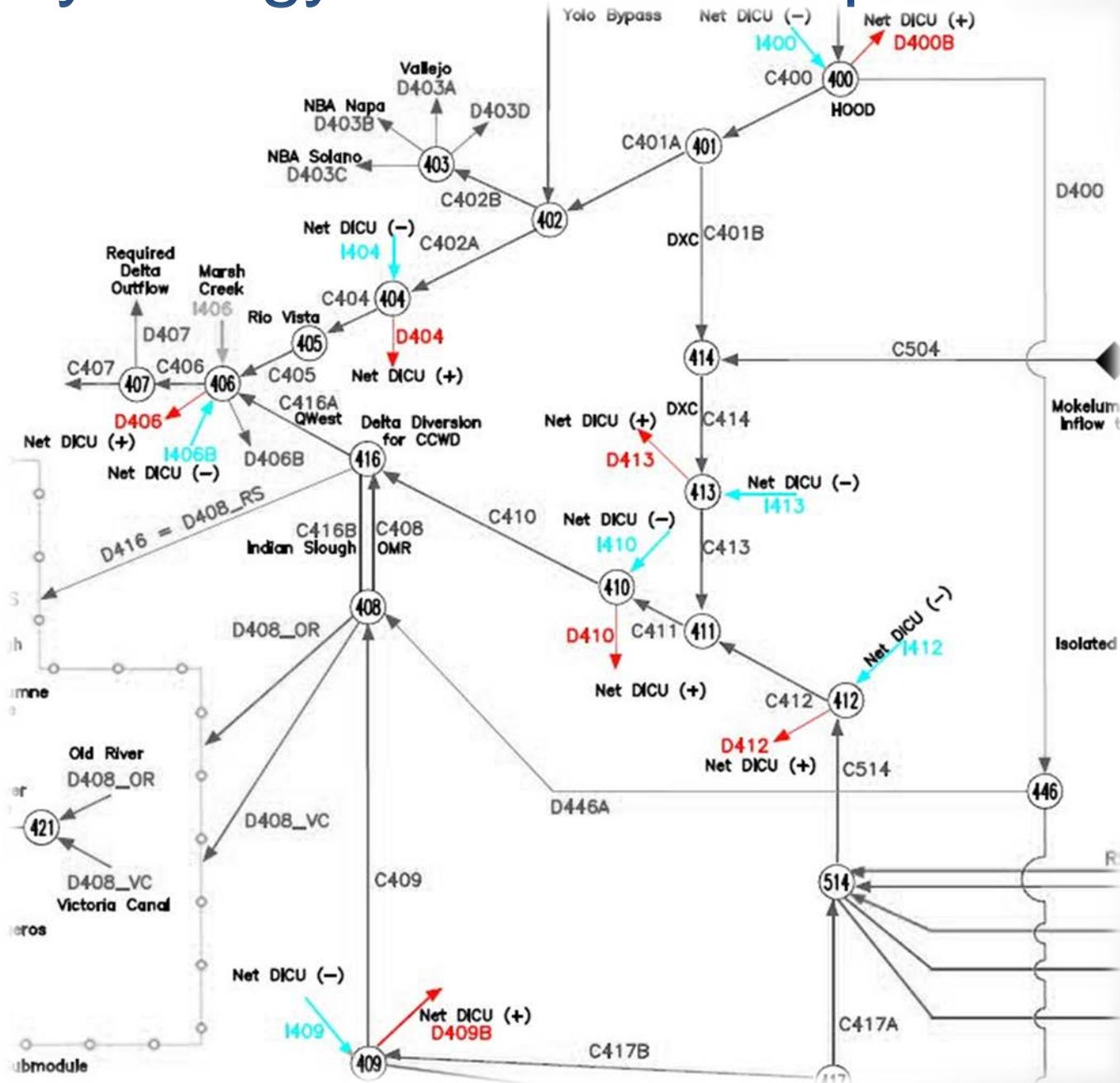


Delta Hydrology

California Department of Water Resources
United States Bureau of Reclamation



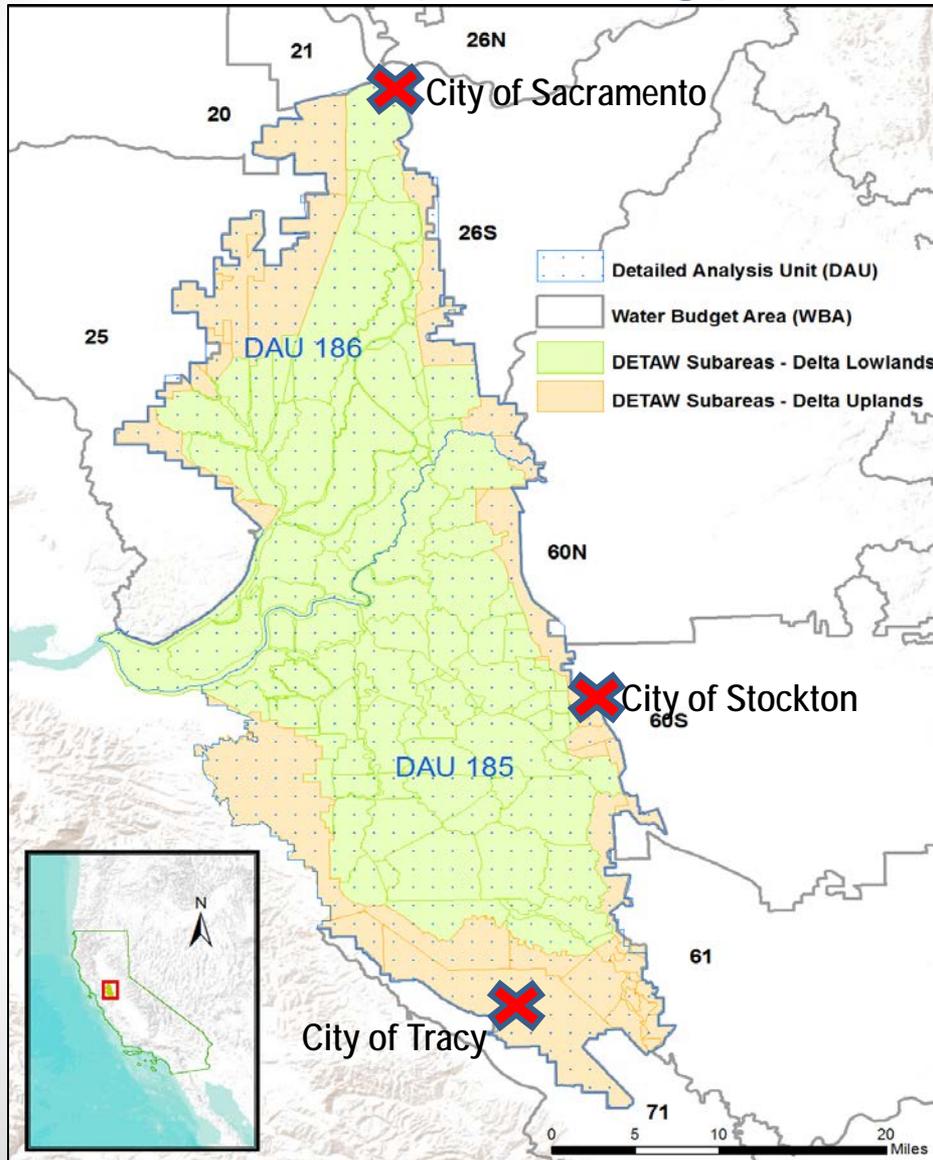
Delta Hydrology – Net Consumptive Use



Delta Hydrology- Quick Overview

- Geographic Boundary
 - Delta Lowlands and Uplands
- Consumptive Use Model (CU Model)
 - CUAW + CUPr
- Net Delta Depletions
- Adjusted Delta Island Consumptive Use (ADICU)
 - Disaggregate Net Delta Depletions
- Depletions (demands) and accretions (inflows) for 7 subregions

Delta Hydrology



Delta Service Area:

Delta Lowlands (DSA54)

- Below 5-foot mean sea level

Delta Uplands (DSA55)

- Above 5-foot mean sea level

Delta Hydrology

Computer Model:

Consumptive Use Model (CU model)

- Model consumptive water demands at a DSA level
- One-dimensional root zone soil moisture balance
- Calculates
 - monthly agricultural and outdoor urban water use (CUAW) → depletion in CalSim II
 - Monthly precipitation that is used consumptively through ET (CUPr) → depletion in CalSim II
- Not: other beneficial uses of irrigation water (e.g. leaching)

Delta Hydrology

Computer Model:

Consumptive Use Model (CU model)

Example1:

Min SM=3;

Max SM=5;

ET=5; \rightarrow Remaining ET = $5 - 3 - 1 = 1$; **CUAW** = 1

PPT=3; \rightarrow 3 inch PPT go to ET; **CUPr**=3

Initial SM=4; \rightarrow Avail SM = Initial SM – Min SM = 1

Example2:

ET=2; \rightarrow ET satisfied by PPT; **CUAW** = 0

PPT=6; \rightarrow 2 inch PPT go to ET; 2 inch PPT fill the SM space; 2 become Runoff

\rightarrow **CUPr** = PPT go to ET + PPT fill SM space = 4

Initial SM=3; \rightarrow SM space = Max SM – Initial SM = $5 - 3 = 2$

Delta Hydrology

Consumptive Use Model (CU model)

4 land use Classifications

- Irrigated agricultural (13 crop types)
- Urban (lawns, vacant lots, impervious surfaces)
- Native vegetation
- Riparian vegetation

Delta Hydrology

Consumptive Use Model (CU model) – 13 Crop Types

- Pasture (PA)
- Alfalfa (AL)
- Field Crops (FI)
- Sugar Beets (SB)
- Grain (GR)
- Cotton (CO) -- zero in Delta
- Rice (RI)
- Truck Crops (TR)
- Tomatoes (TO)
 - Tomatoes Hand (TH); Tomatoes Machine (TM)
- Orchard (OR)
- Citrus and Olives (SO) -- zero in Delta
- Vineyard (VI)

Delta Hydrology

Computer Model: Consumptive Use Model (CU model)

- Key Input data:
 - Annual land uses
 - Monthly precipitation
 - Monthly crop ET rates
 - Crop rooting depth
 - Irrigation season
 - Soil moisture holding capacity
 - Minimum Soil moisture

Delta Hydrology

Consumptive Use Model (CU model) – Urban Outdoor water

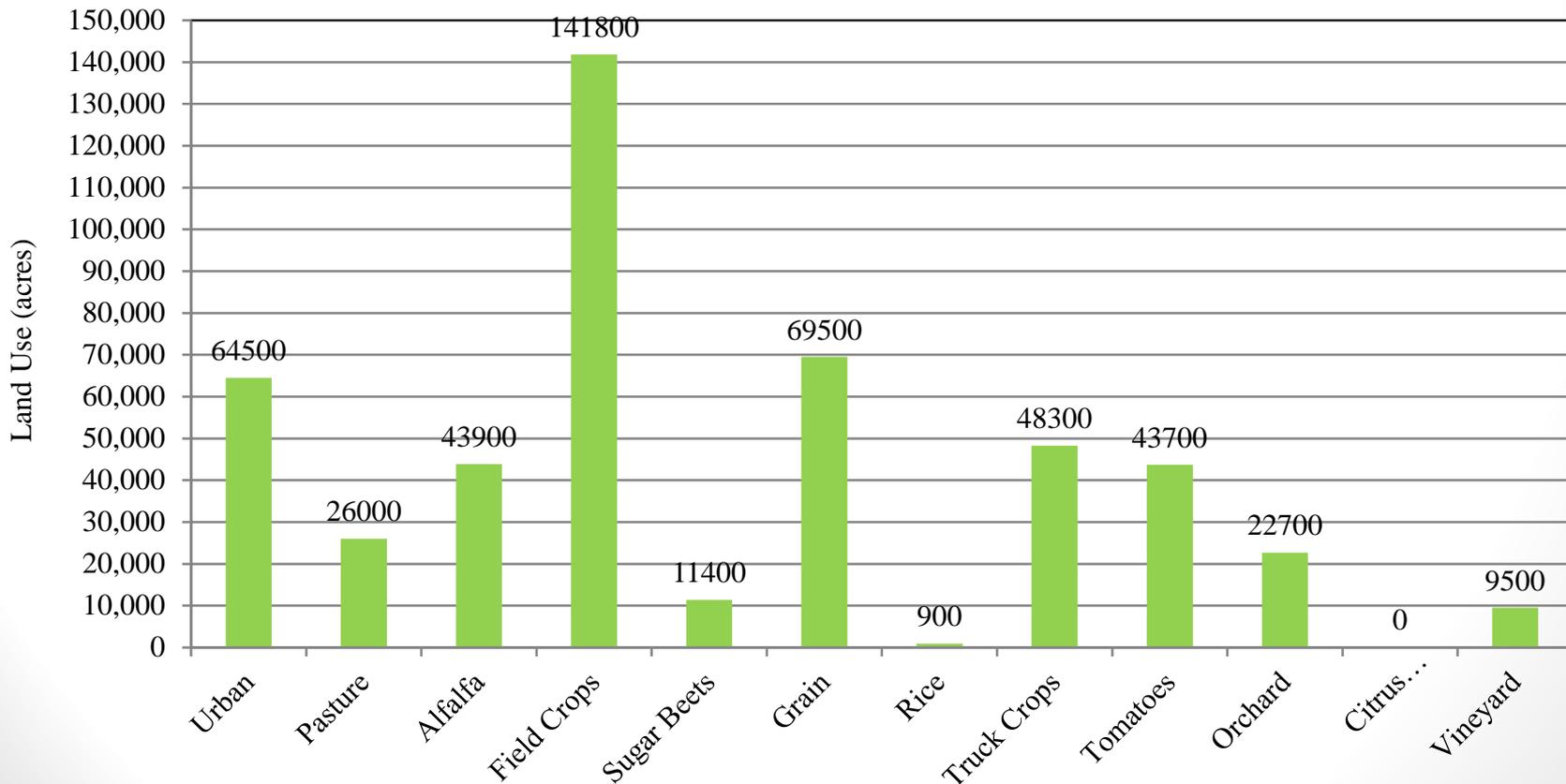
- Lawns (47%), vacant Lots (19%), impervious surfaces (34%)
- Assumptions:
 - Lawns = irrigated pasture
 - Vacant Lots = native vegetation
 - Zero apply water
 - All precipitation on impervious surface results in runoff
 - Zero consumptive use

Delta Hydrology

Consumptive Use Model (CU model)

- Land use – California Water Plan (Bulletin 160-98)

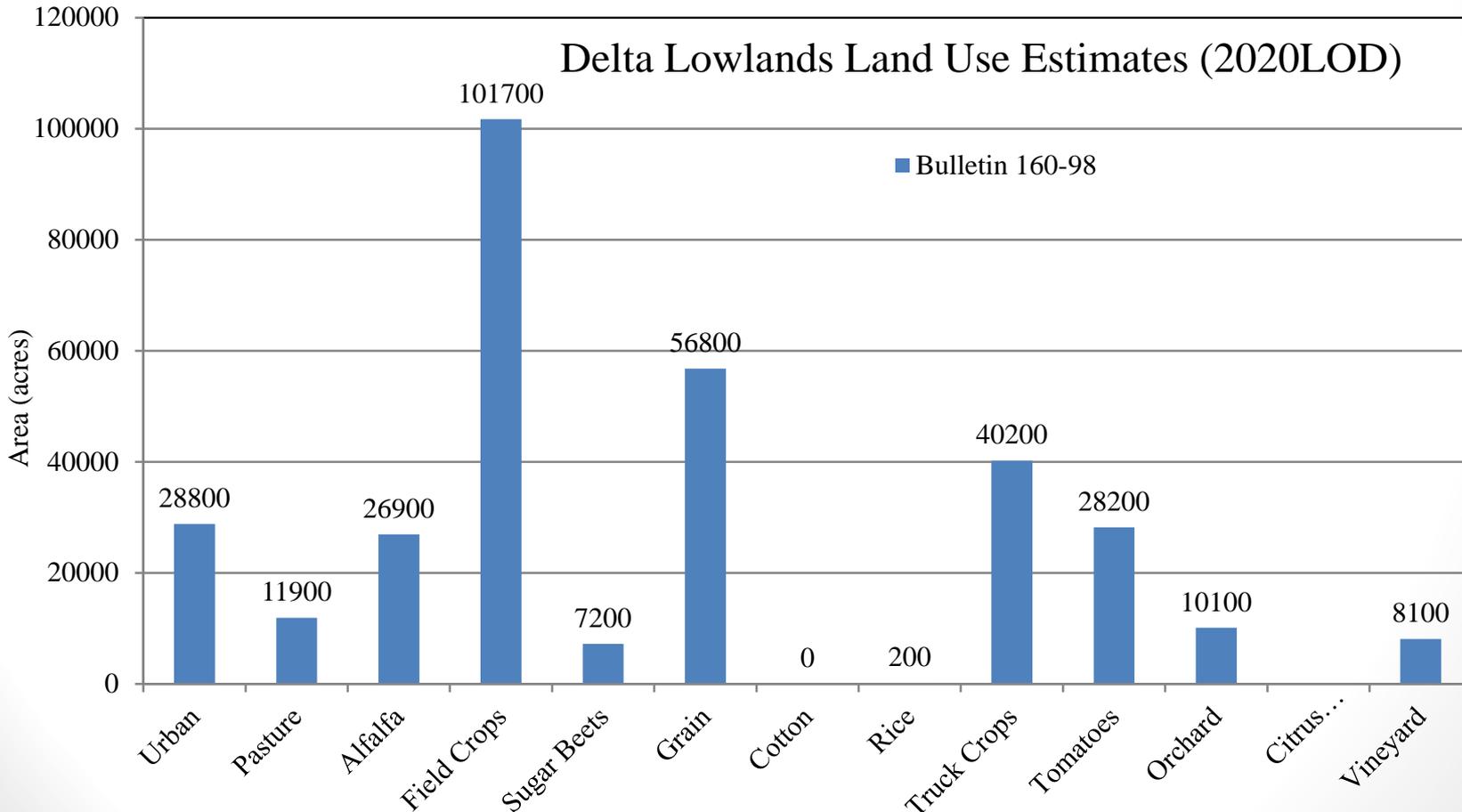
CalSim II (Bulletin 160-98) – 2020 LOD



Delta Hydrology

Consumptive Use Model (CU model)

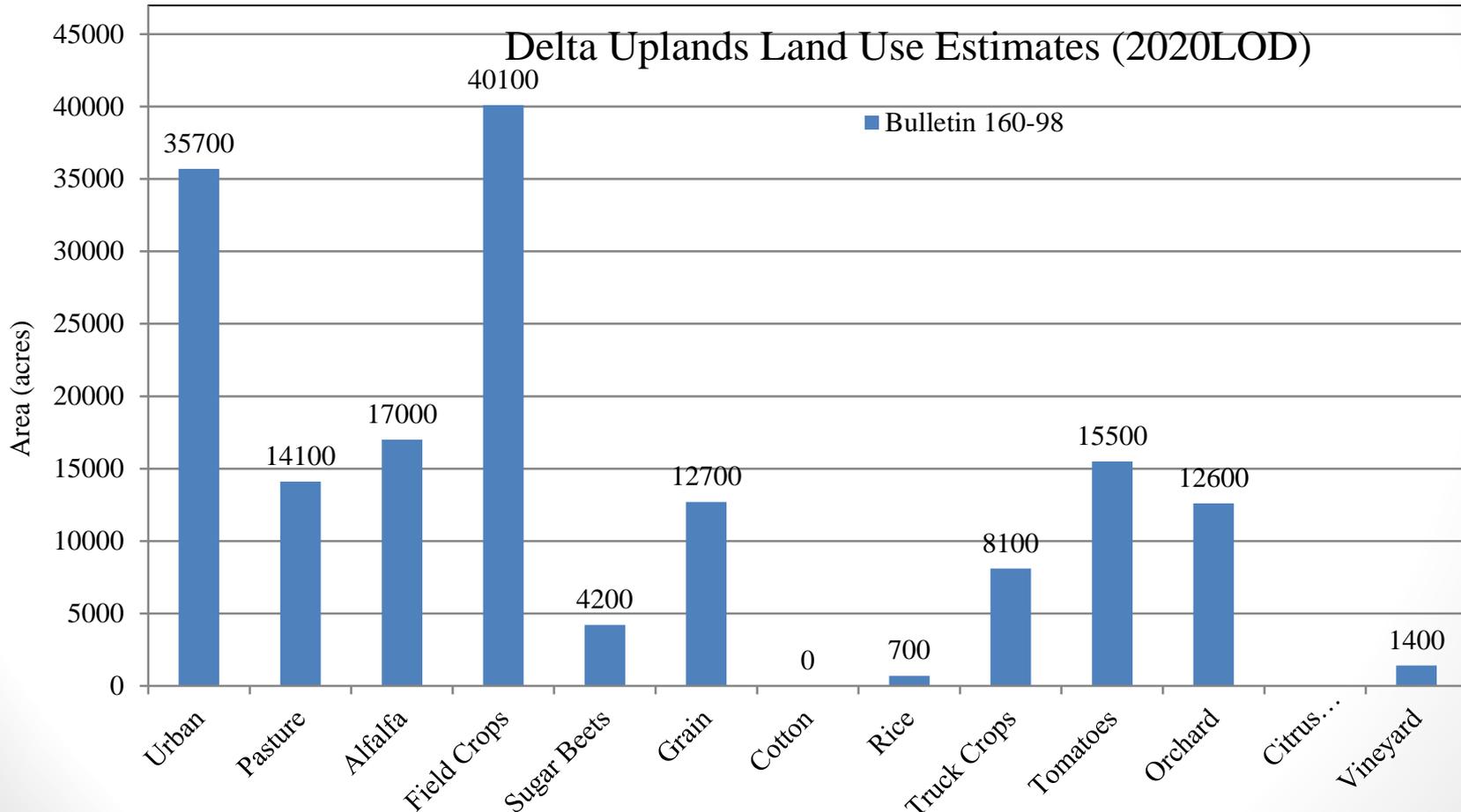
- Lowlands Land use – California Water Plan (Bulletin 160-98)



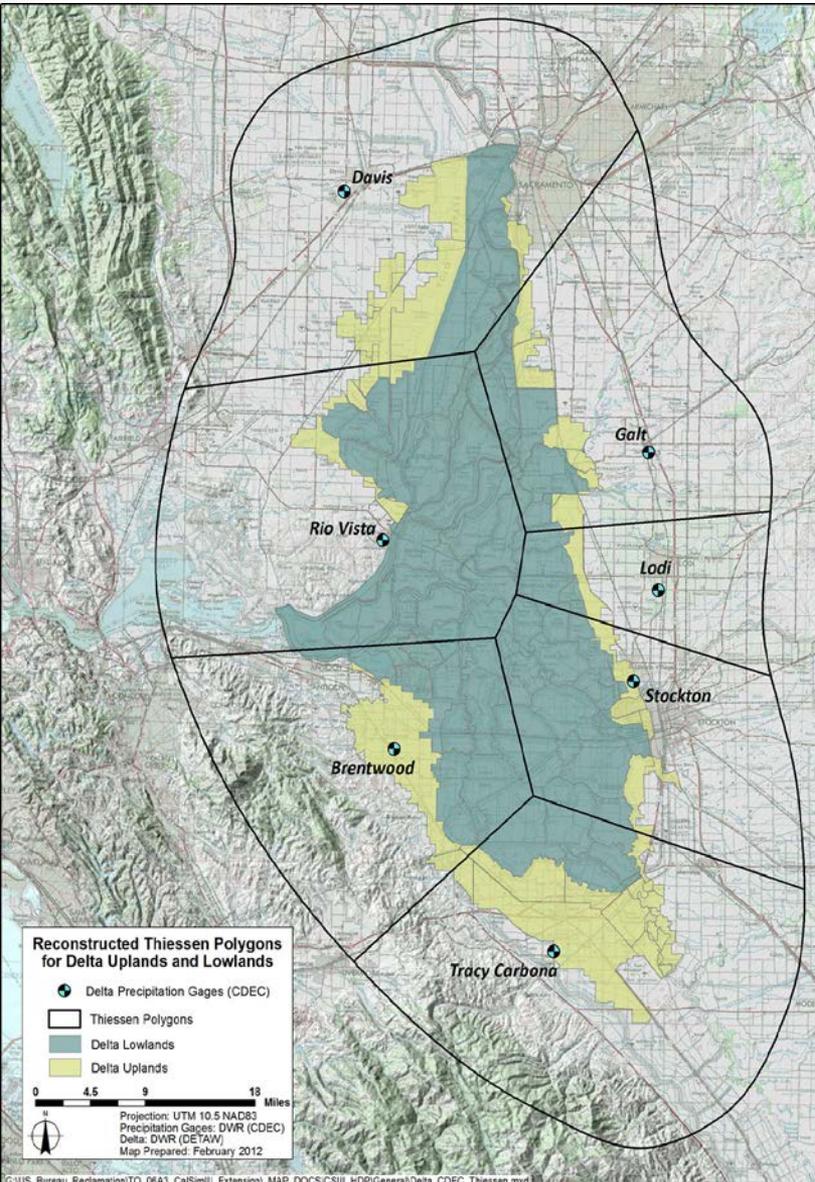
Delta Hydrology

Consumptive Use Model (CU model)

- Lowlands Land use – California Water Plan (Bulletin 160-98)



Delta Hydrology



Consumptive Use Model (CU model)

- Monthly Precipitation – Area weighted average of seven gaging stations in and adjacent to the Delta

7 Stations:

- Brentwood
- Rio Vista
- Davis
- Galt
- Lodi
- Stockton
- Tracy-Carbona

Delta Hydrology

Consumptive Use Model (CU model)

- Evapotranspiration
 - Average $ET_o = 46.1$ inches per year (MacGillvray ET_o)
 - Use Hargreaves-Samani Equation:
 - $ET_o = 0.0023 \cdot R_a \cdot (T_{max} - T_{min})^{0.5} \cdot (T_m + 17.8)$
 - T_{max} and T_{mi} : Lodi (NCDC 5032) and Stockton Fire Station No.4 (NCDC 48560)
 - R_a extraterrestrial radiation: Lodi station (latitude of 38.100 degrees)
 - Adjust the ET_o from Hargreaves-Samani equation to that the average annual ET_o to 46.1 inches

Delta Hydrology

Net Channel Depletions =

Sum of

- $CUAW + CUPr - \text{Precipitation}$ (from CU model)
- Leach water requirement
- Stone Lakes refuge demand

Monthly Values (TAF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
Leach	11.2	16	26.4	-30	-15.6	-7.4	-0.6	0	0	0	0	0
Refuge	2.9	1.3	0.7	0.8	1.5	2.7	0	0	0	0	0	0

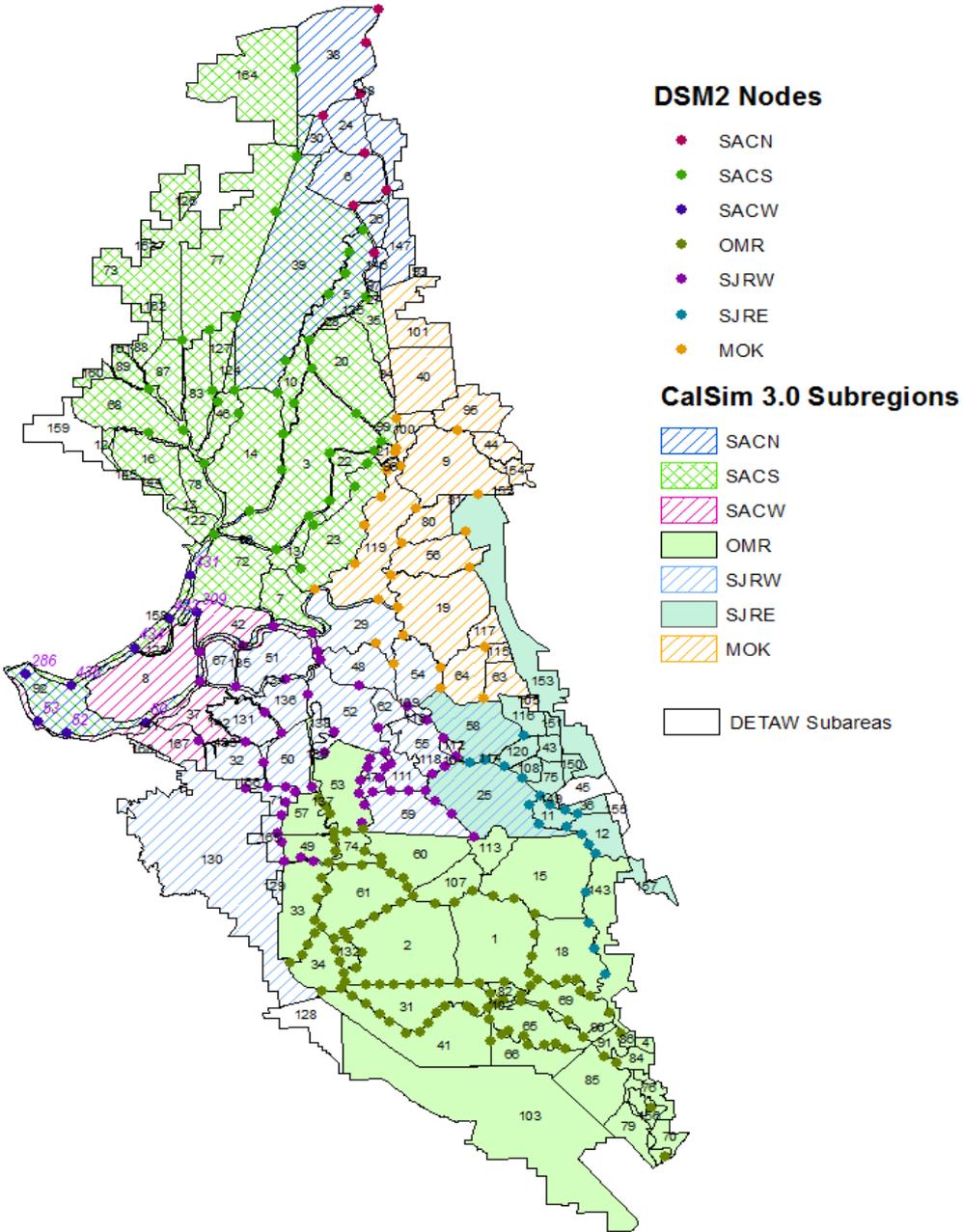


Delta Hydrology – Delta

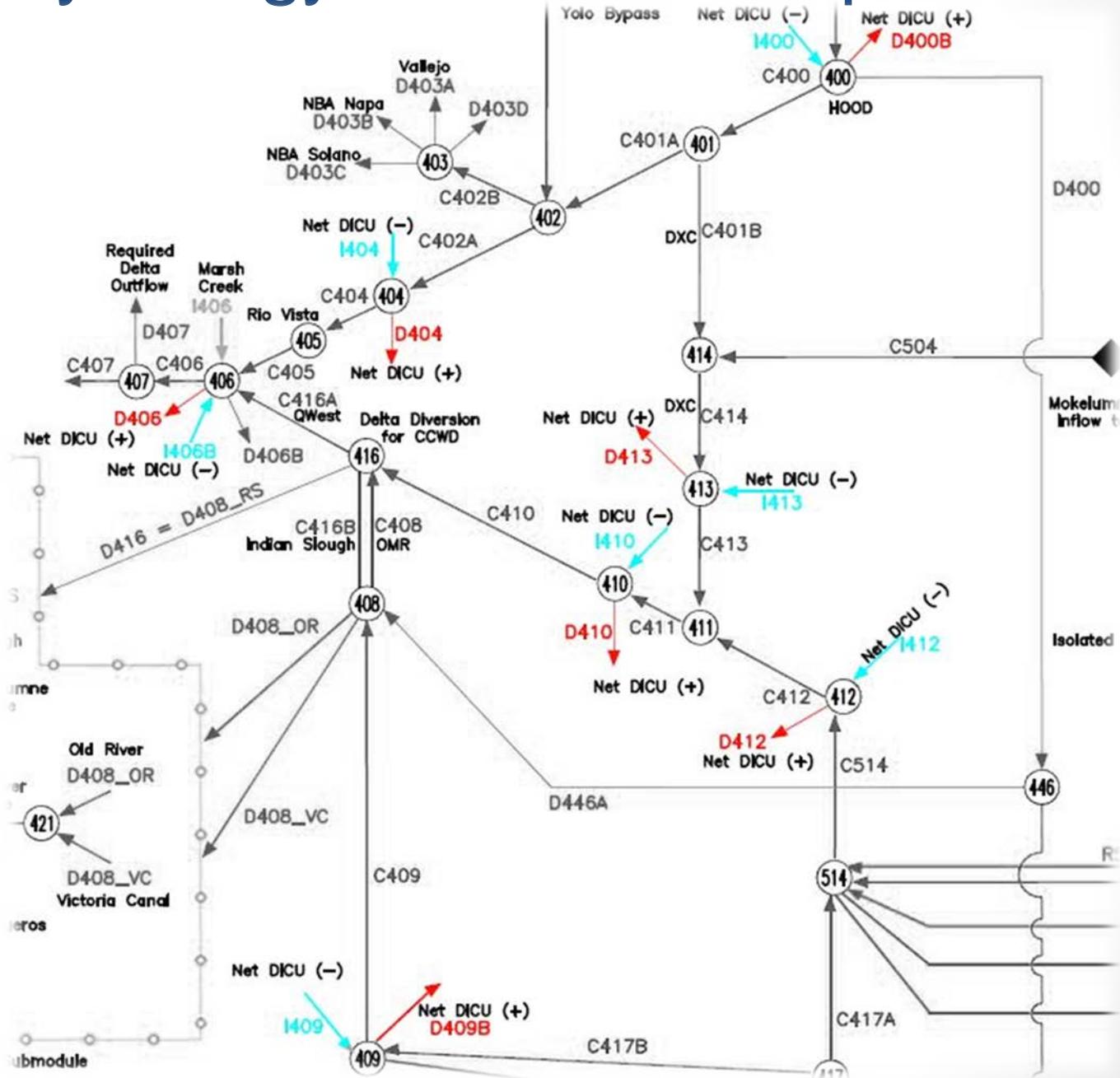
Adjusted Delta Island Consumptive Use (ADICU)

- Maintain consistency between the Delta representation in CalSim and that in DSM2
- Disaggregates the net channel depletions to 258 nodes within Delta as (Irrigation + Seepage – Drainage)
- 258 nodes are aggregated to seven nodes that represent the seven delta subregions in CalSim II

Delta Hydrology – Delta (ADICU)



Delta Hydrology – Net Consumptive Use



Delta Hydrology – Accretions

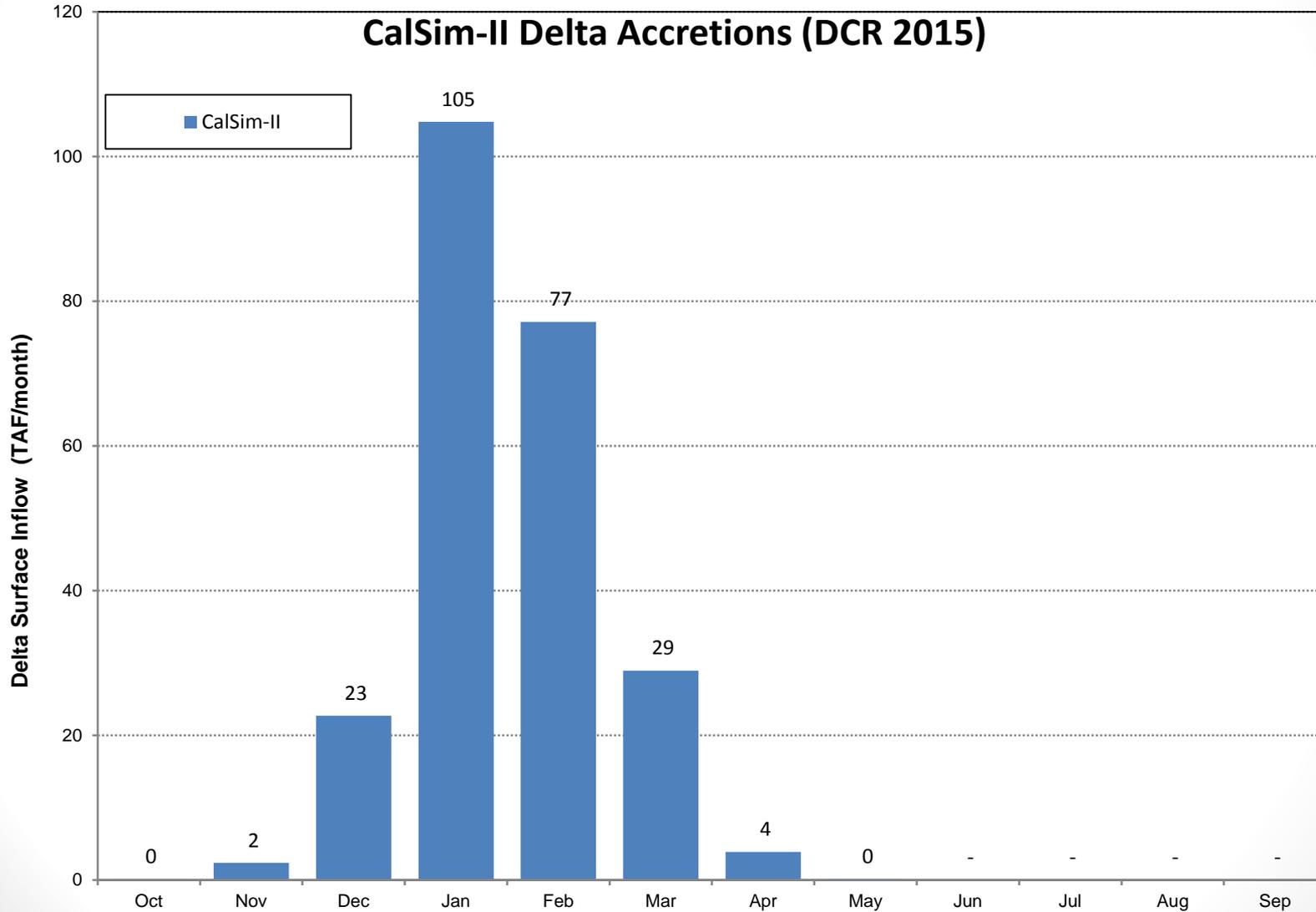
	CalSim-II: DCR2015 Existing		
MOK	I413	23%	54.61
SAC_NORTH	I400	6%	13.55
SAC_SOUTH	I404	34%	81.63
SAC_WEST	I406B	2%	5.95
SJR_EAST	I412	6%	14.17
SJR_WEST	I410	18%	44.37
OMR	I409	11%	25.96
		100%	240.25

Delta Hydrology – Depletions

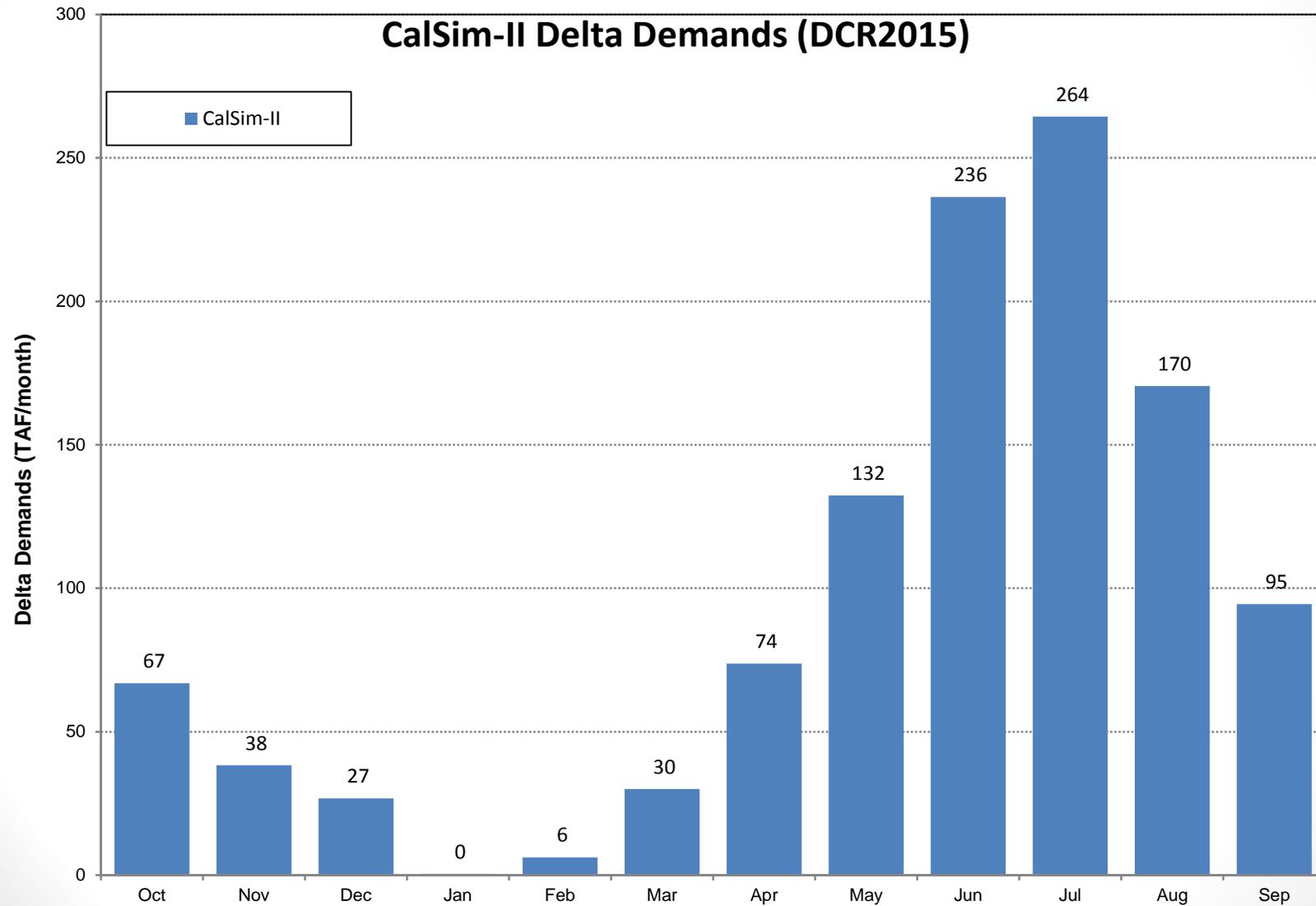
	CalSim-II: DCR2015 Existing			
MOK	DEMAND_D413	14%		159.56
SAC_NORTH	DEMAND_D400B	6%		67.27
SAC_SOUTH	DEMAND_D404	23%		257.31
SAC_WEST	DEMAND_D406	8%		87.66
SJR_EAST	DEMAND_D412	5%		54.86
SJR_WEST	DEMAND_D410	19%		216.06
OMR	DEMAND_D409B	26%		297.76
		100%		1,140.47

Delta Hydrology

CalSim-II Delta Accretions (DCR 2015)



Delta Hydrology



Delta Hydrology – Q & A