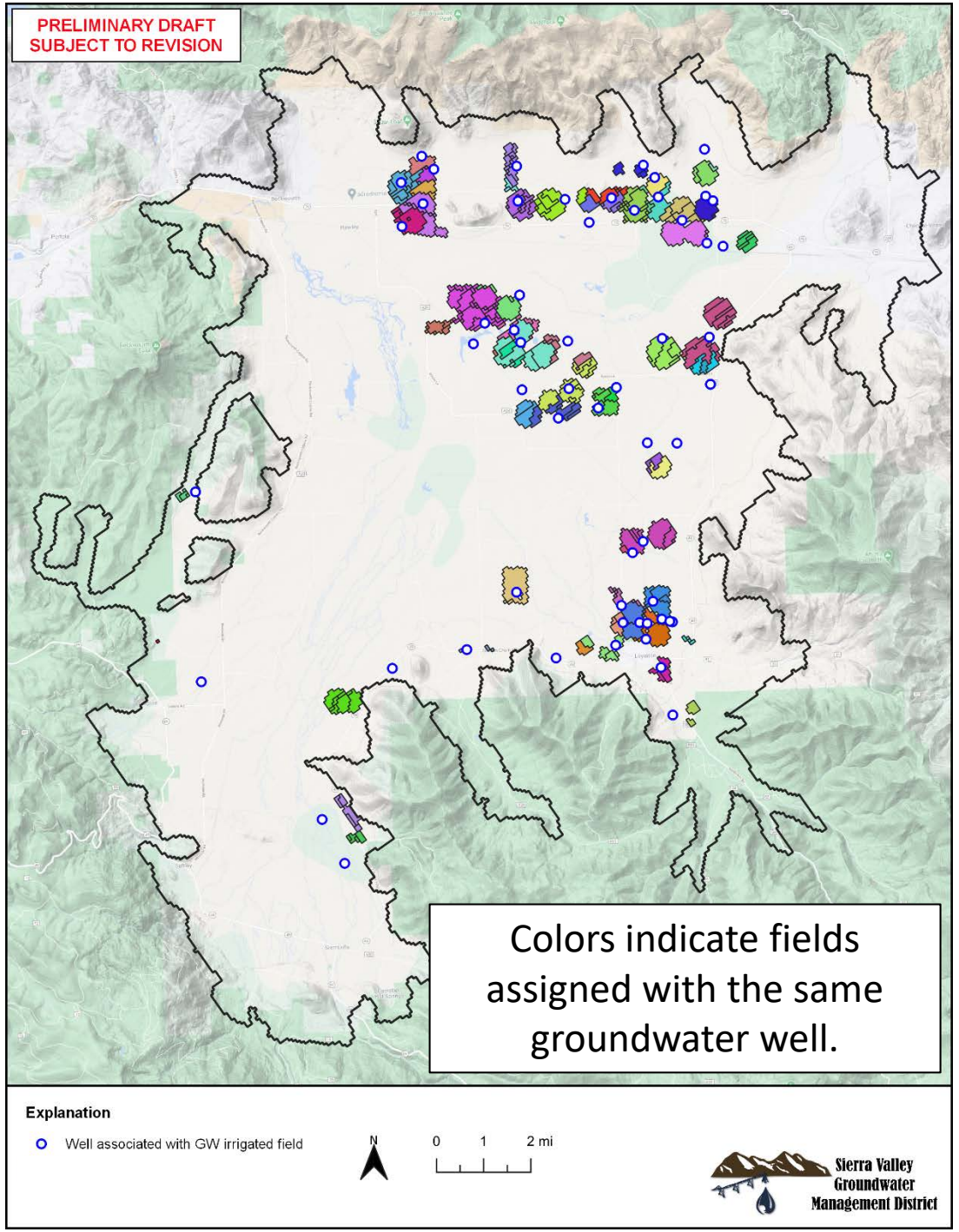
- Majority of alfalfa appears to be irrigated using groundwater
- Most pasture appear to be irrigated with surface-water

Is this distribution of water sources consistent with local knowledge?

Are there any fields that are sustained primarily by shallow groundwater (sub-irrigation)?




PRELIMINARY DRAFT
SUBJECT TO REVISION
Agricultural Wells
Explanation
Agricultural Well
N
0
1
2 mi
Sierra Valley
Groundwater
Management District

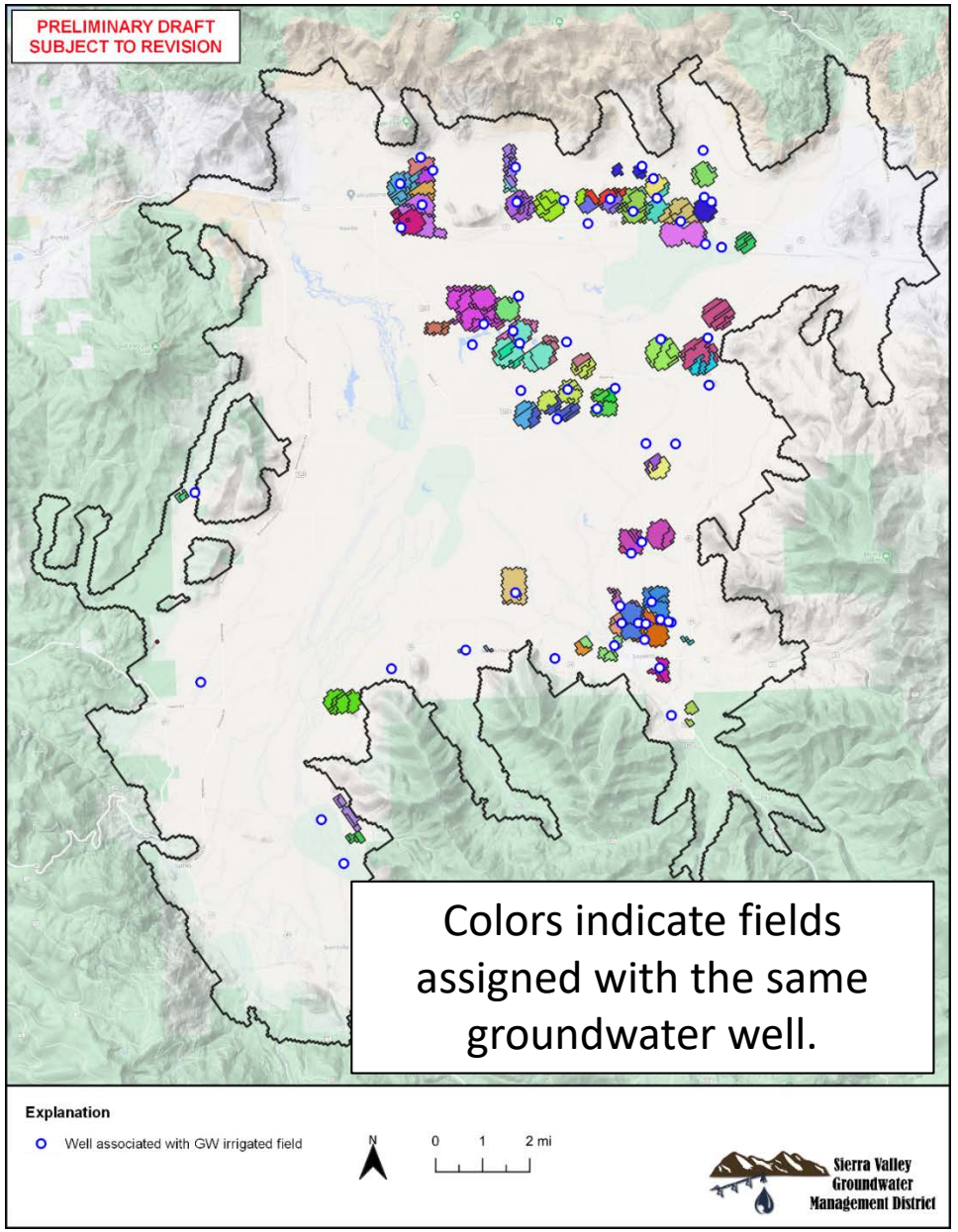

PRELIMINARY DRAFT
SUBJECT TO REVISION
Colors indicate fields assigned with the same groundwater well.
Explanation
Well associated with GW irrigated field
N
0
1
2 mi
Sierra Valley
Groundwater
Management District

Soil-Water Budget Model - Agricultural Wells

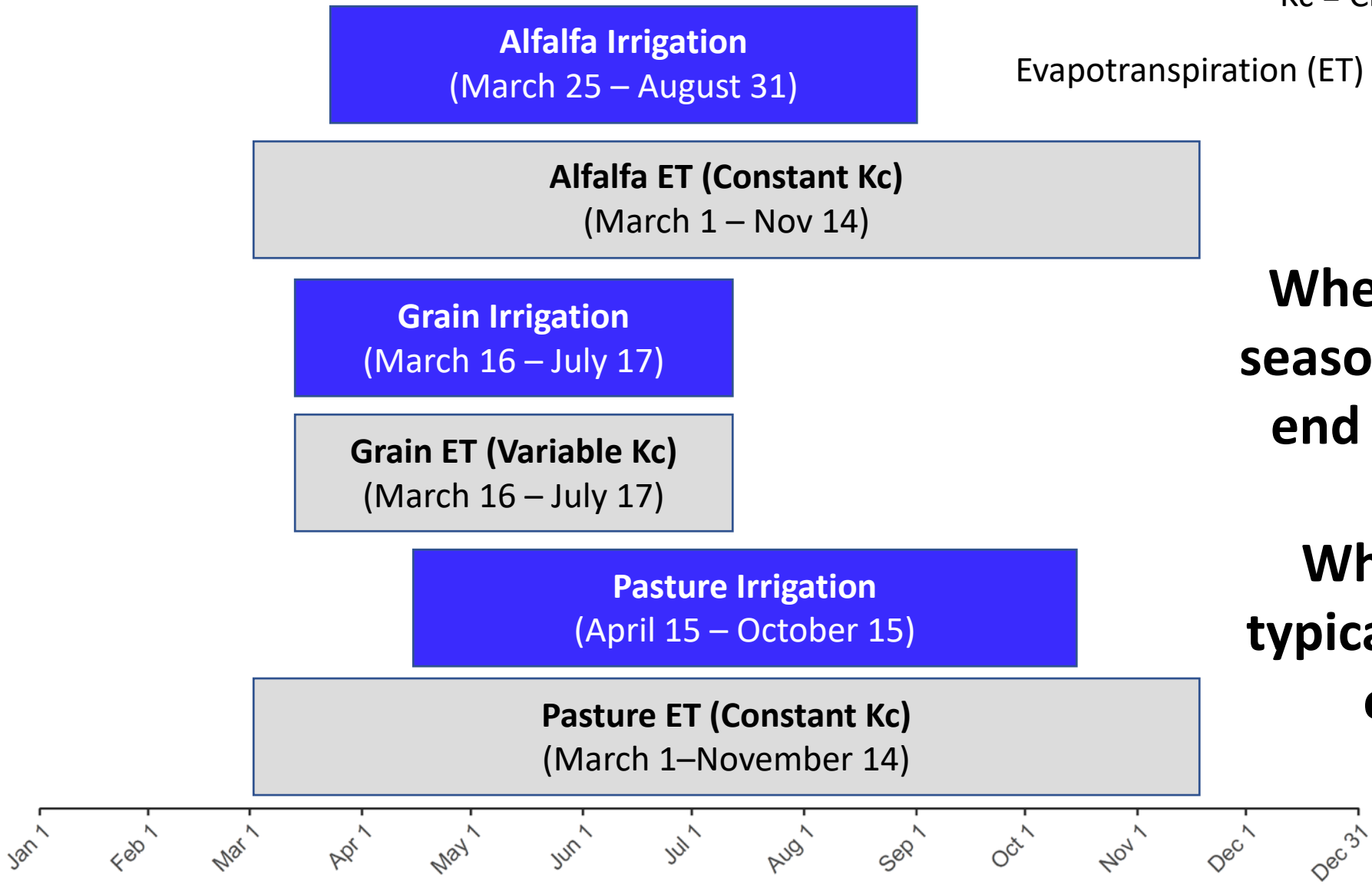
Are the wells associated with the GW irrigated fields accurate?

Are any irrigation wells missing?

Are there GW irrigation wells identified that are no longer used?



Soil-Water Budget Model - Preliminary Timing



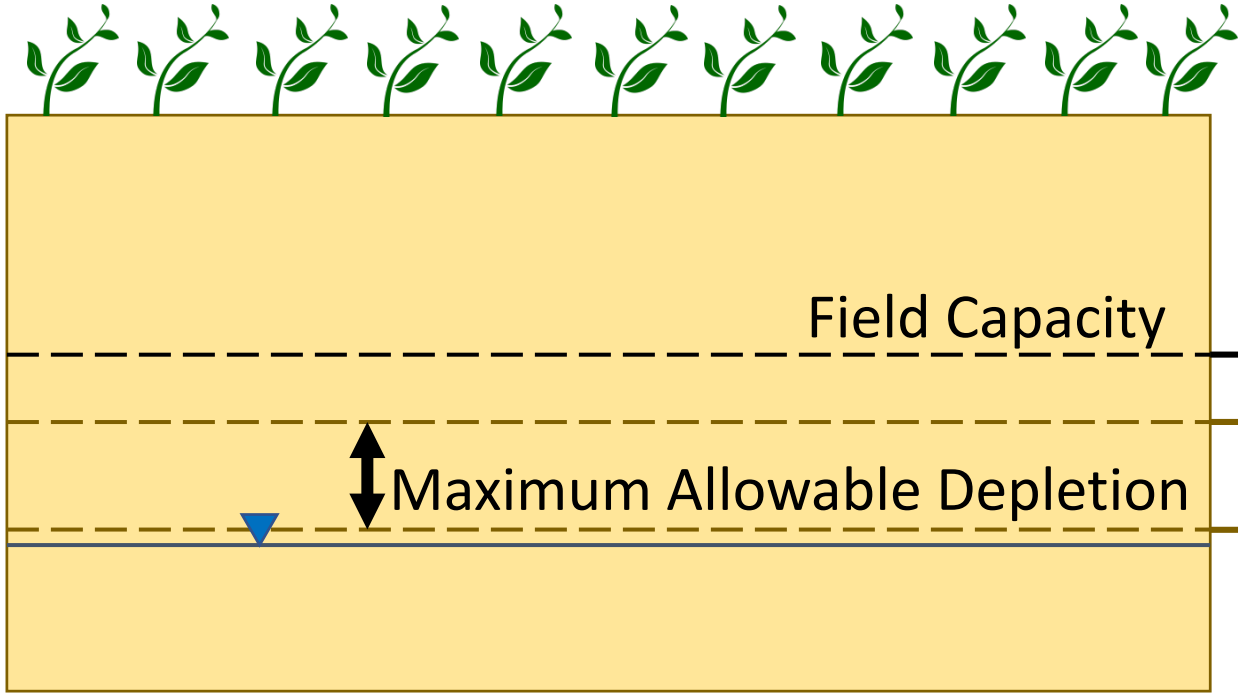
Kc = Crop Coefficient

Evapotranspiration (ET) = Potential ET * Crop Coefficient

When does the growing season typically begin and end for each crop type?

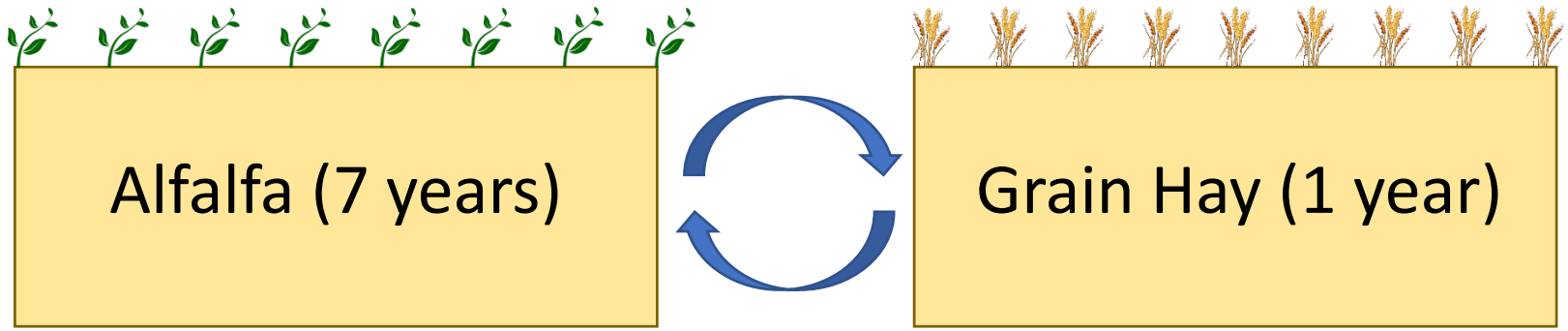
When does irrigation typically start and end for each crop type?

Soil-Water Budget Model - Irrigation Triggers



What irrigation triggers do farmers and ranchers in the valley typically use?

Soil-Water Budget Model - Crop Rotation



8 year rotation

What is the typical crop rotation schedule in the valley?

What crop type is usually rotated in?

Sierra Valley Groundwater Management District