Project Meeting
Vina Subbasin
Development of SMCs
January 19, 2020

Agenda

- Short Recap of previous meeting (5 min)
- Surface water depletion SMC (30 min)
- Water Quality SMC (10 min)
- Break (5-10 min)
- Groundwater Level SMC (30 min)
  - Proposed RMS Locations

Schedule - SMCs

- December 15, 2020 – Draft SMC Presentation
- January 19, 2020 – Continue Discussion of SMCs
- February 10, 2020 – Vina GSA Board Workshop – SMCs
- February 16, 2020 – Start of 30-Day Public Review of SMCs
- March 16, 2020 – Discuss SMC Public Comments

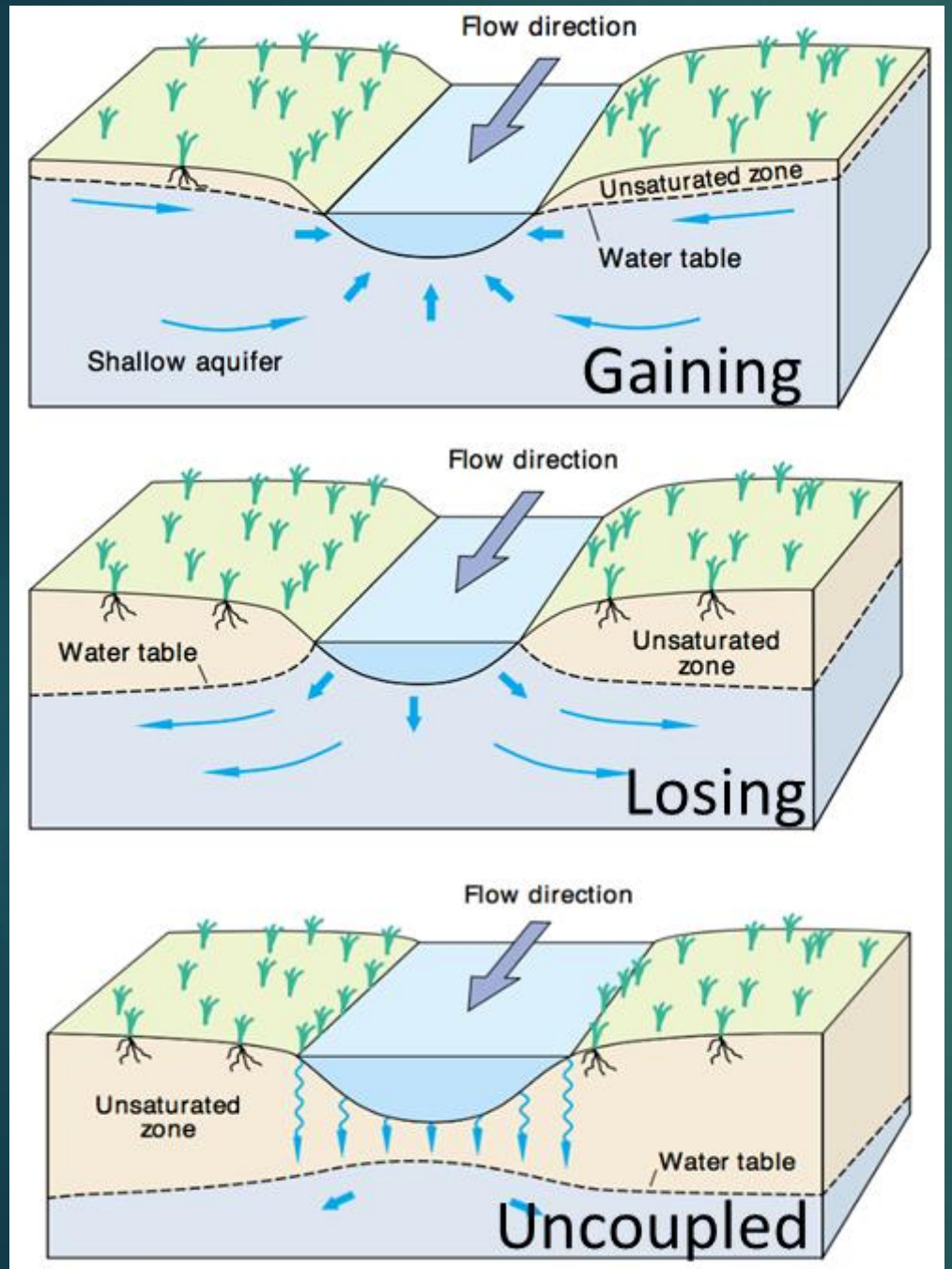
SMC STRAWMAN REVIEW

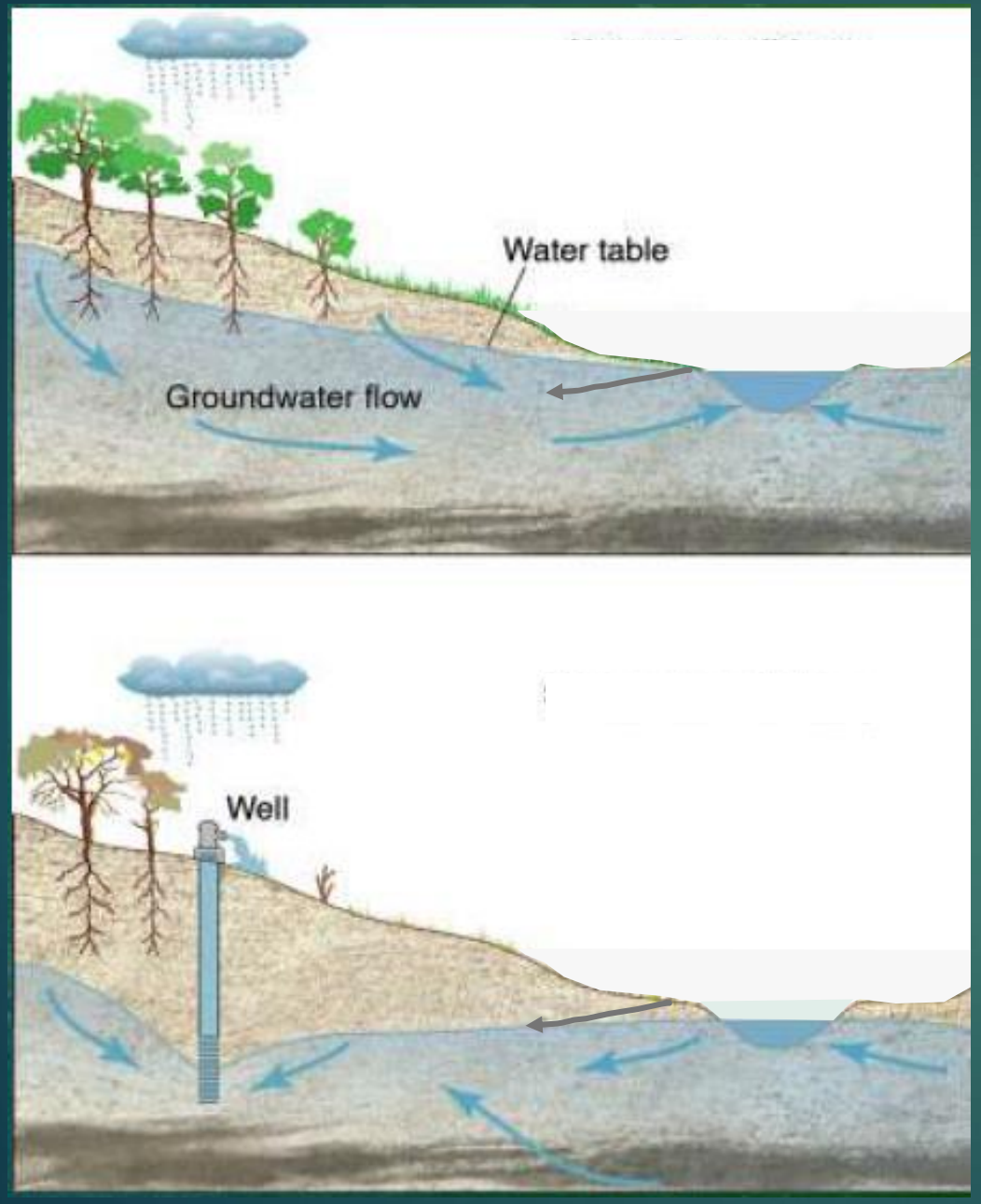
The SMC Process

- Six **Undesirable Results** are defined in SGMA **:** Chronic lowering of groundwater levels; Reduction of groundwater storage; Seawater intrusion; Degraded water quality; Land subsidence; Depletions of interconnected surface water
- **Sustainable Management Criteria (SMC)** and associated representative monitoring site (RMS) must be developed for each undesirable result.
- **Minimum Thresholds (MT)** and **Measurable Objectives (MT)** must be defined at each RMS for each undesirable result.
- MT is an "avoidance criteria" – definitive steps need to be taken if triggered.
- MO is a "desired state" – management targets that are achieved incrementally through **Projects and Management Actions (PMAs)**

Depletion of Interconnected Surface Water

Modes of Stream-Aquifer Interaction





Groundwater Dependent Ecosystem (GDE)

UNDESIRABLE RESULT :

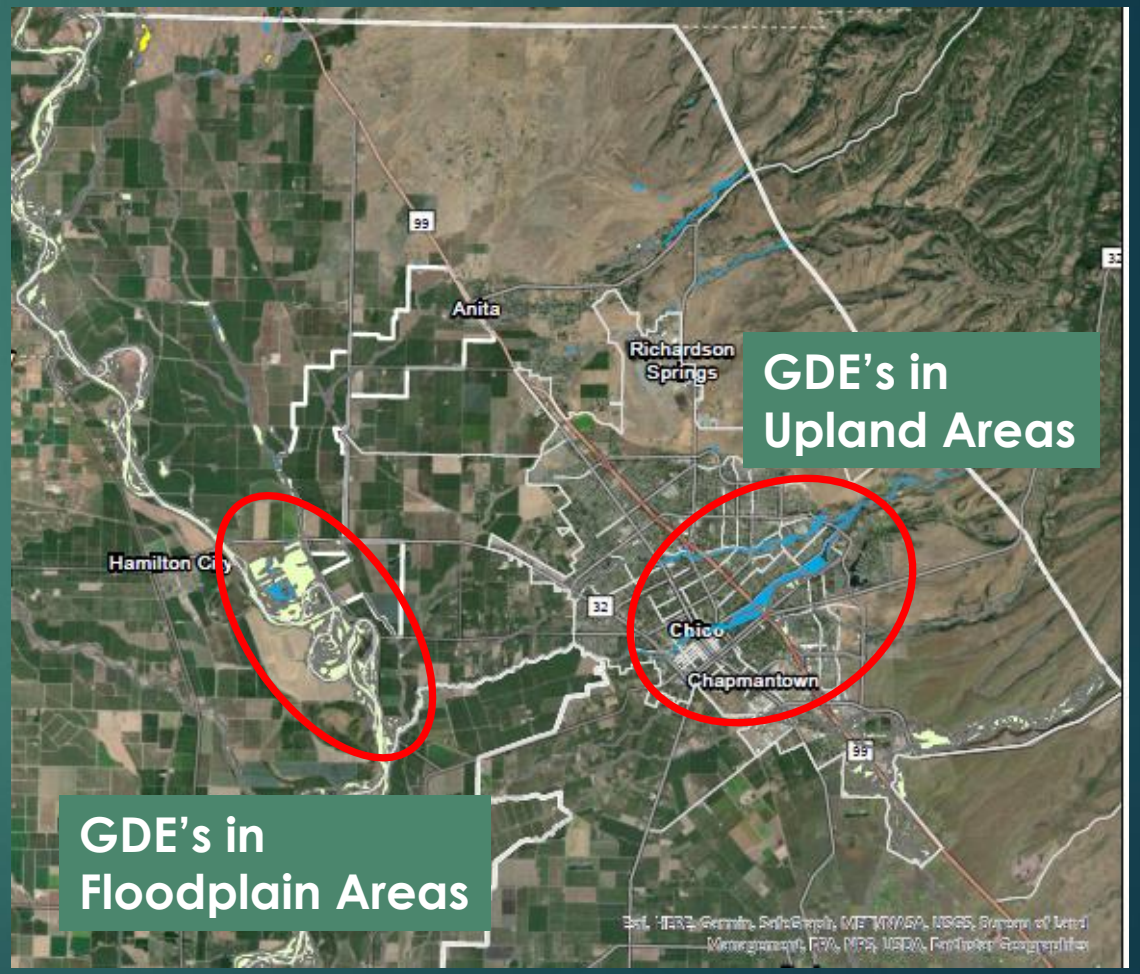
LOWERED WATER TABLE AND/OR REDUCED STREAMFLOW FROM PUMPING THAT IMPACTS GDE'S

SMC for Stream Depletion

1. Stream/Aquifer interaction in upland tributary areas differs from stream aquifer interaction in Sacramento River mainstem

2. Streamflow profiles and groundwater levels in shallow wells adjacent natural stream channels are needed to evaluate depletion, so there are significant data gaps for defining measurable objectives.

3. BBGM Model provides some insight into stream/aquifer dynamics that can help describe a proposed framework for managing this undesirable result.



What can we base SMC on?

BBGM Model

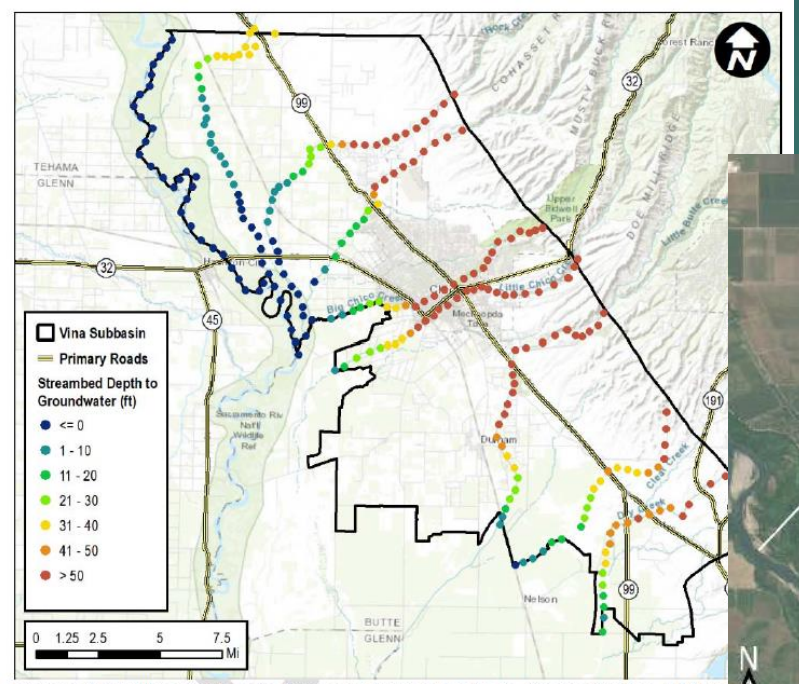
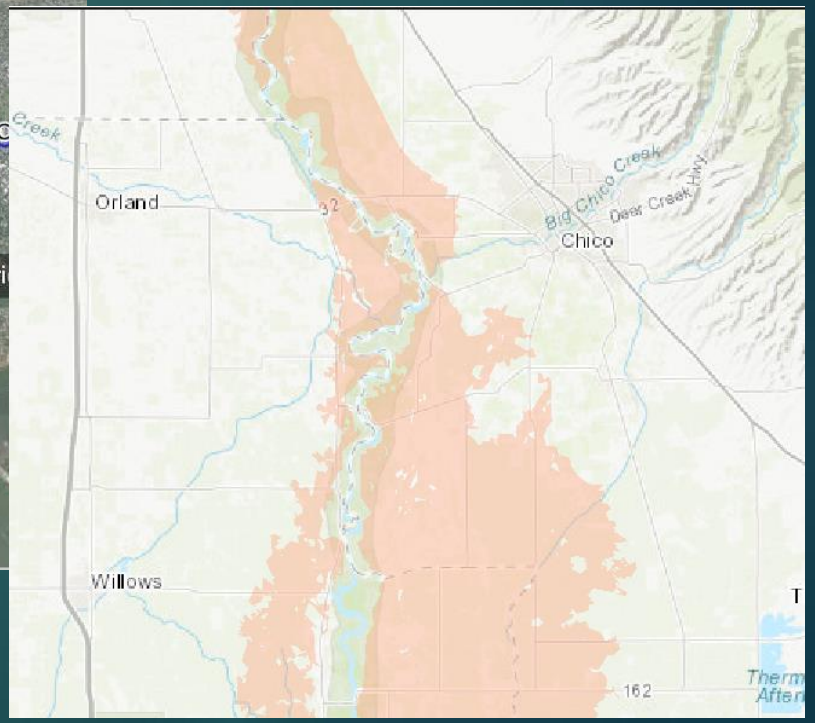


Figure 1-23. Vina Subbasin Average Spring Depth to Groundwater, 2014 to

CSCU Big Chico Streamflow Study (2020)

Floodplain Delineation



BBGM Model

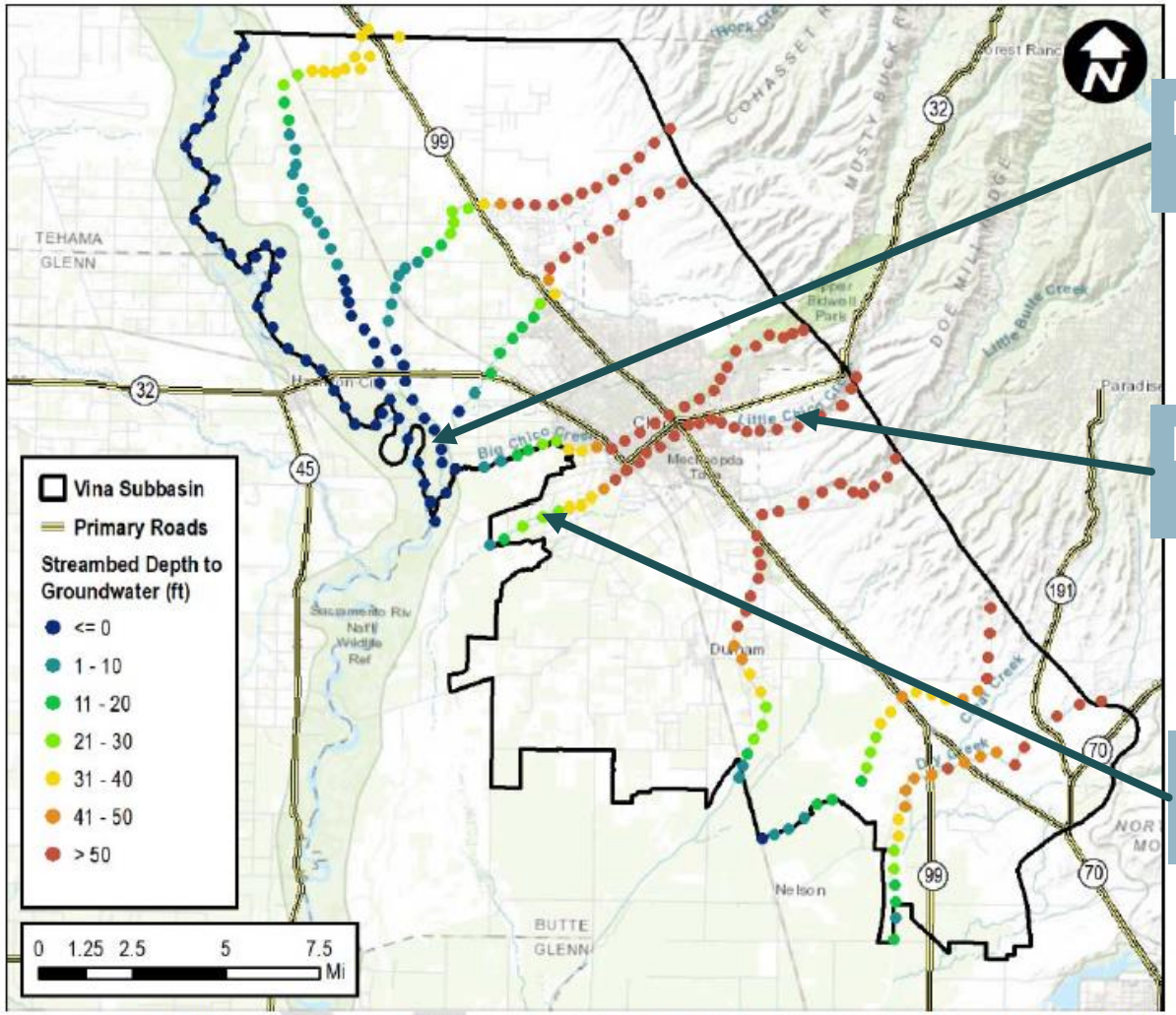


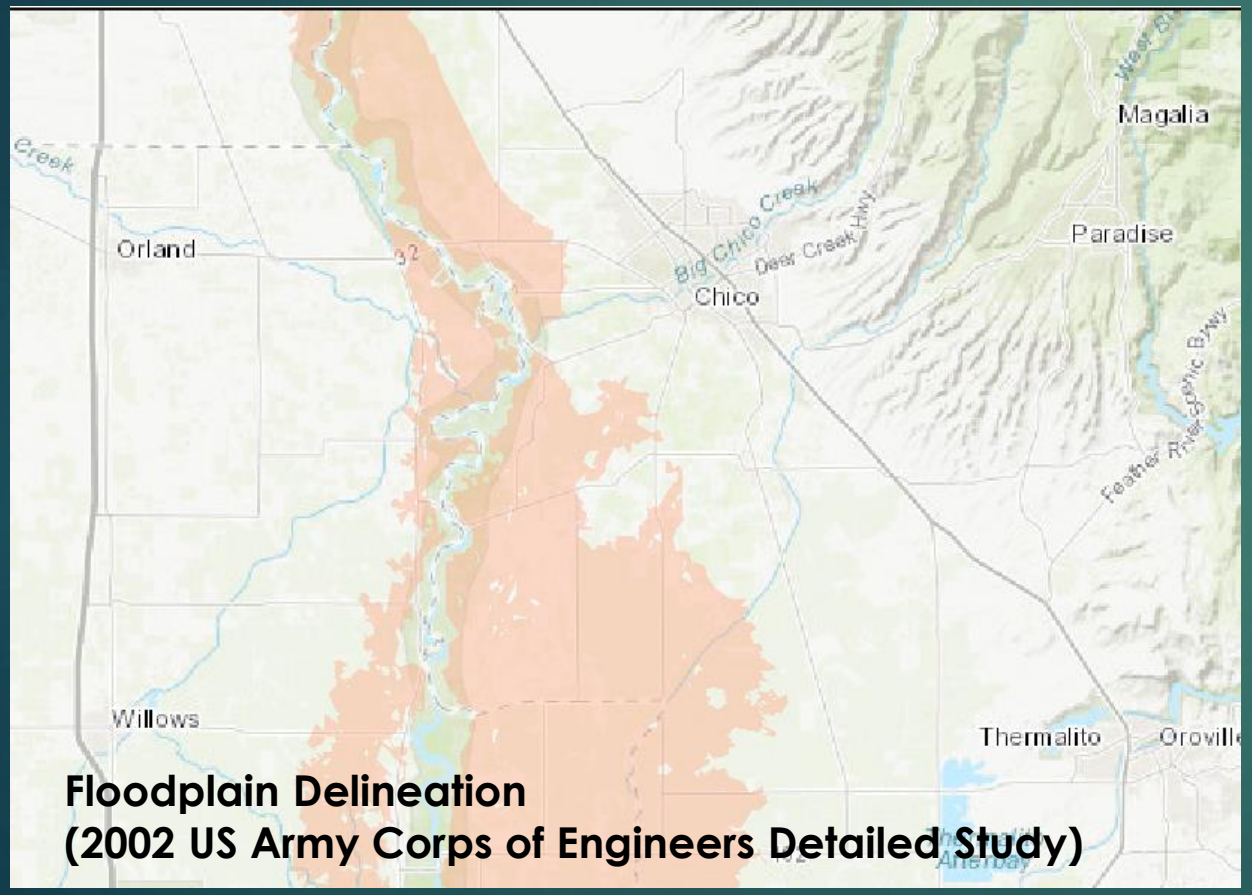
Figure 1-23. Vina Subbasin Average Spring Depth to Groundwater, 2014 to 2018

Blue Dots = Gaining stream
(groundwater is discharging to surface water)

Brown Dots = Losing stream (GW > 50 ft below stream)
(surface water is recharging groundwater)

Green/Yellow Dots = Losing stream
(surface water is recharging groundwater)

BBGM Gaining Stream nodes only in Sacramento River Floodplain



Floodplain Delineation
(2002 US Army Corps of Engineers Detailed Study)

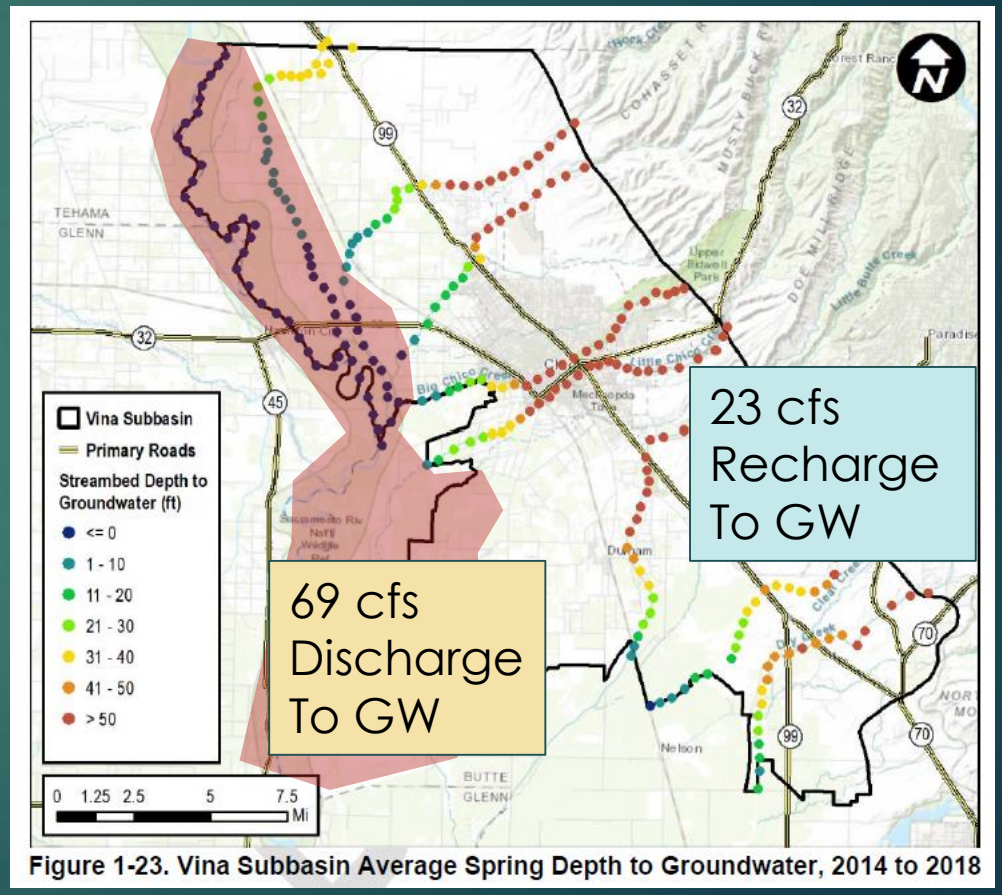
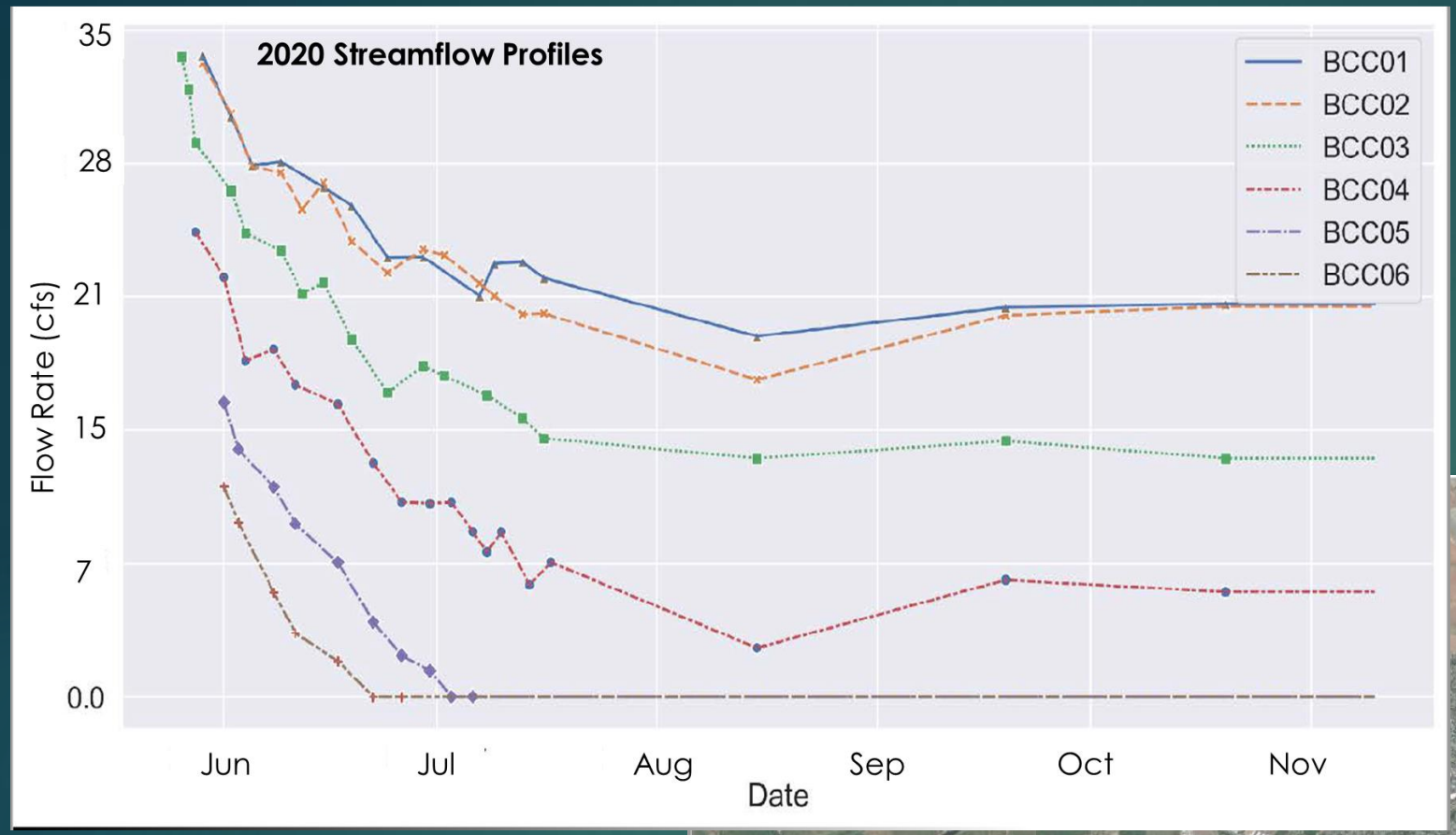


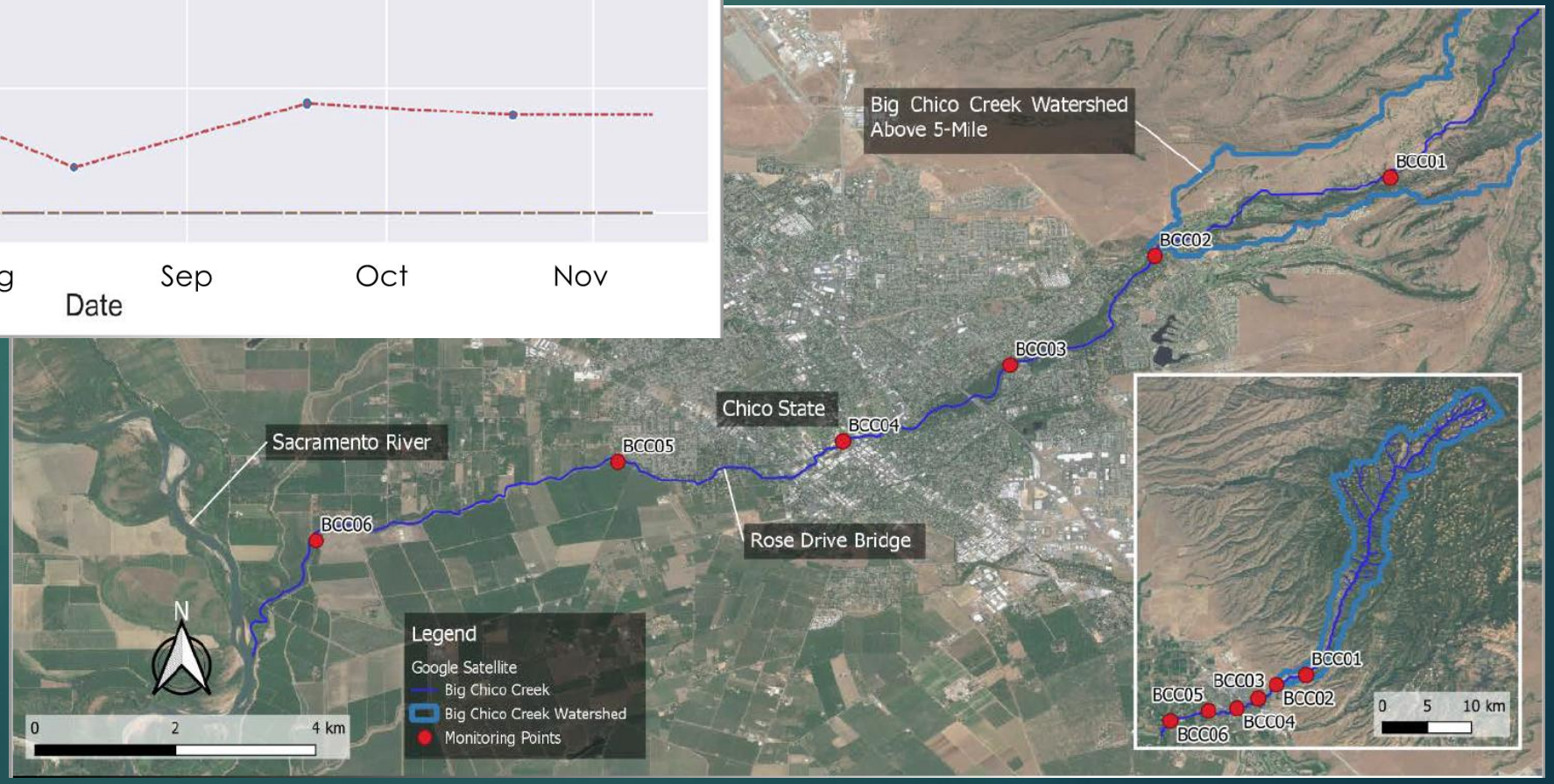
Figure 1-23. Vina Subbasin Average Spring Depth to Groundwater, 2014 to 2018

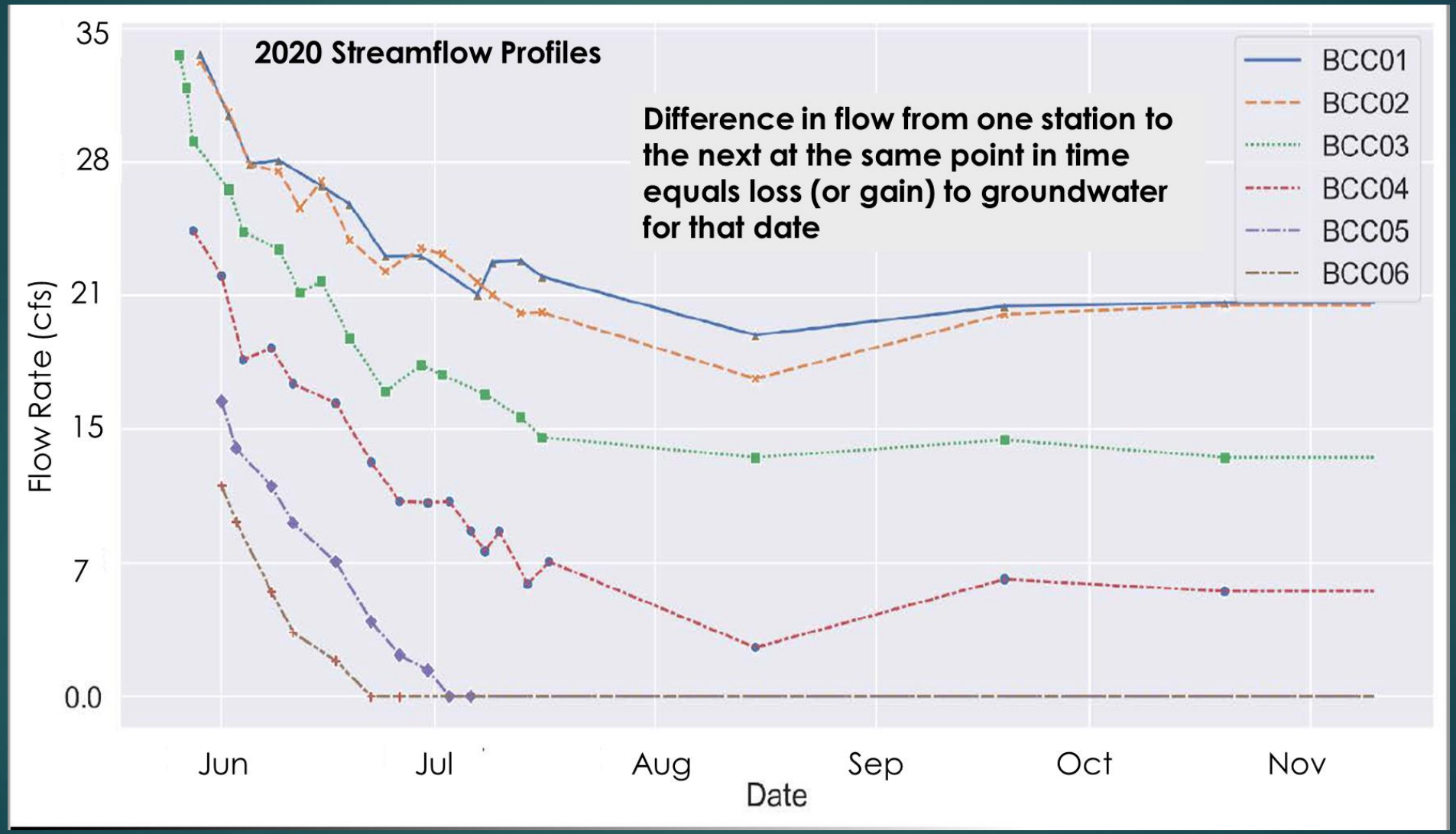
CSCU Big Chico Study (2020)

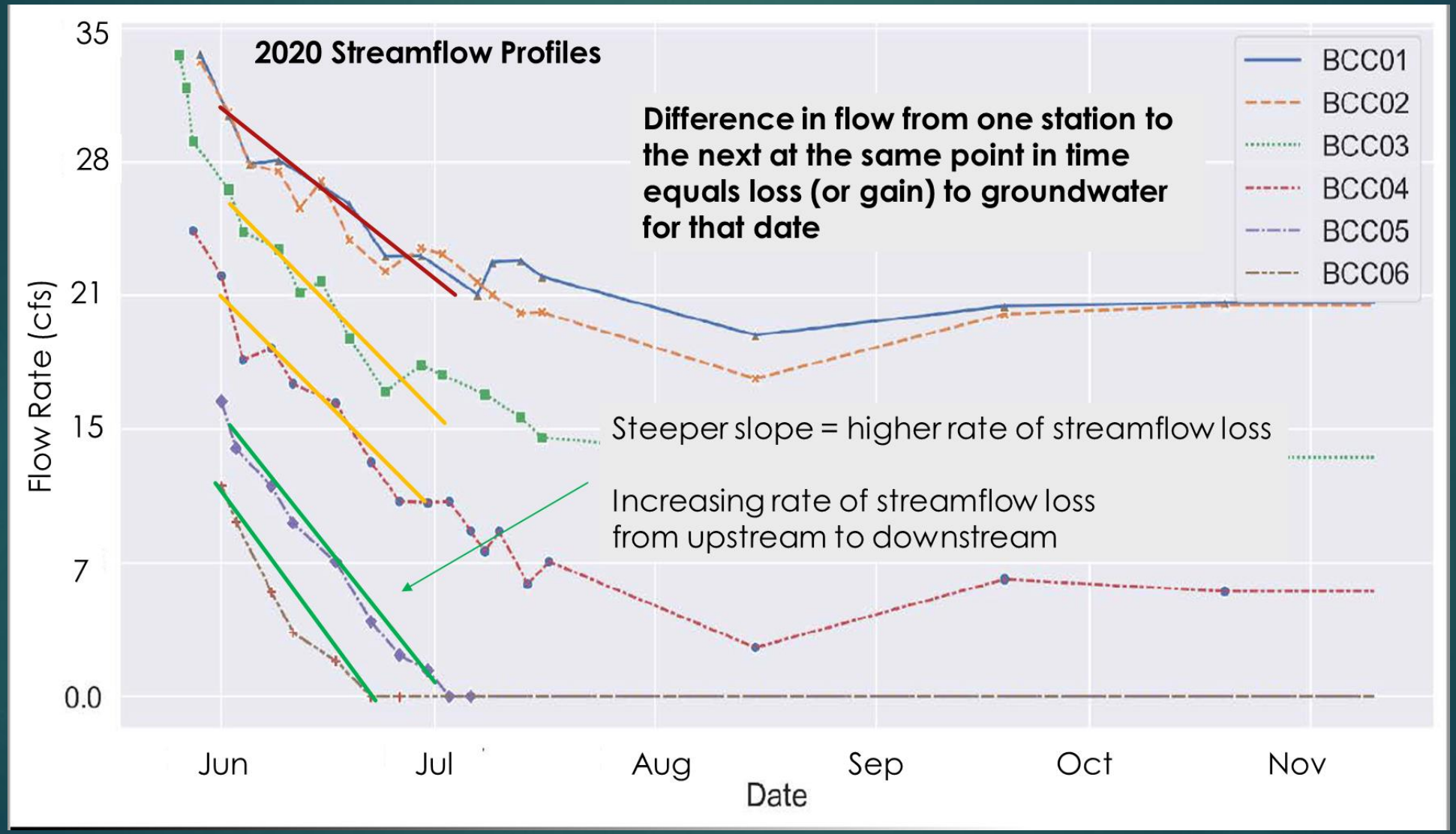

BCC06 in early
June 2020

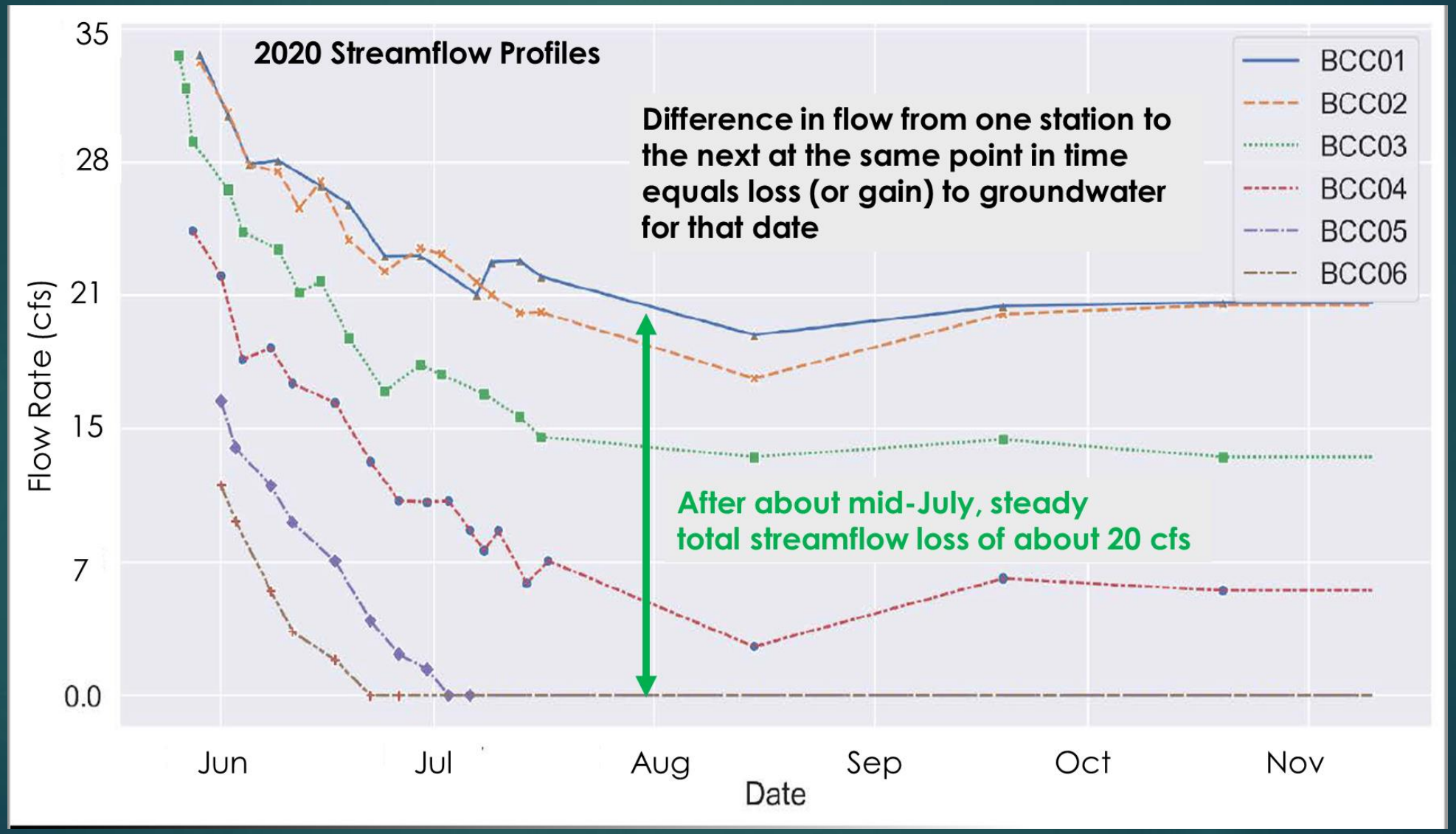

BCC06 in late
June 2020


2020 Streamflow Profiles
BCC01
BCC02
BCC03
BCC04
BCC05
BCC06
Flow Rate (cfs)
35
28
21
15
7
0.0
Jun
Jul
Aug
Sep
Oct
Nov
Date

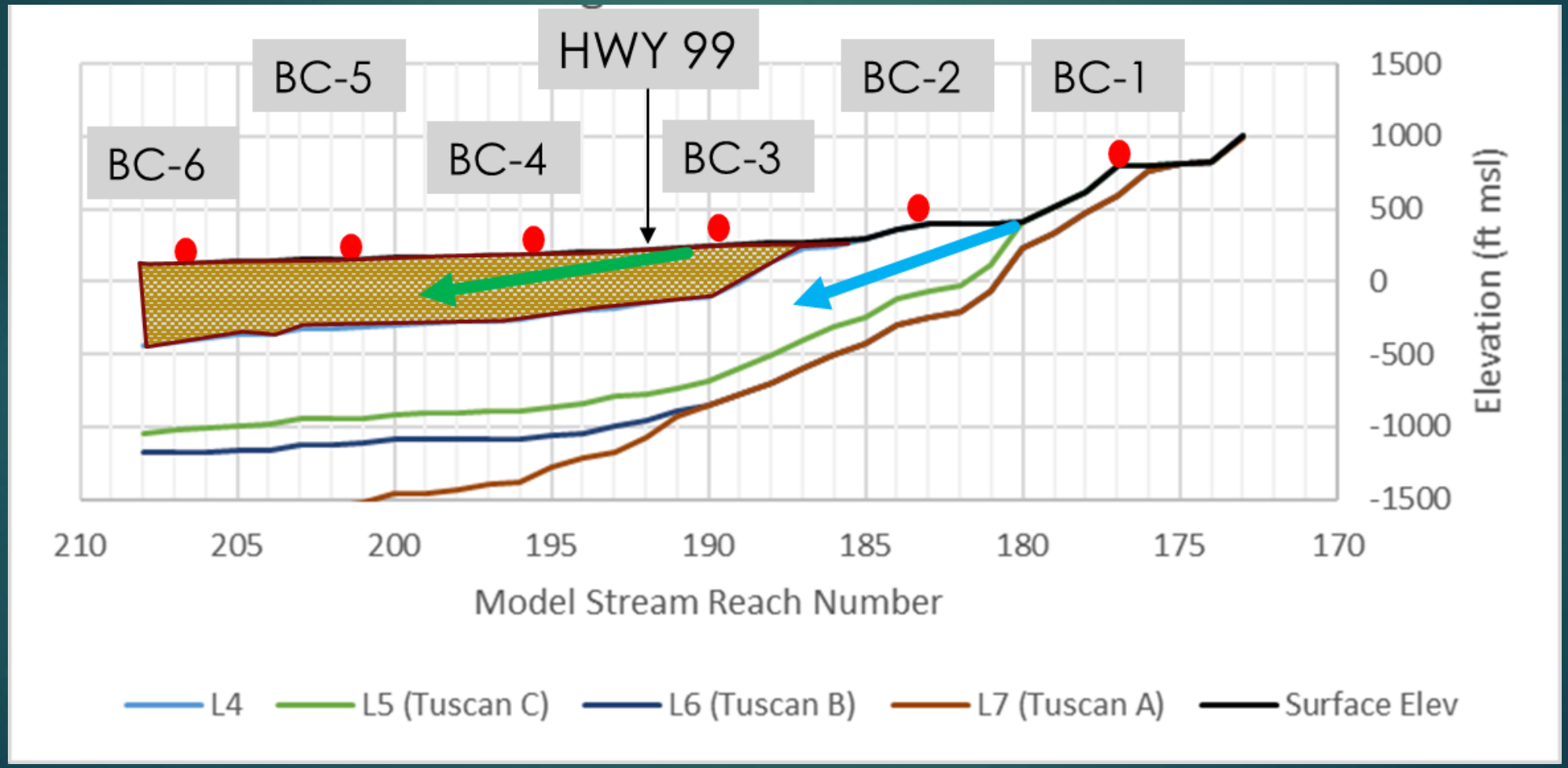

Big Chico Creek Watershed
Above 5-Mile
BCC01
BCC02
BCC03
Chico State
BCC04
BCC05
Sacramento River
BCC06
Rose Drive Bridge
N
Legend
Google Satellite
Big Chico Creek
Big Chico Creek Watershed
Monitoring Points
0
2
4 km
0
5
10 km


2020 Streamflow Profiles
Difference in flow from one station to the next at the same point in time equals loss (or gain) to groundwater for that date
BCC01
BCC02
BCC03
BCC04
BCC05
BCC06
Flow Rate (cfs)
35
28
21
15
7
0.0
Jun
Jul
Aug
Sep
Oct
Nov
Date


2020 Streamflow Profiles
Difference in flow from one station to the next at the same point in time equals loss (or gain) to groundwater for that date
Steeper slope = higher rate of streamflow loss
Increasing rate of streamflow loss from upstream to downstream
BCC01
BCC02
BCC03
BCC04
BCC05
BCC06
Flow Rate (cfs)
35
28
21
15
7
0.0
Jun
Jul
Aug
Sep
Oct
Nov
Date


2020 Streamflow Profiles
Difference in flow from one station to the next at the same point in time equals loss (or gain) to groundwater for that date
After about mid-July, steady total streamflow loss of about 20 cfs
BCC01
BCC02
BCC03
BCC04
BCC05
BCC06
Flow Rate (cfs)
35
28
21
15
7
0.0
Jun
Jul
Aug
Sep
Oct
Nov
Date

BBGM Model along Big Chico



BBGM gaining/losing groundwater

Stream	Monthly Gains from Groundwater (cfs)												Average (cfs)
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Angel Slough	0	0	0	0	0	0	0	0	0	0	0	0	0
Big Chico Creek	-2	-3	-6	-7	-7	-8	-5	-3	-2	-2	-2	-1	-4
Butte Creek	-7	-10	-15	-15	-18	-20	-18	-14	-10	-7	-6	-6	-12
Dry Creek	-1	-1	-3	-2	-2	-2	-1	0	0	0	0	0	-1
Little Chico Creek	-1	-1	-2	-2	-2	-2	-2	-1	-1	-1	-1	-1	-1
Little Dry Creek	-2	-3	-6	-6	-6	-5	-4	-2	-2	-1	-1	-1	-3
Mud Creek	0	0	-1	1	1	2	2	1	1	0	0	0	0
Pine Creek	-1	-2	-4	-1	0	2	3	3	2	1	1	0	0
Rock Creek	-3	-3	-4	-3	-3	-2	-2	-2	-2	-2	-2	-2	-2
Sac River	109	151	24	-44	20	50	181	142	91	13	33	57	69
Singer Creek	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	92	129	-17	-79	-18	15	154	123	76	1	22	46	45

BBGM vs 2020 Big Chico Data

1. Model correctly predicts observed streamflow at gaging site BC01, but underpredicts rate of streamflow loss to groundwater between BC01 and BC06.
   - Observed losses to GW from Big Chico are higher than model prediction
2. Model shows slight increase in rate of streamflow loss in the alluvium (layer 4) versus Tuscan (Layer 5)
   - Model generally underpredicts groundwater levels in Layer 5 beneath the alluvium, which is consistent with higher losses and higher downward flow from L4 to L5
3. Model predicts influence from floodplain (gaining conditions) near BC06.
   - Observed transition to gaining conditions with floodplain influence is not yet defined

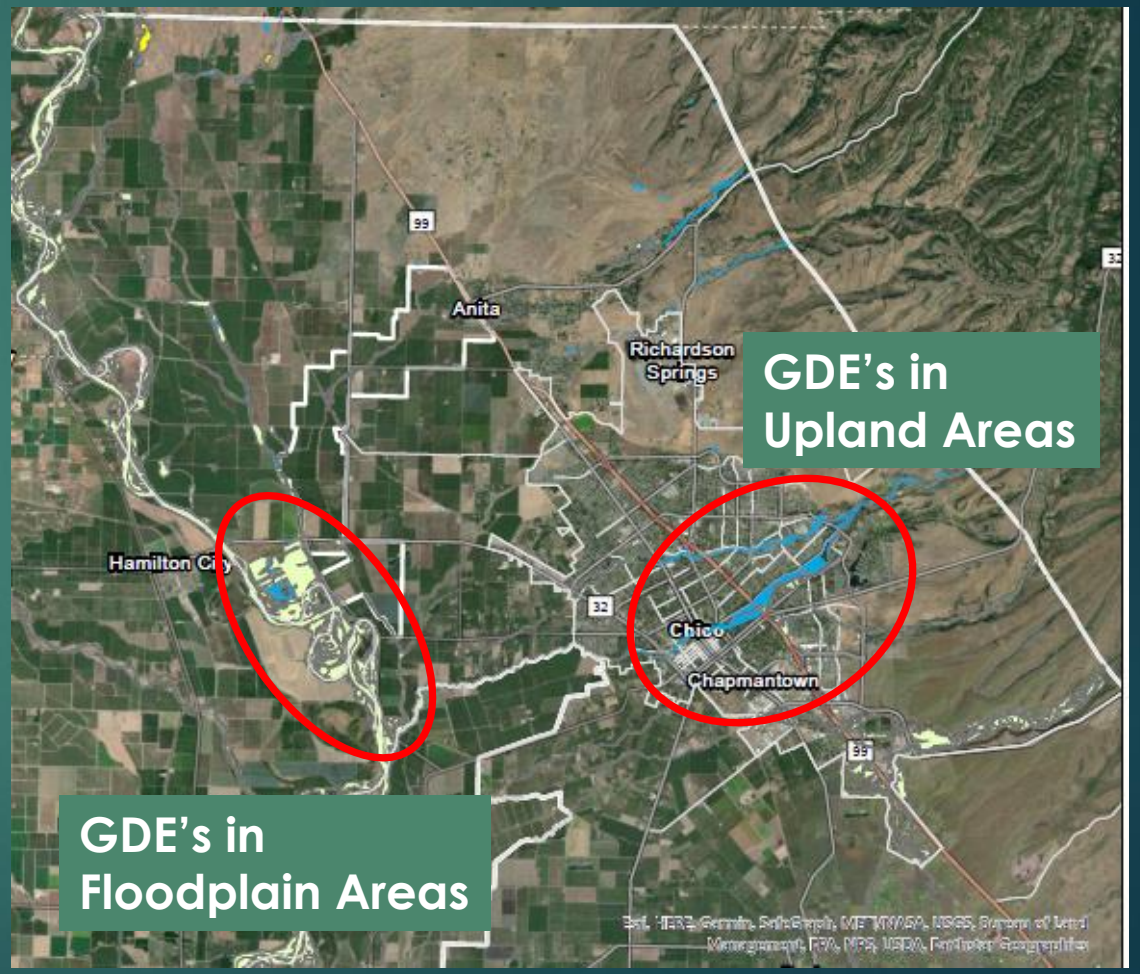
Model is doing the right thing, but in the wrong quantities

What does this mean for setting SMC?

SMC for Upland Stream Depletion/GDE's

GDEs in upland areas:

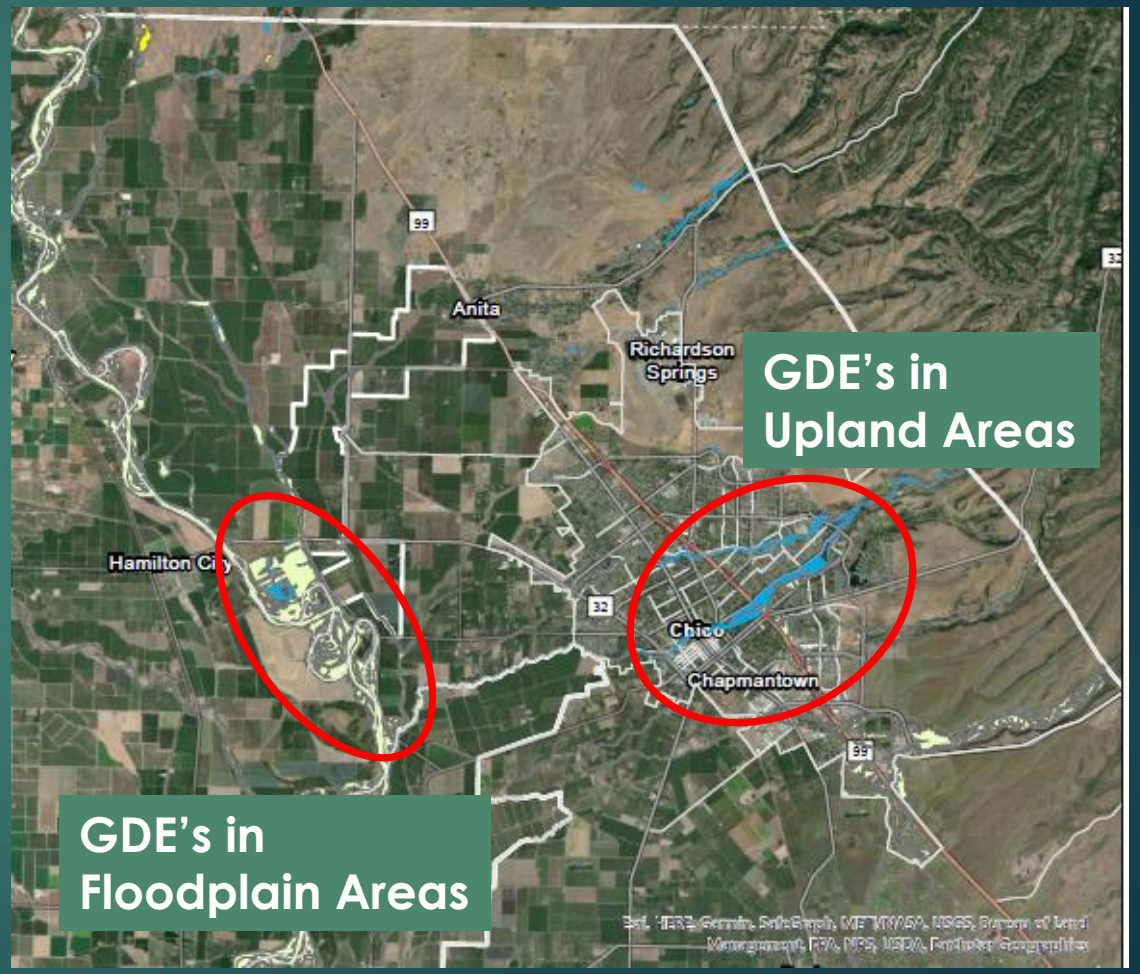
- May be "dependent" on losses upland streams, but if those streams are losing, reductions in GW pumping will not affect the rate of streamflow loss
- GDEs are influenced more by shallow, near-surface channel dynamics (flood frequency, hyporheic zone, soil moisture, and riparian uptake)



SMC for Upland Stream Depletion/GDE's

SMC for upland areas - TBD:

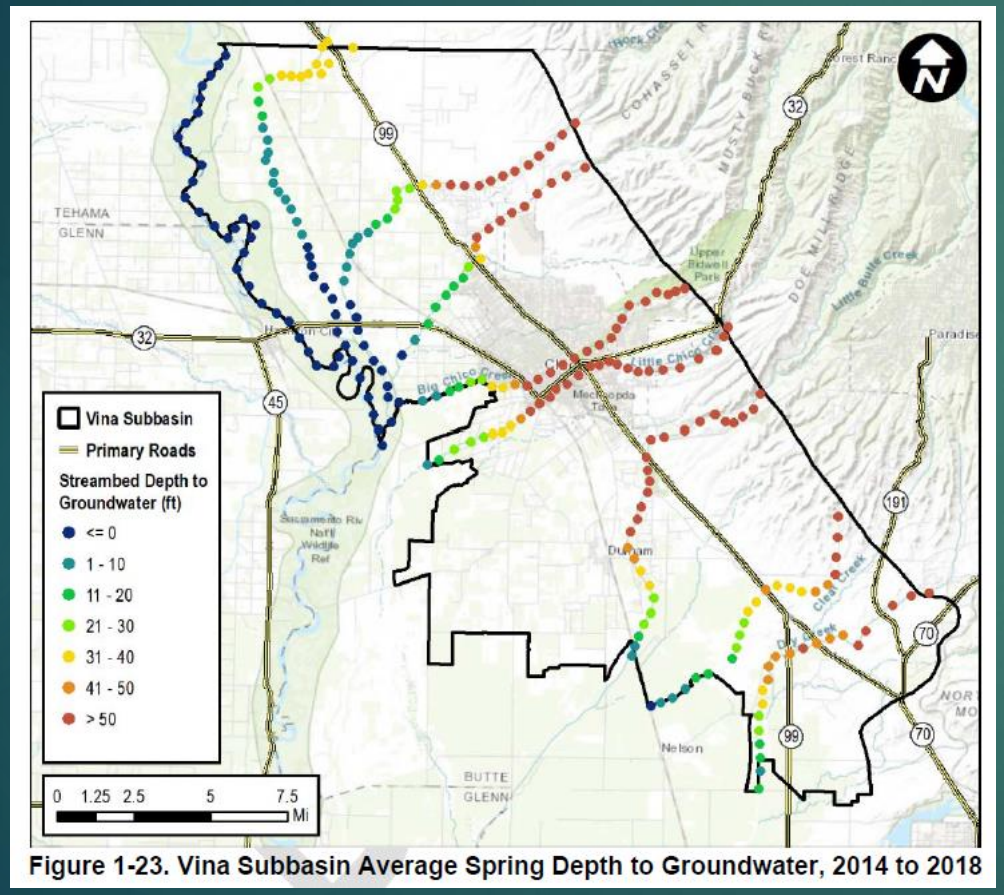
- Groundwater connected to upland streams that are shown to be losing along their entirety will not be assigned MO/MT
- Groundwater connected to upland streams that are shown to have one or more gaining reaches will be assigned specific MO/MT values based on site specific stream/aquifer dynamics
- Further investigation of near surface stream/GDE dynamics in upland areas is warranted.



Depletion of Interconnected Surface Water Upland Areas

Undesirable Results and Sustainability Criteria	
Undesirable Result Statement	• Surface water depletion caused by groundwater pumping prevents beneficial uses over a sustained period. This includes environmental beneficial uses in natural stream channels that supports a viable ecosystem, particularly ecosystems containing endangered species. • Surface water depletion in streams containing Groundwater Dependent Ecosystems (GDEs) is the first priority
Minimum Threshold (onset of undesirable result) and Measurable Objective (desired condition)	• Groundwater connected to upland streams that are shown to be losing along their entirety will not be assigned MO/MT • Groundwater connected to upland streams that are shown to have one or more gaining reaches will be assigned specific MO/MT values based on site specific stream/aquifer dynamics
Quantitative definition of significant and unreasonable impact	• >10% reduction in GDE species resulting from pumping within the GSA

SMC for Floodplain GDE



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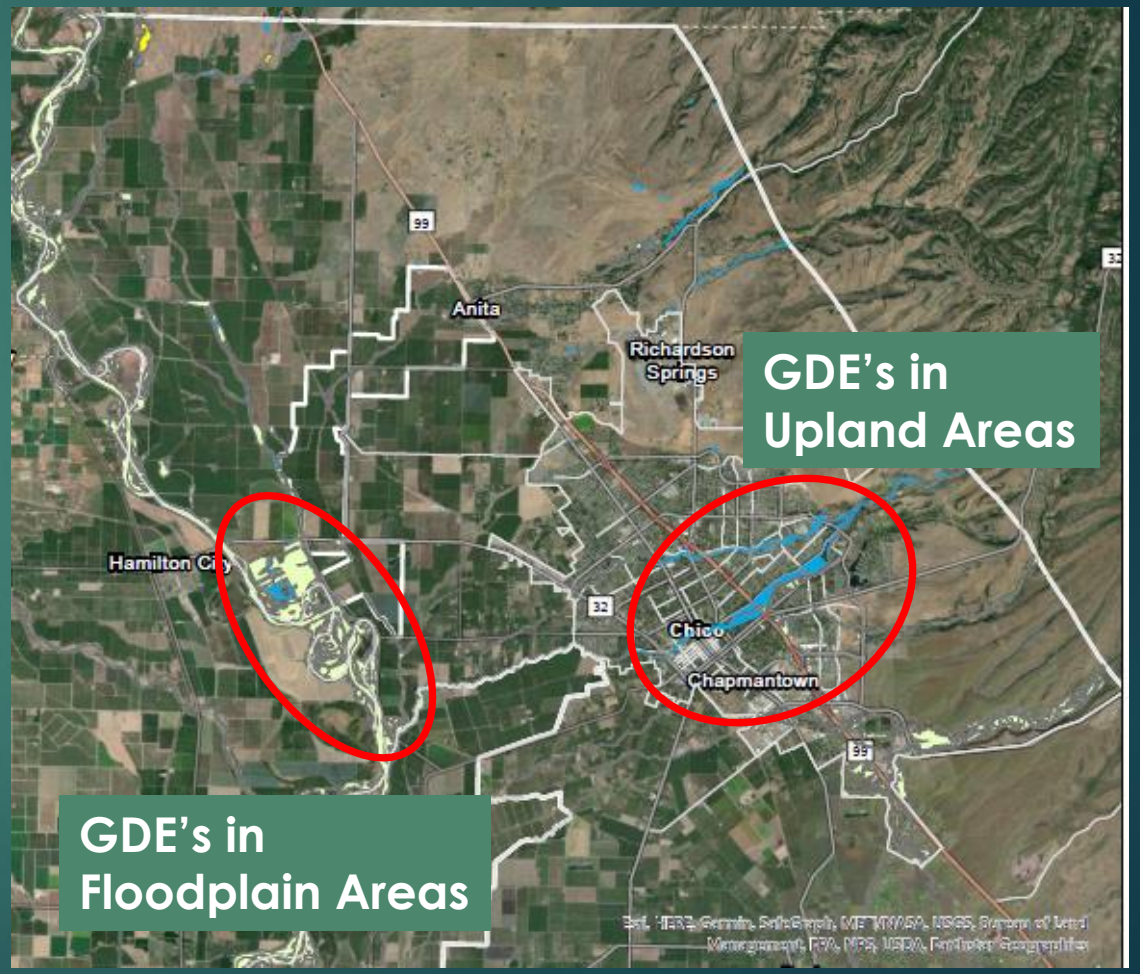
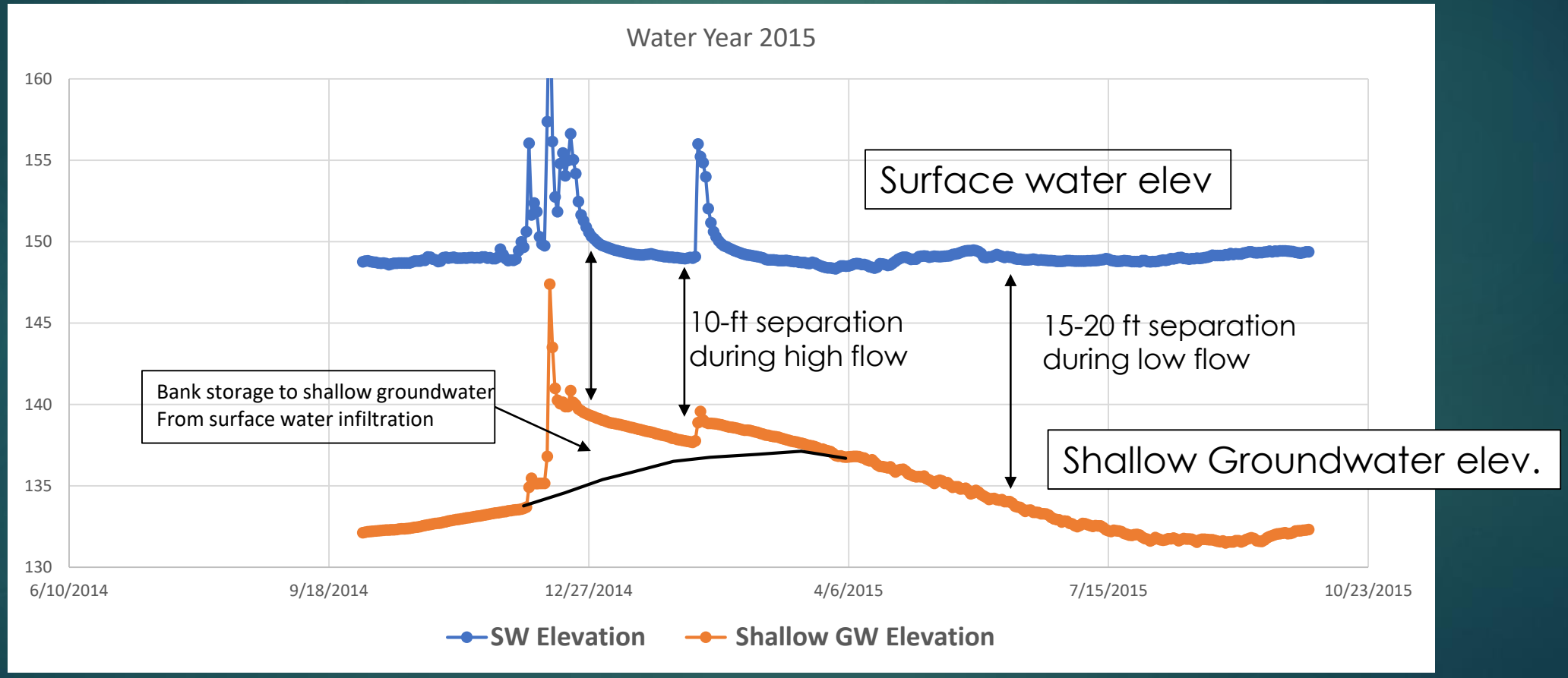


High flow surface water infiltration from Sacramento River



BBGM gaining/losing groundwater

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Mud Creek	0	0	-1	1	1	2	2	1	1	0	0	0	0
Pine Creek	-1	-2	-4	-1	0	2	3	3	2	1	1	0	0
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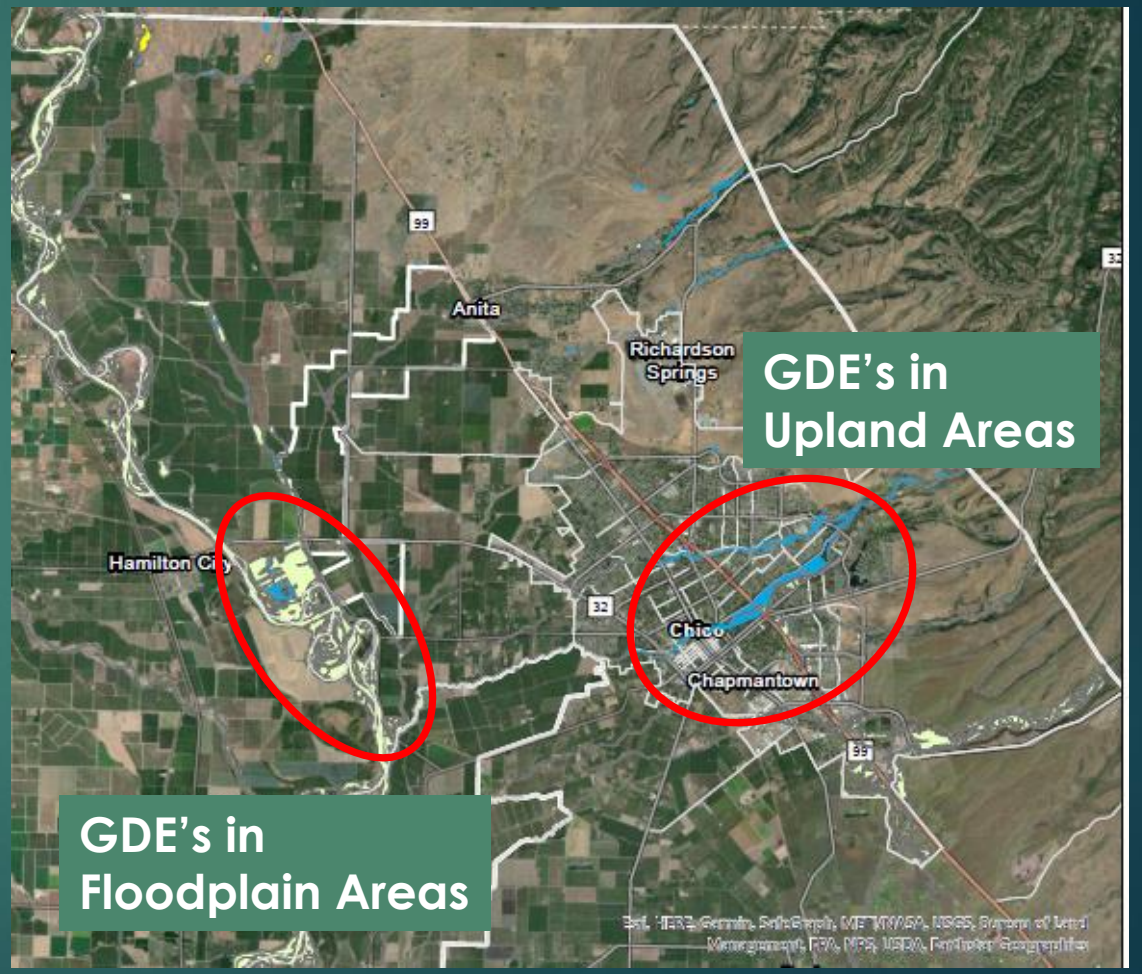
Sac River	109	151	24	-44	20	50	181	142	91	13	33	57	69
Singer Creek	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	92	129	-17	-79	-18	15	154	123	76	1	22	46	45

SMC for Stream Depletion/GDE's in Floodplain areas

GDEs in floodplain areas:

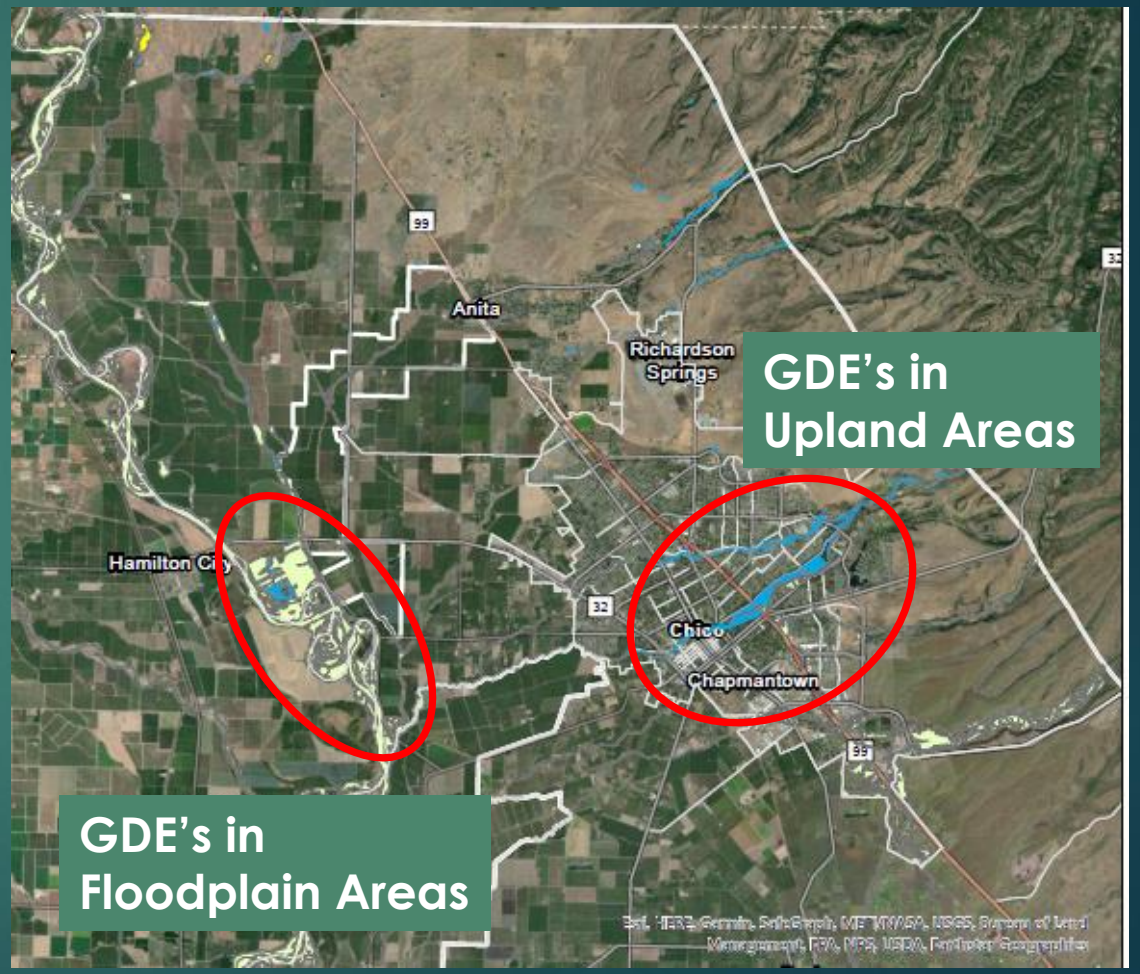
- May be "dependent" on gains from groundwater, but those gains are <10% of in-channel flow
- Groundwater pumping may be affecting discharge, but is less than <10% in-channel flow
- More likely to be connected to shallow, near-surface floodplain dynamics (flood frequency, hyporheic zone, soil moisture, and riparian uptake).



SMC for Floodplain Depletion/GDE's

SMC for Floodplain areas - TBD:

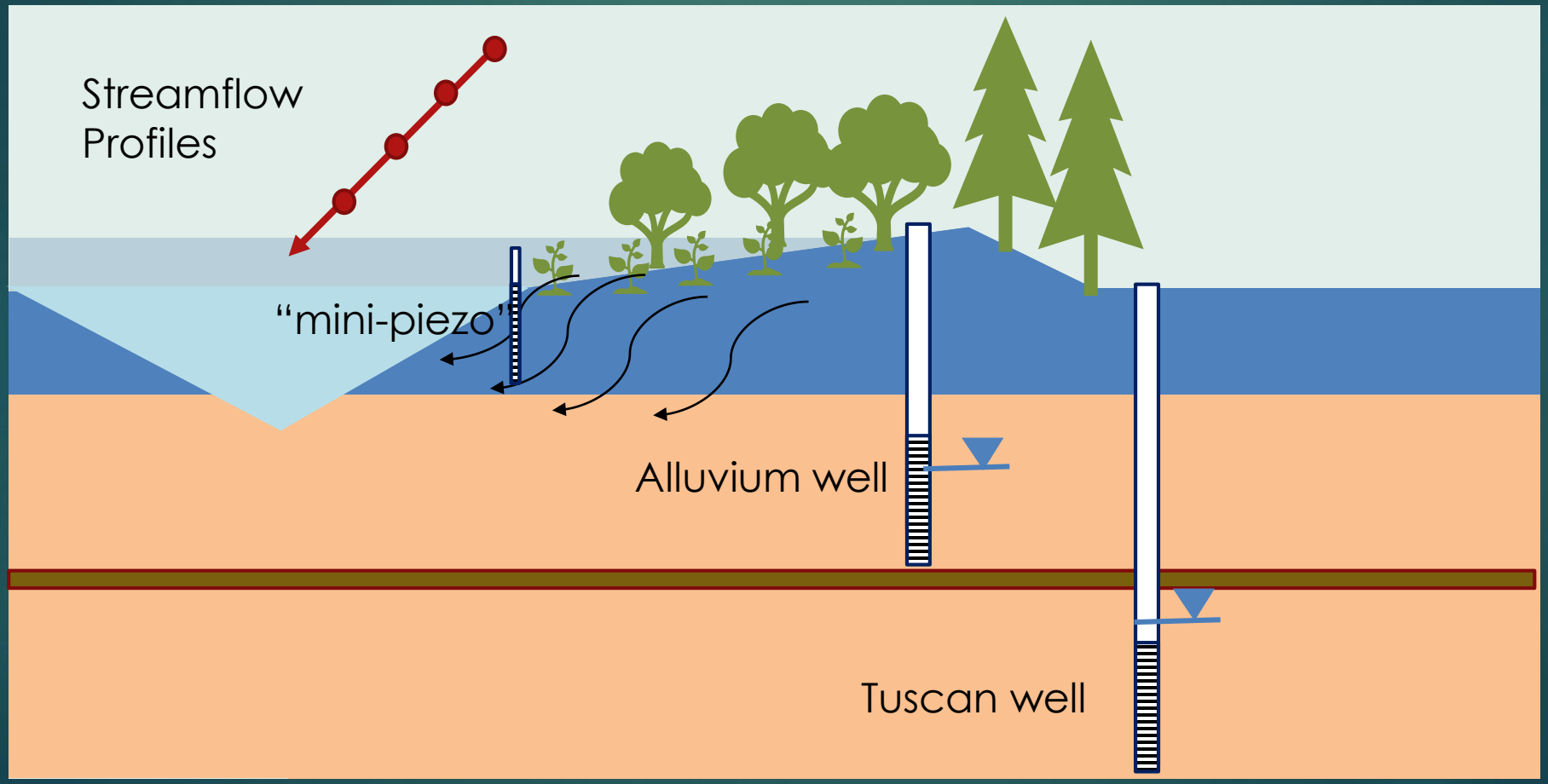
- If cumulative groundwater discharge is <10% of streamflow in Sacramento River, no MO/MT will be assigned
- Stream reaches shown to have >10% of streamflow from groundwater discharge will be assigned specific MO/MT values based on site specific stream/aquifer dynamics
- Further investigation of near surface stream/GDE dynamics in upland areas is warranted, but lower priority than uplands



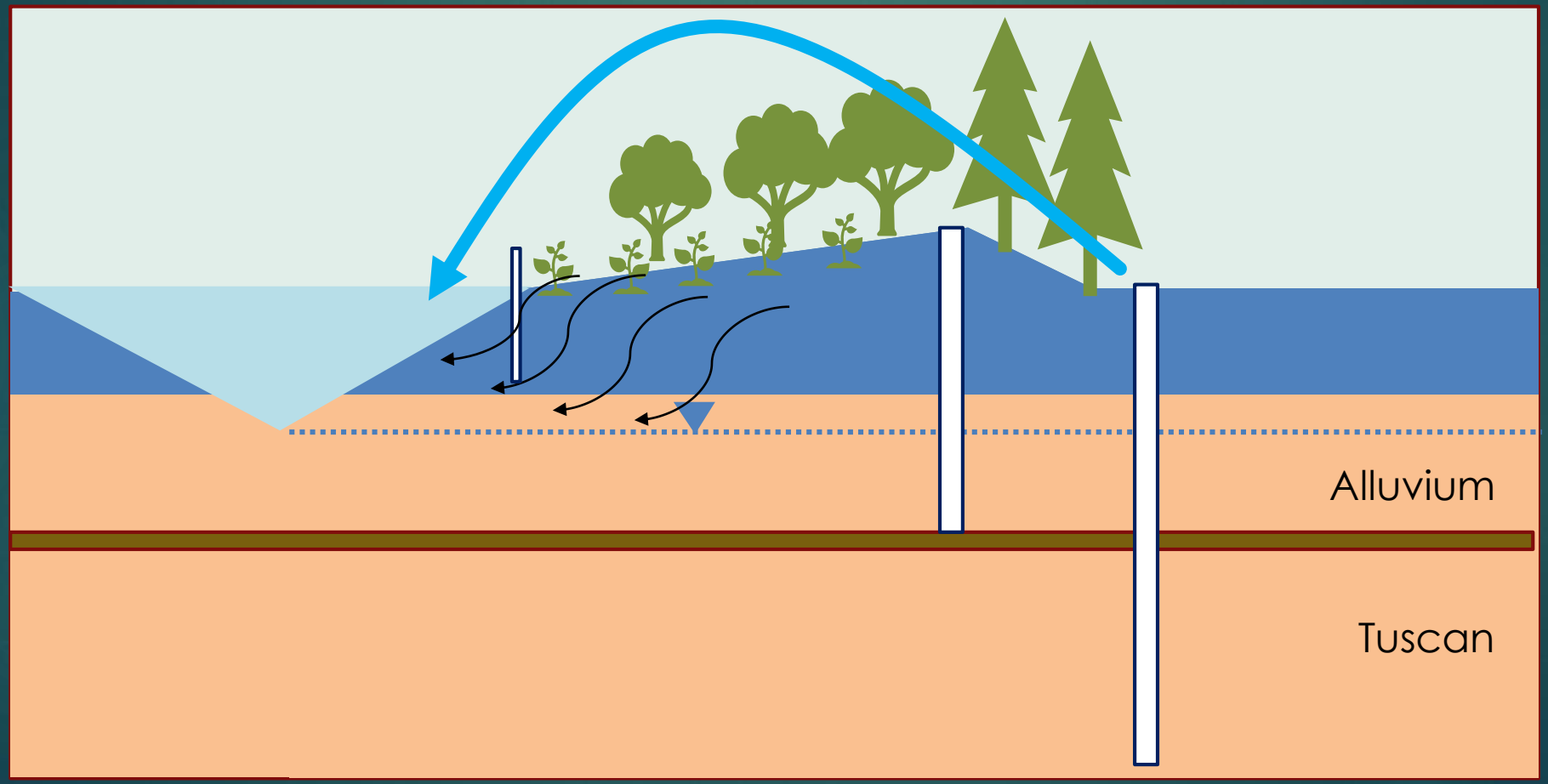
Depletion of Interconnected Surface Water Floodplain Areas

Undesirable Results and Sustainability Criteria	
Undesirable Result Statement	• Surface water depletion caused by groundwater pumping prevents beneficial uses over a sustained period. This includes environmental beneficial uses in natural stream channels that supports a viable ecosystem, particularly ecosystems containing endangered species. • Surface water depletion in streams containing Groundwater Dependent Ecosystems (GDEs) is the first priority
Minimum Threshold (onset of undesirable result) and Measurable Objective (desired condition)	• If cumulative groundwater discharge is <10% of streamflow in Sacramento River, no MO/MT will be assigned. • Stream reaches shown to have >10% of streamflow from groundwater discharge will be assigned specific MO/MT values based on site specific stream/aquifer dynamics.
Quantitative definition of significant and unreasonable impact	• >10% reduction in GDE species resulting from pumping within the GSA

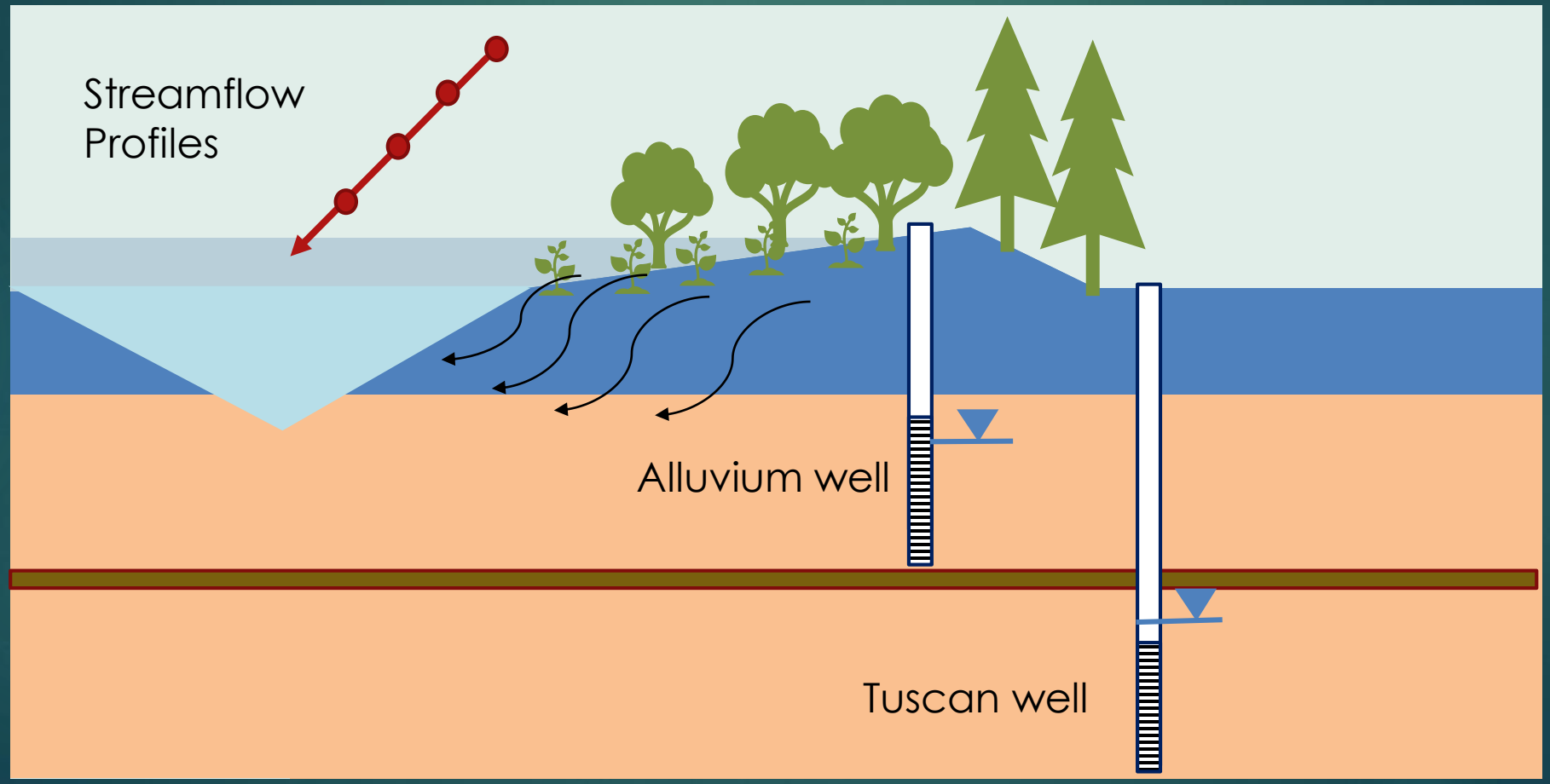
Framework for Investigating Upland Stream/Aquifer Interaction and GDEs



Potential PME for Upland GDE's. Unrelated to "impacts" from GW



Framework for Investigating Floodplain Interaction and GDEs

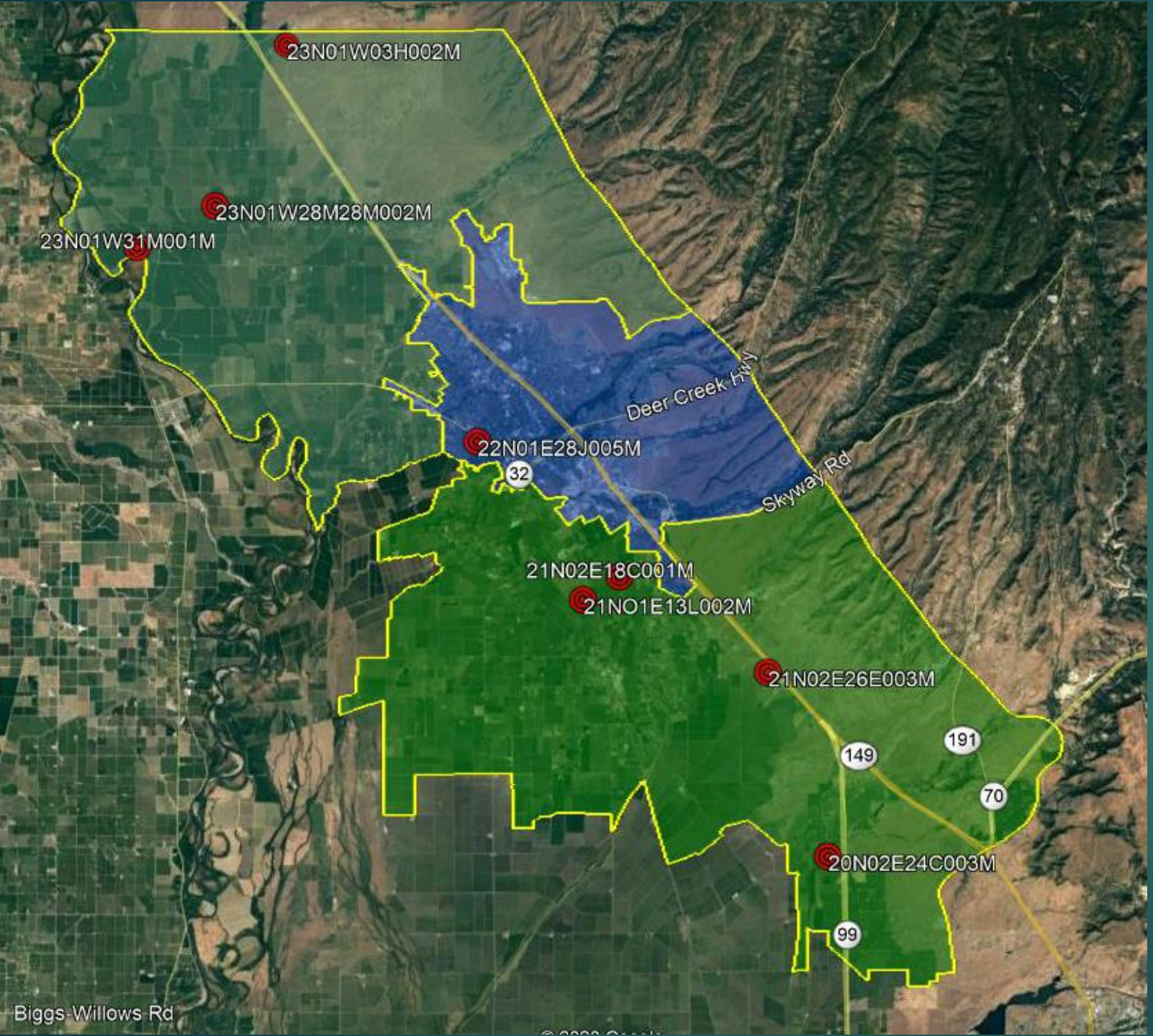


Degraded Groundwater Quality

Degraded Groundwater Quality

Undesirable Results and Sustainability Criteria	
Undesirable Result Statement	• Water quality is below State Maximum Contaminant Levels (MCLs) or thresholds for agricultural productivity as a result of groundwater pumping. • Salinity will be used as a proxy for overall water quality. • Other programs and agencies are responsible for enforcing groundwater quality violations. GSA will coordinate with other agencies if water quality degradation is associated with groundwater pumping
Minimum Threshold (onset of undesirable result) and Measurable Objective (desired condition)	• Minimum Threshold – 1,600 µS/cm – Upper SMCL • Measurable Objective – 900 µS/cm – Secondary MCL (SMCL)
Quantitative definition of significant and unreasonable impact	• 25 % of representative monitoring wells fall below minimum threshold for 2 consecutive years

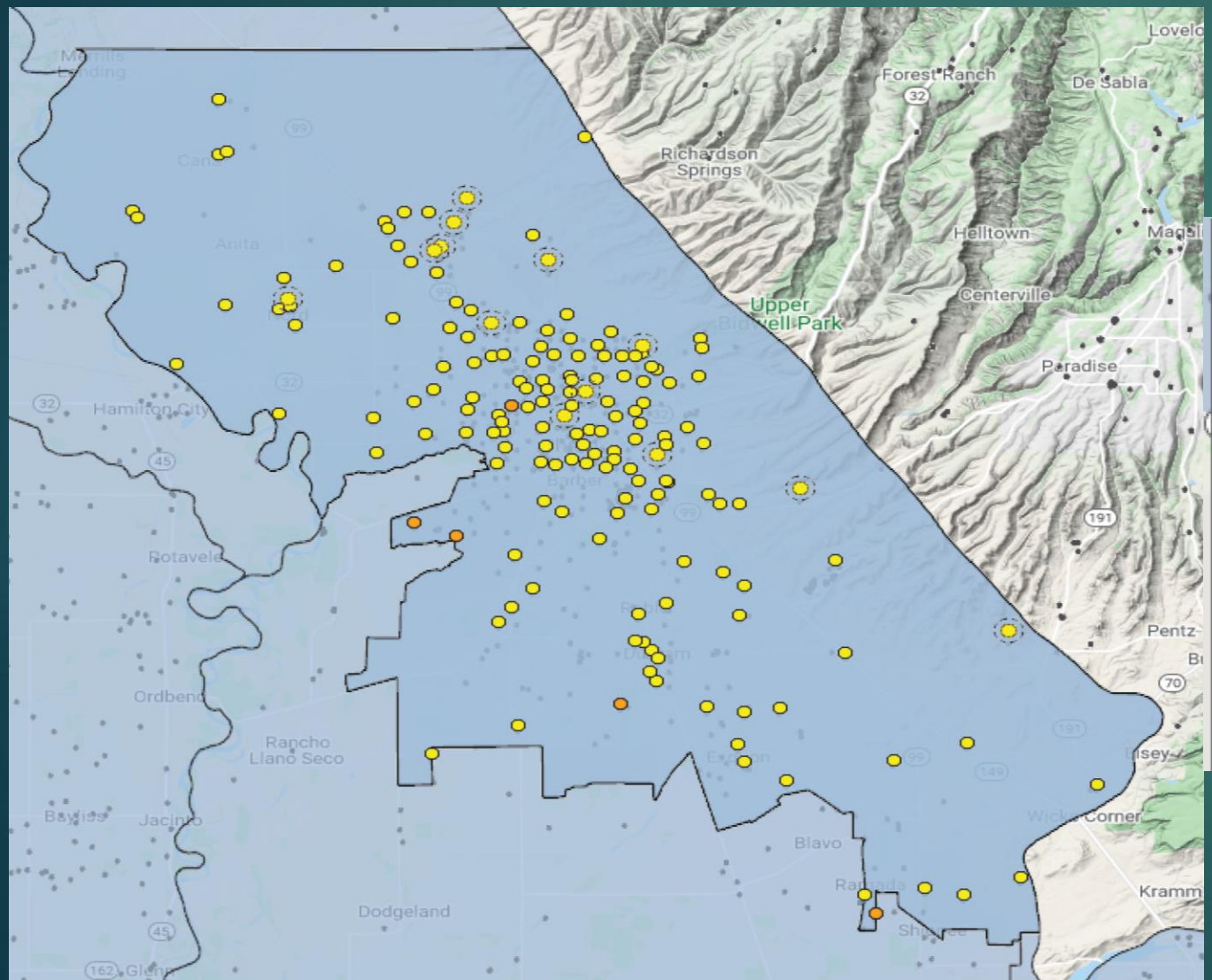
Representative Monitoring Wells For Groundwater Quality



RMS Wells – Groundwater Quality

RMS Wells: Minimum Threshold Water Quality Based on California Upper Secondary Maximum Contaminant Level (SMCL) For Specific Conductance									
RMS Well Identifying Information						These are reported values from proposed RMS Wells that are completed at depth in the basin. Values are well below the Measureable Objective.		This value is the California SMCL for Specific Conductance.	This value is the proposed minimum threshold based on the California Upper SMCL for Specific Conductance. Values below this number are acceptable for drinking water.
Station Number	**Management Area**	**Latitude**	**Longitude**	**Top of Screen (Feet BGS)**	**Bottom of Screen (Feet BGS)**	**Sample Date**	**Specific Conductance (uhmos/cm)**	**Measurable Objective (uhmos/cm)**	**Minimum Threshold (uhmos/cm)**
23N01W28M002M	Vina North	39.818611	-121.991111	791	1021	7/22/09	218	900	1600
						1/12/16	215		
23N01W03H002M	Vina North	39.878215	-121.95712	510	540	10/26/10	252		
						5/13/11	252		
						7/16/12	179		
23N01W31M001M	Vina North	39.80318	-122.028398	1020	1030	8/19/08	329		
						5/2/17	364		
22N01E28J005M	Vina Chico	39.731667	-121.864992	740	800	NA	NA		
21N02E18C001M	Vina South	39.681956	-121.797011	780	880	10/5/2010	247		
						7/23/2019	277		
21NO1E13L002M	Vina South	39.67348	-121.814403	735	760	10/22/10	240		
						5/5/11	240		
						7/12/12	231		
21N02E26E003M	Vina South	39.646774	-121.726247	610	620	8/6/2008	216		
						1/12/2016	205		
20N02E24C003M	Vina South	39.579218	-121.697806	484	505	10/14/2008	148		
						7/23/2019	196		

Specific conductance for wells in Vina Subbasin - Data from Geotracter GAMA



DATA SUMMARY

WELLS FOUND	201
WELLS ABOVE COMPARISON (1600 UMHOS/CM - SMCL)	0 (0%)
MAXIMUM CONCENTRATION (UMHOS/CM)	1010

LOCATIONS FOUND	MAX VALUE	
1 WELL - HIGHLIGHT	1010	[ZOOM]
1 WELL - HIGHLIGHT	944	[ZOOM]
1 WELL - HIGHLIGHT	930	[ZOOM]
1 WELL - HIGHLIGHT	930	[ZOOM]
1 WELL - HIGHLIGHT	890	[ZOOM]
1 WELL - HIGHLIGHT	800	[ZOOM]
1 WELL - HIGHLIGHT	791	[ZOOM]

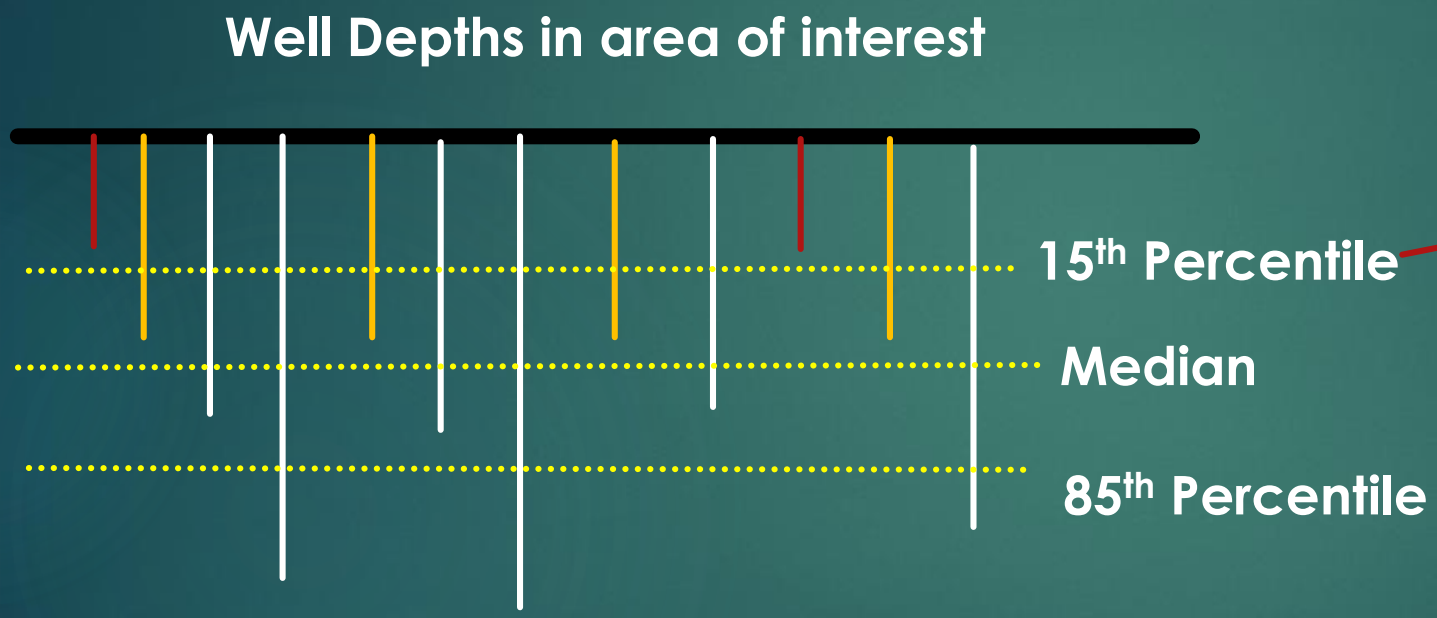
Chronic Lowering of Groundwater Levels

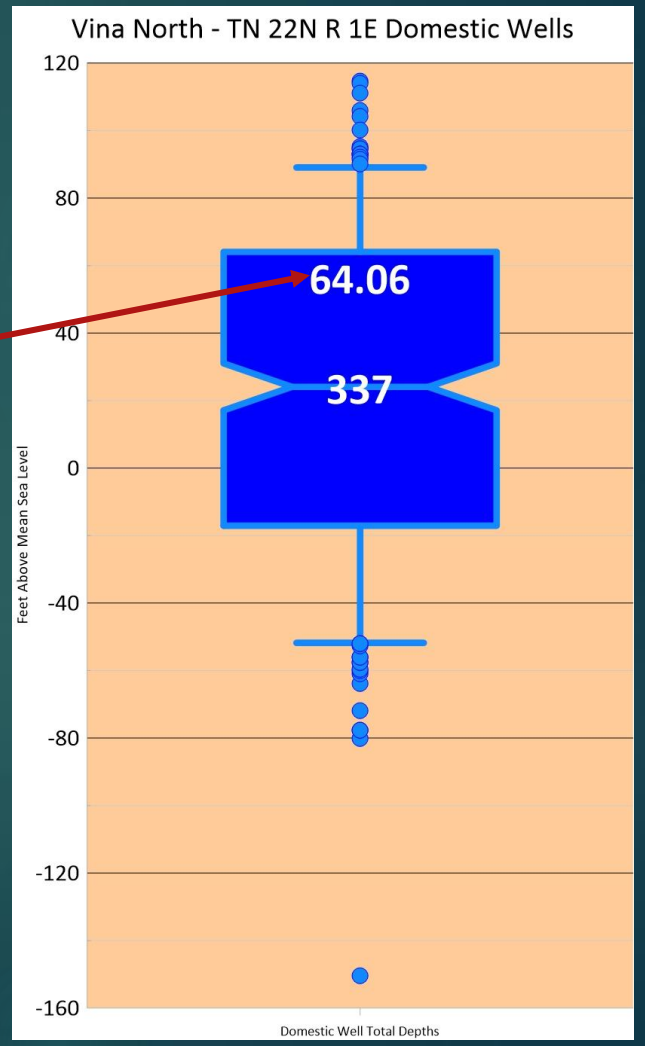
Recap and discussion of MO/MT process and initial quantitative values

Chronic Lowering of Groundwater Levels

Undesirable Results and Sustainability Criteria	
Undesirable Result Statement	• GW Levels are unable to satisfy beneficial uses over a sustained period. Specific examples of undesirable results include domestic wells going dry, reduction in pumping capacity, Increase in pumping costs, Potential impacts to GDEs
Minimum Threshold (onset of undesirable result) and Measurable Objective (desired condition)	• Minimum Threshold – Fall (Sept/Oct) GW level is above the 15th Percentile of all domestic well depths in a given area or sub-area. This means 85% of all domestic wells are completed below the minimum threshold and will be "protected" • Measurable Objective – Fall 2015 groundwater level (or modeled 2015 groundwater level if no data are available). This means dry cycle minimums are no worse than 1993-2015 minimums.
Quantitative definition of significant and unreasonable impact	• 25 % of representative monitoring wells fall below minimum threshold for 2 consecutive years

Box and Whiskers plot is a rank-order analysis of all well depths

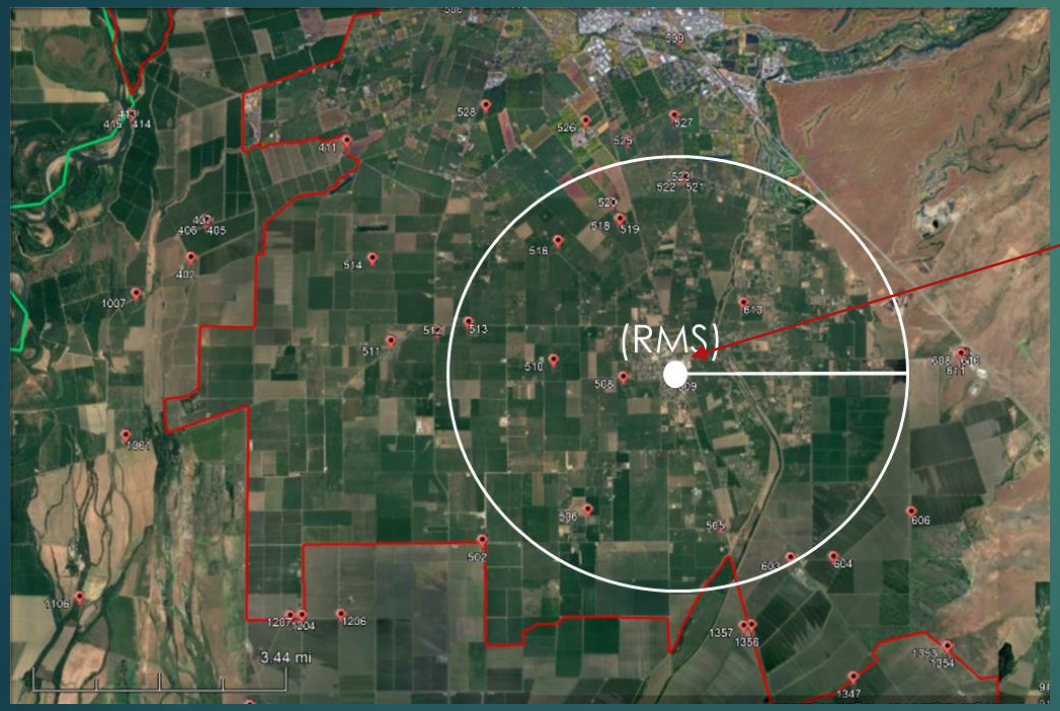


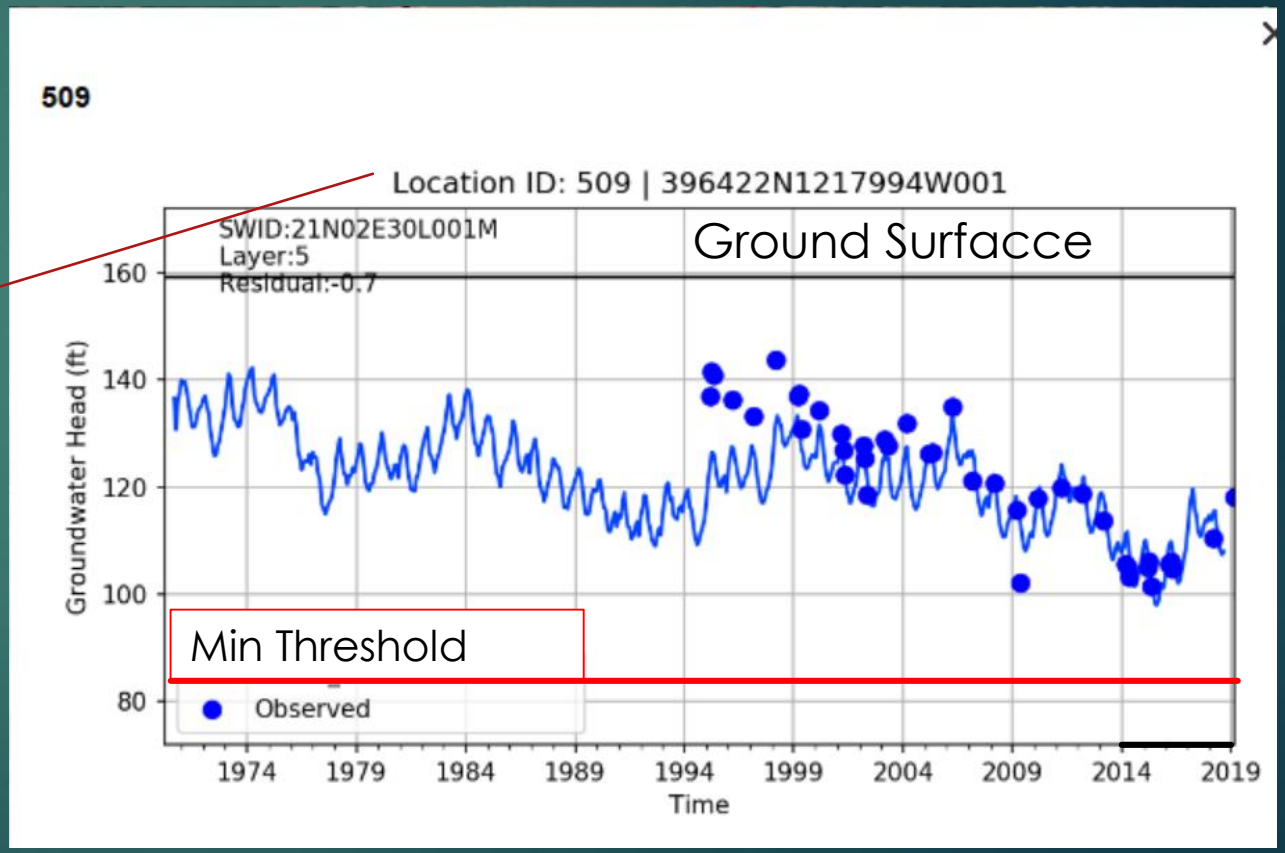


15th percentile depth means 85% of wells are completed below this depth and "protected" by the minimum threshold.

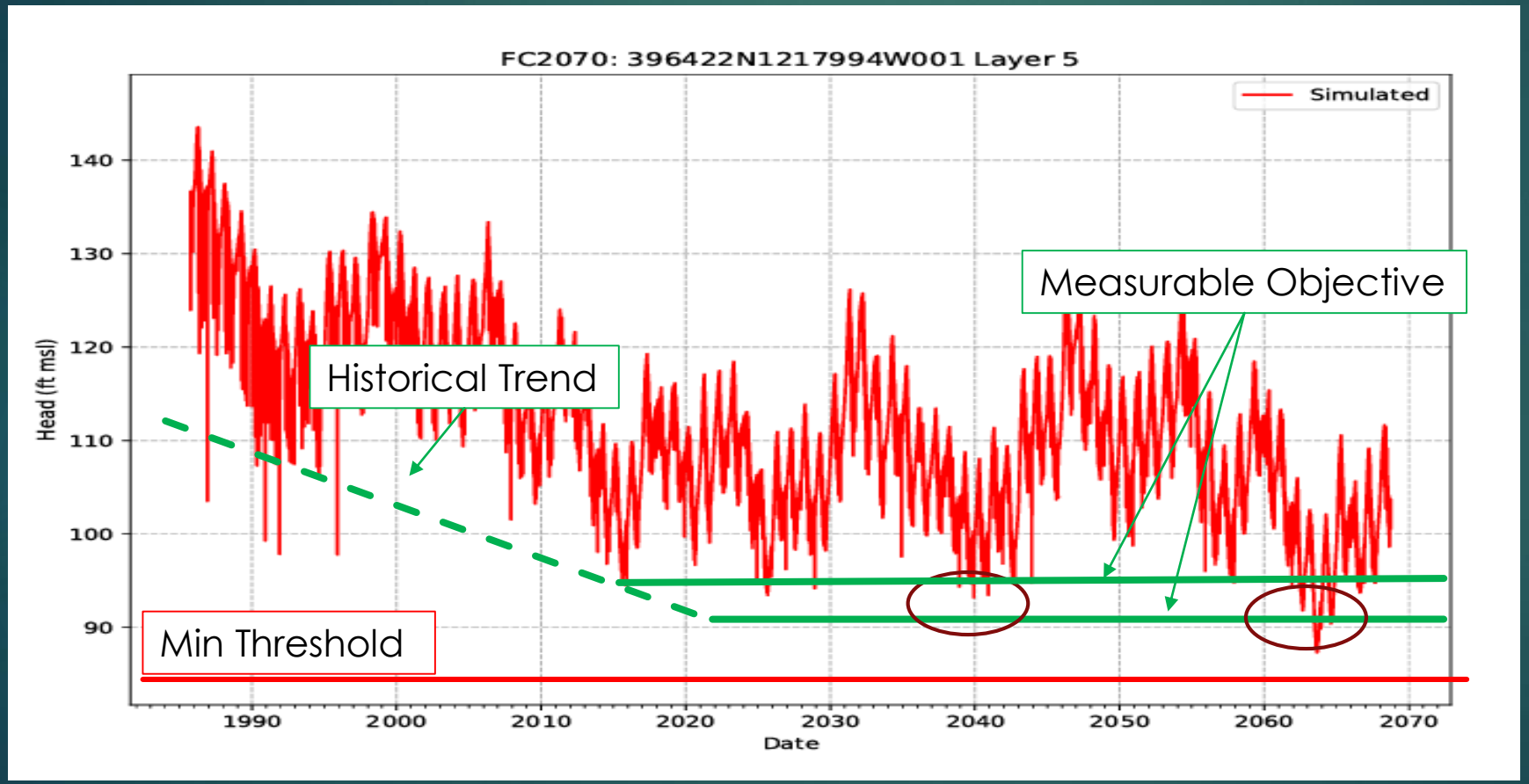
Summary : Domestic well depths set the Minimum Threshold

Chronic Lowering of Groundwater Levels





Model Projection (2020-2070)
Chronic Lowering of Groundwater Levels



Projection based on:

1. 2030 Butte Co. General Plan land use
2. CalWater 2050 Urban water demands
3. Historical hydrology wit DWR central tendency for 2070 climate projection

THANK YOU

Reduction in Aquifer Storage

Undesirable Results and Sustainability Criteria	
Undesirable Result Statement	• Total groundwater storage volume is insufficient to satisfy beneficial uses. • Groundwater level will be used as a proxy for aquifer storage (i.e. groundwater storage will not be calculated explicitly)
Minimum Threshold (onset of undesirable result) and Measurable Objective (desired condition)	• Minimum Threshold – Fall (Sept/Oct) GW level is above the 15th Percentile of all domestic well depths in a given area or sub-area. This means 85% of all domestic wells are completed below the minimum threshold "will be protected" • Measurable Objective – Fall 2015 groundwater level (or modeled 2015 groundwater level if no data are available). Dry cycle minimums are no worse than 1993-2015 minimums.
Quantitative definition of significant and unreasonable impact	• 25 % of representative monitoring wells fall below minimum threshold for 2 consecutive years

Ground Subsidence

Undesirable Results and Sustainability Criteria	
Undesirable Result Statement	• Ground subsidence that results from groundwater pumping creates a safety hazard to critical infrastructure or property. • Other programs and agencies are responsible for enforcing ground engineering requirements for critical infrastructure. GSA will coordinate with other agencies if subsidence is associated with groundwater pumping • Groundwater levels will be used as a proxy for ground subsidence
Minimum Threshold (onset of undesirable result) and Measurable Objective (desired condition)	• Minimum Threshold – Fall (Sept/Oct) GW level is above the 15th Percentile of all domestic well depths in a given area or sub-area. This means 85% of all domestic wells are completed below the minimum threshold and "will be protective" • Fall 2015 groundwater level (or modeled 2015 groundwater level if no data are available). Dry cycle minimums are no worse than 1993-2015 minimums.
Quantitative definition of significant and unreasonable impact	• A subsidence rate of more than 0.2 feet per year for a 10-year period that is directly related to groundwater pumping and within 2,000 feet of critical infrastructure, including roads, railways, pipelines, water conveyance systems, hospitals or other critical facilities.