YSGA Working Group Meeting

March 9, 2021

Agenda

- Approve Minutes
- Executive Officer Update – Kristin Sicke
- GSP Development:
  - Update Received from SEI – Water Budget and Model Documentation
  - Land Subsidence & GW/SW Interaction
    - Method for establishing MTs and MOs
    - Data Utilized and Relationship to Sustainability Criteria
    - Process for Selecting Representative Wells for GW/SW Interaction
- Draft Chapters of the GSP and Scheduling Focused Workshops
- BOD Meeting Agenda

Approve Minutes

Executive Officer Update

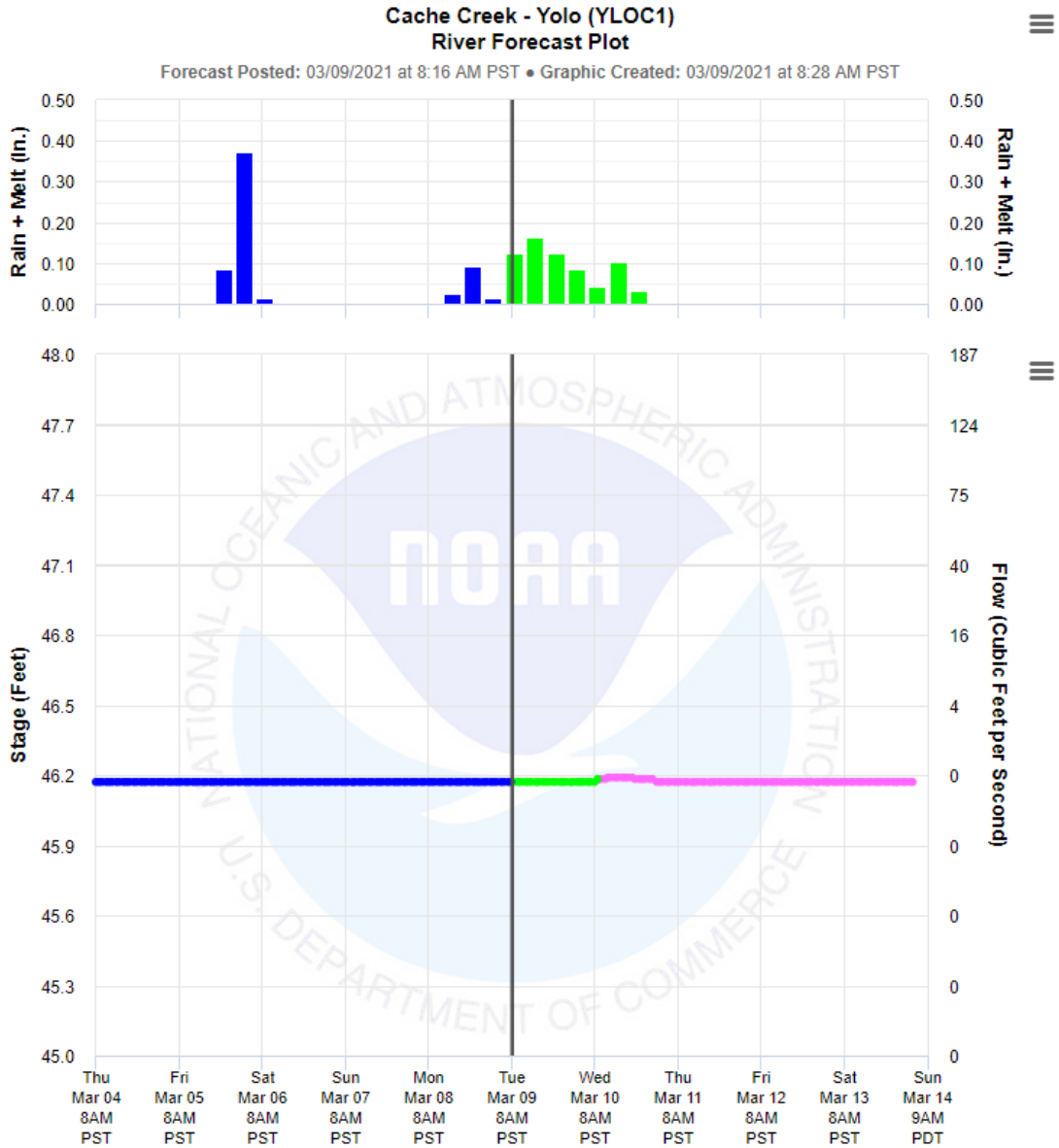
CACHE CREEK - YOLO (YLOC1)

Latitude: 38.73° N **Longitude:** 121.81° W **Elevation:** 86 Feet
Location: Yolo County in California **River Group:** Lower Sacramento

Issuance Time: Mar 09 2021 at 8:28 AM PST **Next Issuance:** Mar 09 2021 at 3:00 PM PST

Monitor Stage: 75.0 Feet *Flood Stage: 81.0 Feet* *Danger Stage: 82.1 Feet*

Export Graph as PNG Image



Well Monitoring

Depth to Water Historical Comparison

(Daily Average DTW in feet)

SCADA Links | Well Map | Select Date | 03/09/21

Comparison Trends | Comparison Table 2

Well	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Δ 2020 - 2021	Δ 2015 - 2021
1.	82.3	77.9	78.9	78.9	94.4	101.3	104.2	91.0	89.8	90.9	86.9	96.1	-9.2	5.2
2.	31.6	29.2	30.0	29.3	36.3	39.6	40.9	23.7	30.1	25.0	29.9	32.1	-2.2	7.5
3.		42.2	39.6	39.5	51.3	59.2	59.4	39.1	40.2	38.3	39.8	44.0	-4.2	15.1
4.		25.0	29.3	24.6	31.8	41.5	39.3	21.1	28.4	18.8	27.7	35.8	-8.0	5.7
5.		21.1	21.3	22.7	29.7	33.6	39.6	12.0	28.2	8.4	22.8	29.9	-7.0	3.8
6.			41.2	34.2	42.7	50.9	54.0	25.8	36.2	20.2	36.0	43.1	-7.1	7.9
7.					21.4	32.2	34.1	16.4	21.1	14.6	19.7	26.0	-6.3	6.2
8.					49.9	60.0	63.2	47.3	42.4	37.6	37.9	46.7	-8.7	13.3
9.					49.9	55.7	58.6	37.5	40.7	34.9	41.6	47.4	-5.8	8.3
10.						24.3	26.9	12.3	12.1	9.5	11.1	17.7	-6.5	6.7
11.						11.1	12.7	5.4	8.8	5.6	9.3	12.7	-3.4	-1.6
12.										112.5	101.3	109.8	-8.6	
13.									53.2	48.0	48.9	59.0	-10.1	
14.										6.1	9.5	12.5	-3.0	
15s.										34.2	36.9	45.9	-9.0	
16.										26.1	36.7	37.5	-.8	

GSP Technical Team Activities

- TAC Meetings
  - #4: 12/8 – Water Budgets Review & Land Subsidence
  - #5: 1/14 – Land Subsidence & Depletion of Interconnected Surface Water
  - #6: 2/9 – Land Subsidence & Depletion of Interconnected Surface Water
- Yolo Subbasin Farmers Update on GSP Development: 12/18
- Management Area Workshops
  - Capay Valley: 10/6
  - North Yolo: 10/28
  - Clarksburg: 11/4
  - South Yolo: 11/13
  - Central Yolo: 12/4
- Discussions with TNC and CDFW about GDE Identification

Management Area Workshops

Management Area	Findings/Comments
Capay Valley	Need to improve selected rep wells to include wells in the upper aquifer (newer, shallow wells) Desire to focus on regenerative agricultural practices for improving groundwater recharge
North Yolo	Likely reduction of surface water supplies available + need to rely more on groundwater supplies in the future Desire to consider alternate methodology for setting MTs (below historical average)
Clarksburg	High groundwater levels, limited groundwater use – consider as a formal monitoring area
South Yolo	Consider impacts/changes in Yolo Bypass, along with projects
Central Yolo	Emphasized the need to thoughtfully consider the definition of *reasonable* and *beneficial use of, and access to* groundwater Areas of special concern: N and NW of Winters / Hungry Hollow-Dunnigan Hills

Management Area Workshops

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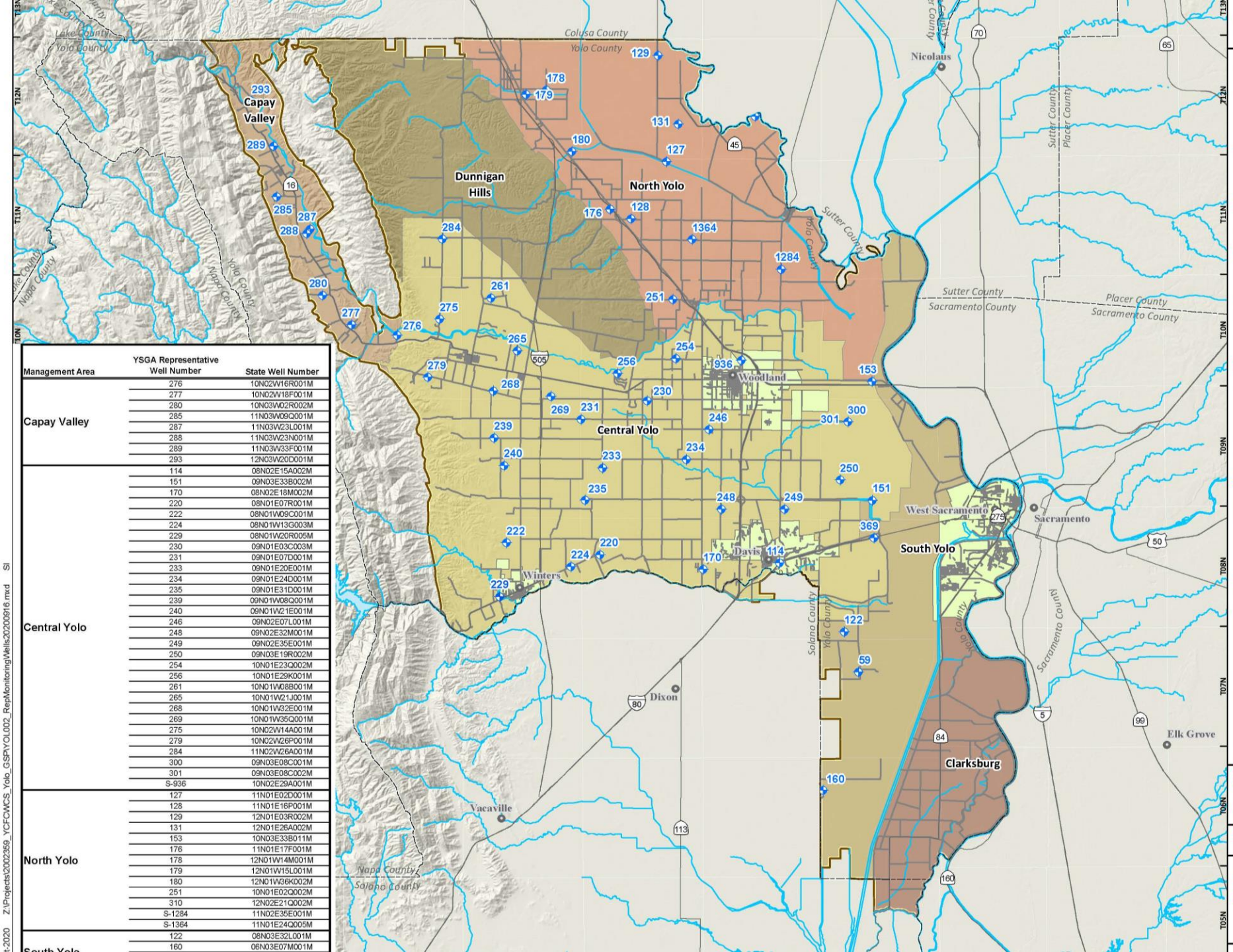
COMMON THEMES

- Local action policies:
  - responsive to MT exceedances in drought
  - mitigation of individual well impacts
  - land use relationship with County
- Coordinate with County DEH on Well Permitting process
- Projects/Management Actions are important to MA sustainability



YSGA REPRESENTATIVE WELLS

- YSGA Representative Well
- Yolo Subbasin GSA

Management Area

- Capay Valley
- Central Yolo
- Clarksburg
- Dunnigan Hills
- North Yolo
- South Yolo
- City Boundary

Other Features

- Highway
- Road
- Waterway
- Lake

0 2.5 5 10
Miles

N

Yolo Subbasin Groundwater Agency

Yolo County, California

GEI Consultants

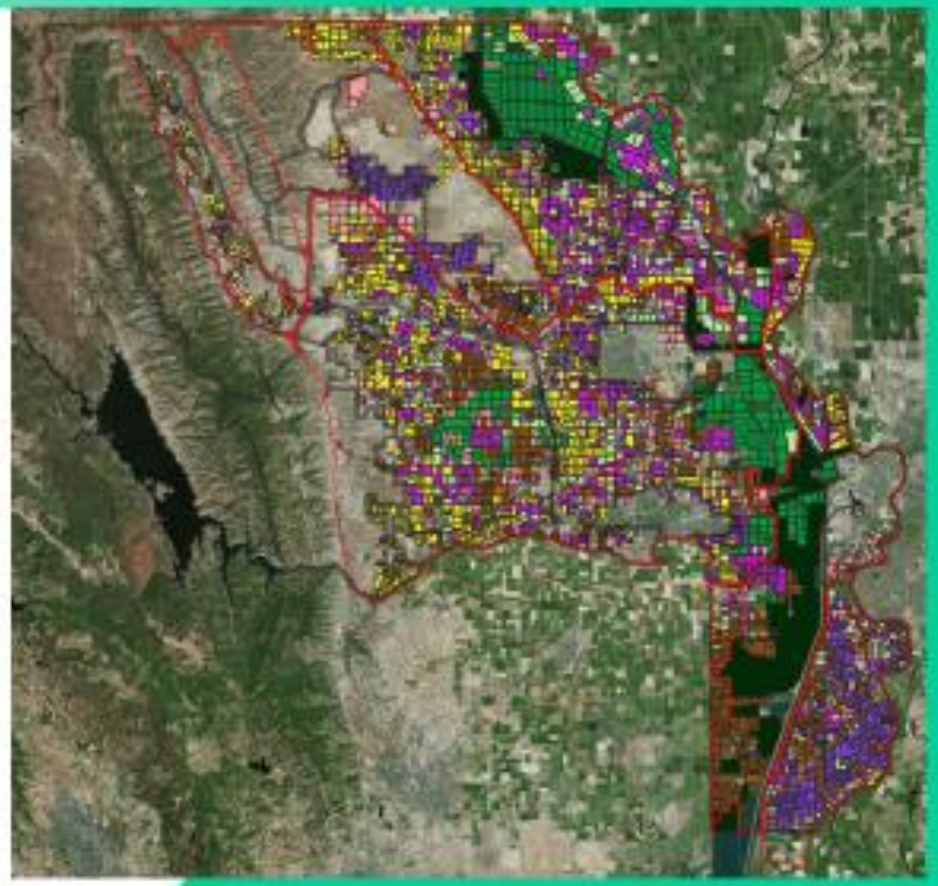
Management Area	YSGA Representative Well Number	State Well Number
Capay Valley	276	10N02W16R001M
	277	10N02W18F001M
	280	10N03W02R002M
	285	11N03W09Q001M
	287	11N03W23L001M
	288	11N03W23N001M
	289	11N03W33F001M
	293	12N03W20D001M
Central Yolo	114	08N02E15A002M
	151	09N03E33B002M
	170	08N02E18M002M
	220	08N01E07R001M
	222	08N01W09C001M
	224	08N01W13G003M
	229	08N01W20R005M
	230	09N01E03C003M
	231	09N01E07D001M
	233	09N01E20E001M
	234	09N01E24D001M
	235	09N01E31D001M
	239	09N01W08Q001M
	240	09N01W21E001M
	246	09N02E07L001M
	248	09N02E32M001M
	249	09N02E35E001M
	250	09N03E19R002M
	254	10N01E23Q002M
	256	10N01E29K001M
	261	10N01W08B001M
	265	10N01W21J001M
	268	10N01W32E001M
	269	10N01W35Q001M
	275	10N02W14A001M
	279	10N02W26P001M
	284	11N02W26A001M
	300	09N03E08C001M
	301	09N03E08C002M
	S-936	10N02E29A001M
North Yolo	127	11N01E02D001M
	128	11N01E16P001M
	129	12N01E03R002M
	131	12N01E26A002M
	153	10N03E33B011M
	176	11N01E17F001M
	178	12N01W14M001M
	179	12N01W15L001M
	180	12N01W36K002M
	251	10N01E02Q002M
	310	12N02E21Q002M
	S-1284	11N02E35E001M
	S-1364	11N01E24Q005M
South Yolo	122	08N03E32L001M
	160	06N03E07M001M

GSP Development – TAC Meeting Update from SEI on Water Budget and Model Documentation

Yolo Subbasin Water Budgets

Key results from Draft #2
of the Water Budget chapter

1. YSGA model overview
2. Historical water budget
3. Future scenarios
4. Sustainable Yield
5. Next steps



SEI Stockholm Environment Institute

Vishal Mehta Susie Bresney Charles Young

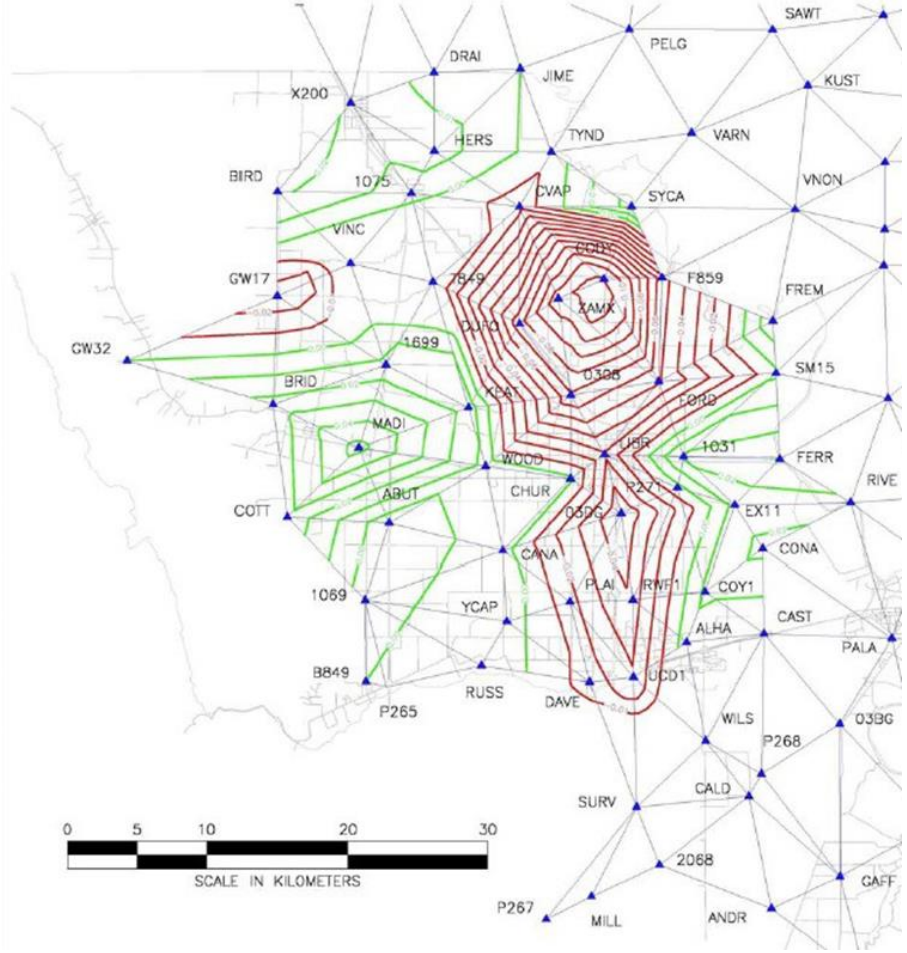
YSGA TAC meeting Dec 8, 2020

GSP Development – Land Subsidence

Subsidence

GPS-Based Approach: Yolo Subsidence Network 1999-2008 Contours (Potterfield and Frame, 2009)

- Elevation gains in green, elevation decreases in red
- Total subsidence within the Subbasin ranges from +7 to -26 cm (1999-2008)
- Maximum subsidence in the Zamora area
- Average rate of subsidence: +0.8 to -2.9 cm per year

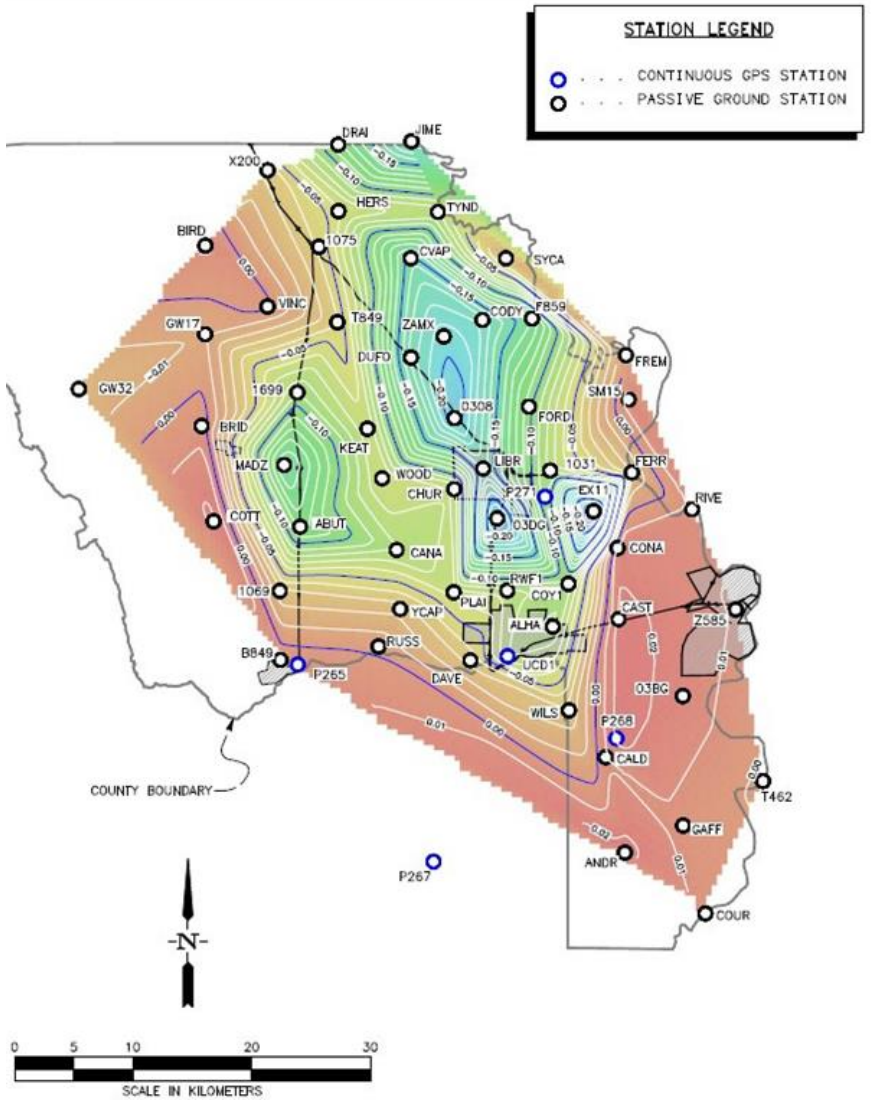


Credit: Potterfield and Frame, 2009

Subsidence

GPS-Based Approach: Yolo Subsidence Network 2008-2016 Contours (Frame, 2016)

- Elevation gains in green, elevation decreases in red
- Total subsidence within the Subbasin ranges from +2 to -20 cm (2008-2016)
- Maximum subsidence in the Zamora area
- Average rate of subsidence: +0.25 to -2.5 cm per year

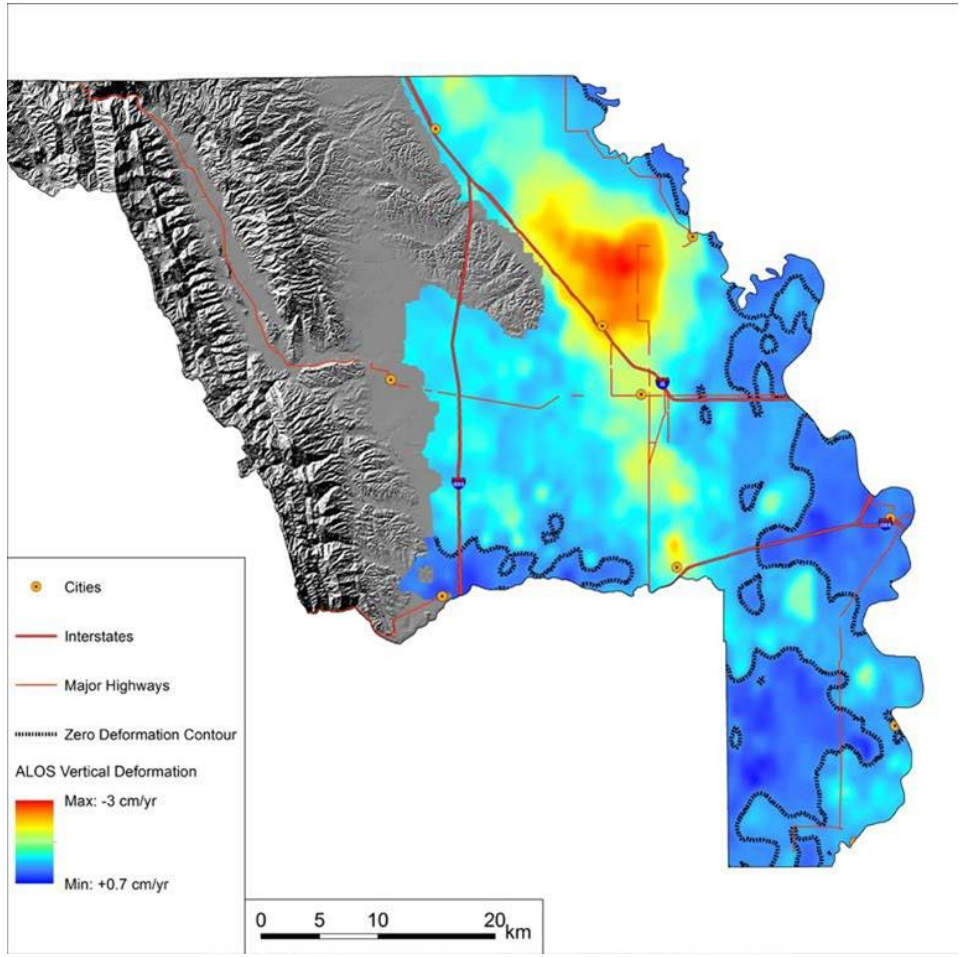


Credit: Frame, 2016

Subsidence

Interferometric Synthetic-Aperture Radar (InSAR) Results, 2007-2011 period (Crew, 2017)

- Maximum rate of subsidence between Zamora and Woodland – up to 3 cm per year
- Areas to the south and east have displayed positive elevation gains during wet years

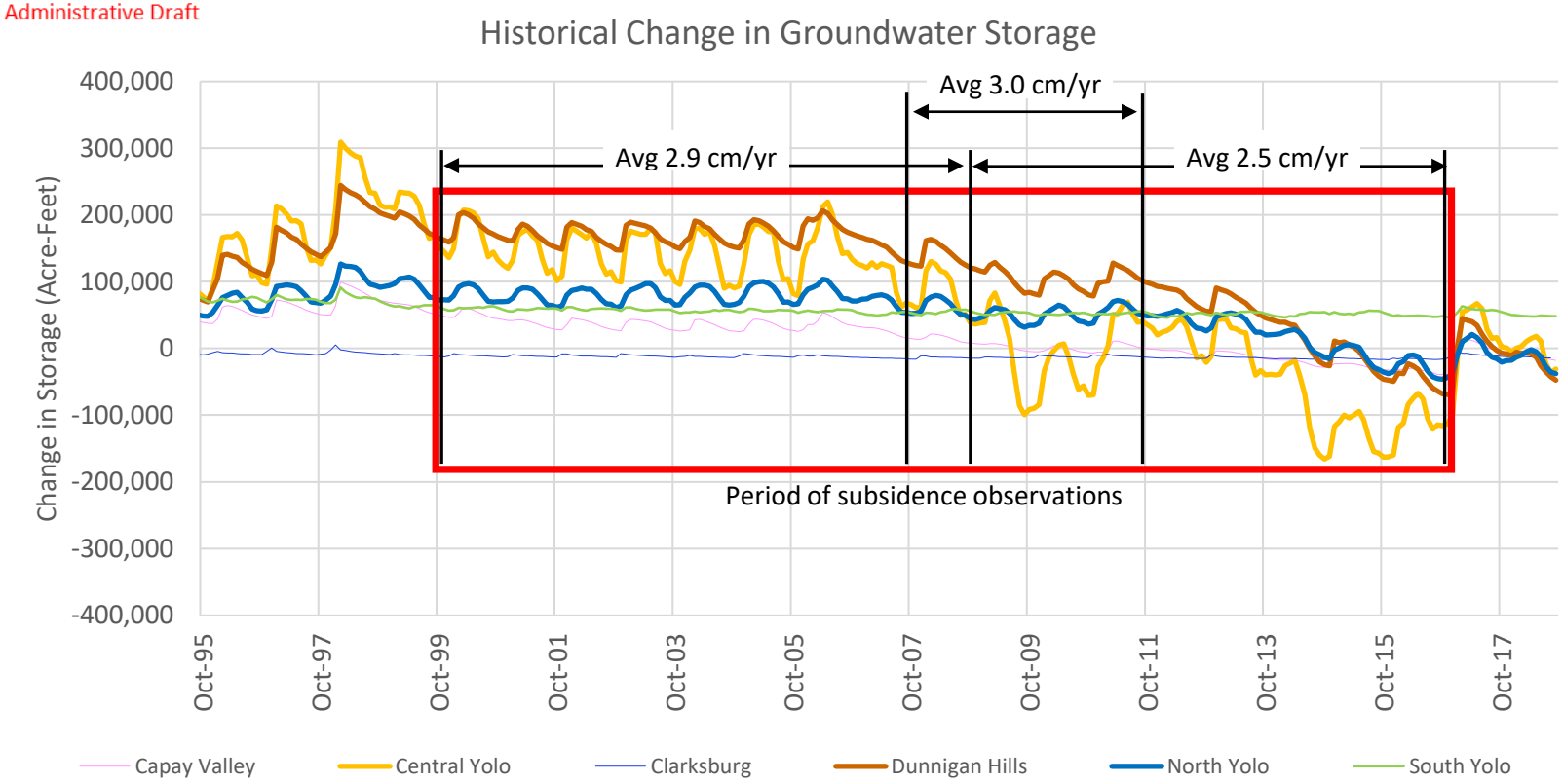


Credit: Stanford University, Crew 2017

Subsidence

Relationship between subsidence and change in groundwater storage.

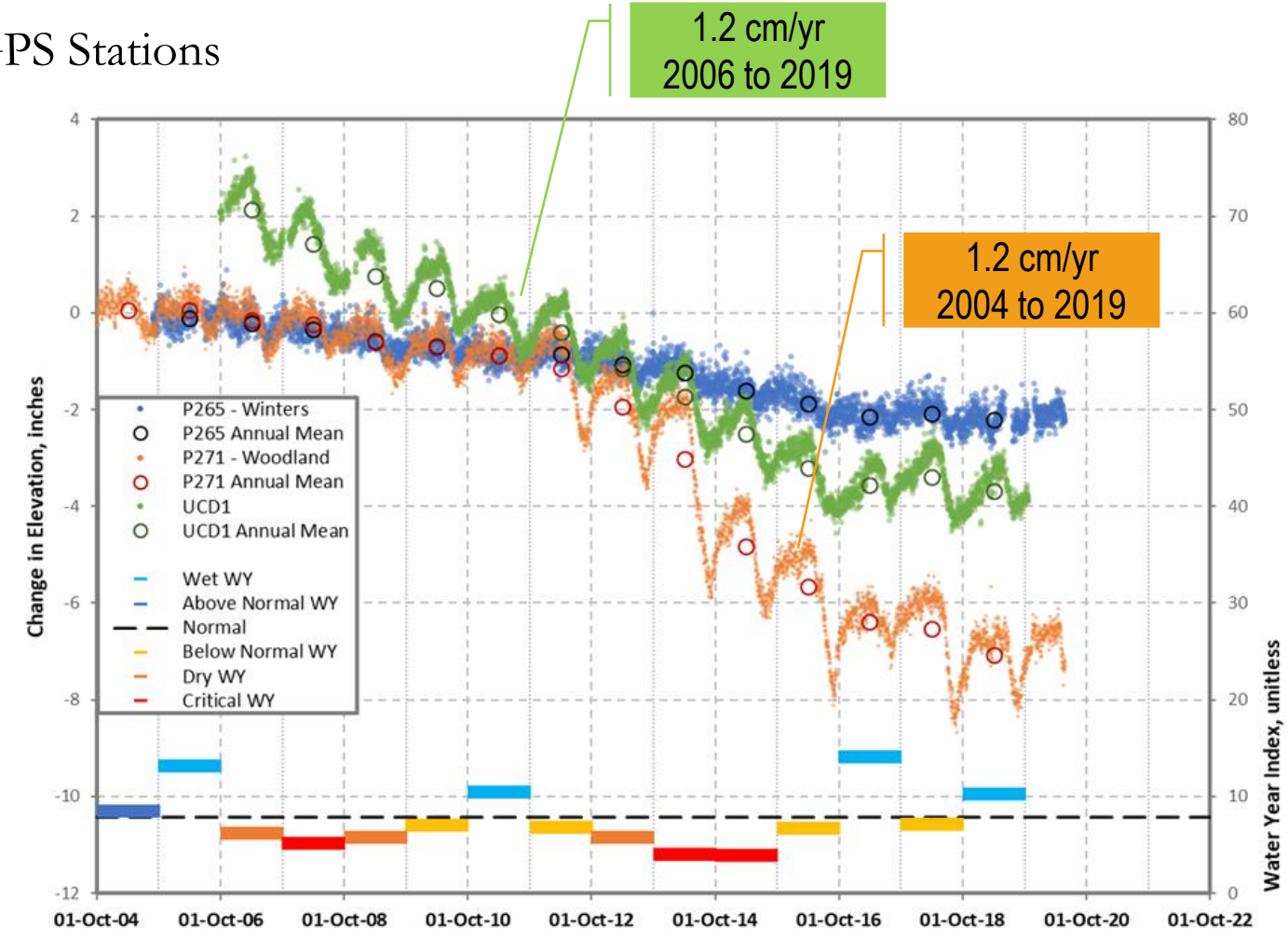
Administrative Draft



Credit: SEI, 2020

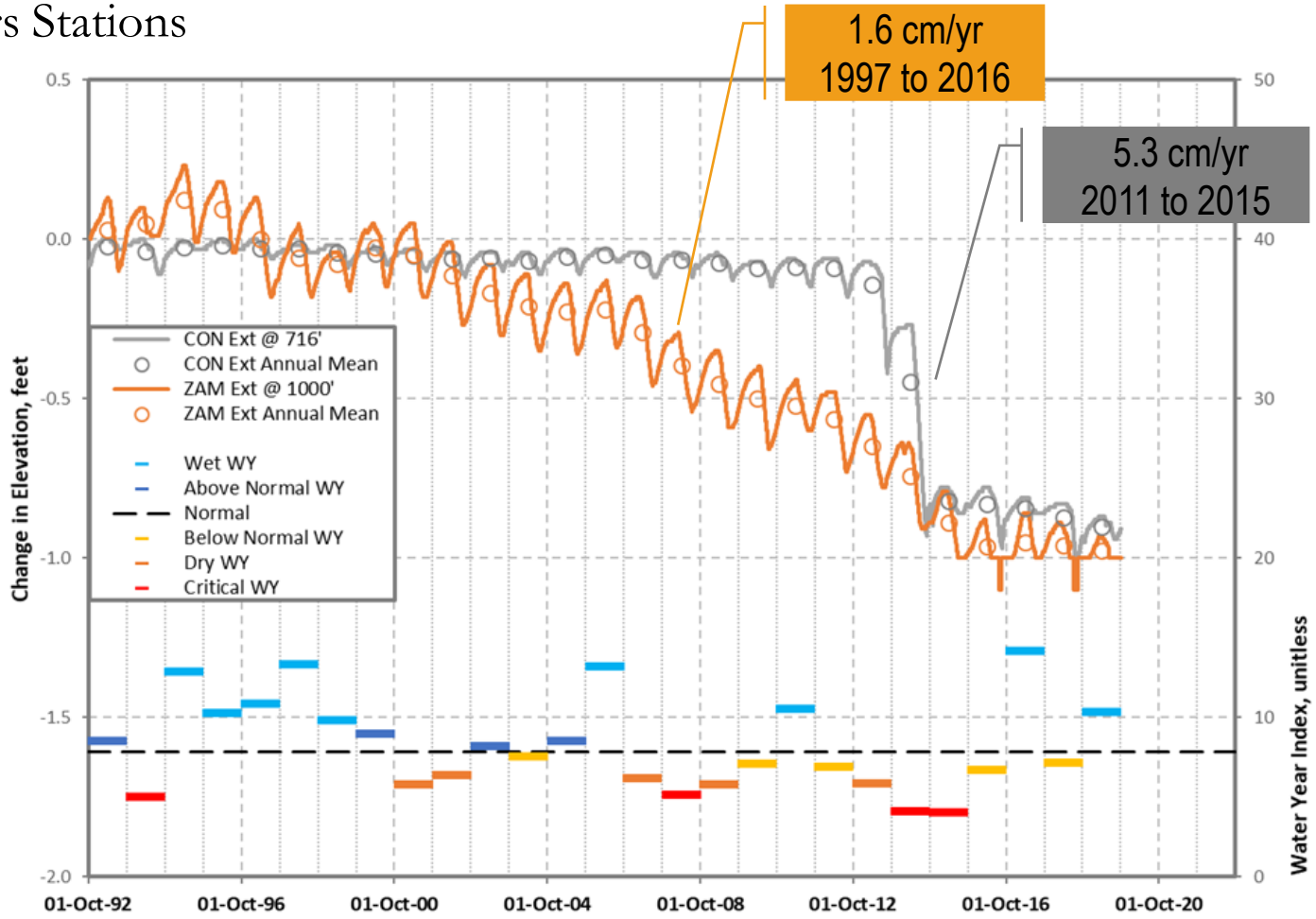
Subsidence

Continuous GPS Stations



Subsidence

Extensometers Stations



Subsidence

- Subsidence has been observed in the Subbasin, most notably in area between Woodland and Zamora, and to a lesser extent around Davis.

- Are there currently impacts to land uses?
  - Impacts could include conveyance facilities, channel gradients, or major infrastructure (roads, highways, transmission lines, buildings and facilities)
  - Currently there are no documented impacts to land uses from subsidence

Subsidence

§ 354.26. Undesirable Results

(a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin.

Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

§ 354.28

(c)(5) Land Subsidence. The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results.

Subsidence

Undesirable Results - Draft Definition

- Land Subsidence
  - ***The point at which significant and unreasonable impacts, as determined by the rate and extent of subsidence in the Subbasin, that affects surface land uses or critical infrastructure.***

  - Next step is to define level of impacts that would cause significant and unreasonable impacts

Subsidence

Undesirable Results - Draft Definition

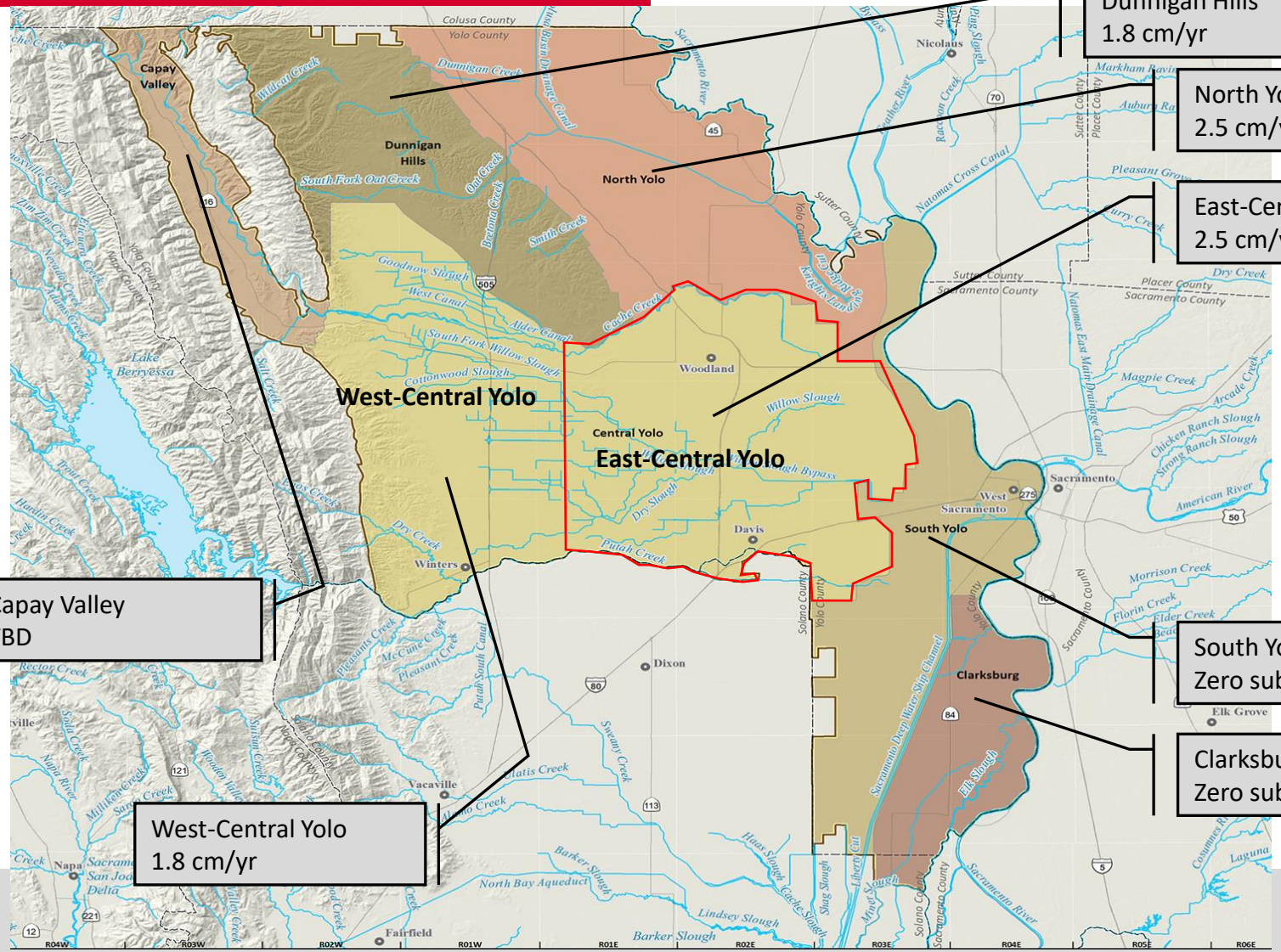
- Measurable Objective
  - ***The three-year running average of the maximum rate of subsidence established for each management area shall not be exceeded in 2 or more management areas (or sub-management).***
- Minimum Threshold
  - ***The five-year running average of the maximum rate of subsidence established for each management area shall not be exceeded in 2 or more management areas (or sub-management area).***

Subsidence

Undesirable Results - Draft Definition

- Establish a maximum rate of subsidence within a management area (or portion of a management area) that is presumed to avoid significant and unreasonable impacts
  - Require continued monitoring and reporting of the level of land subsidence occurring in the Subbasin
  - Require annual monitoring and reporting of potential impacts to land uses, critical infrastructure, and wells (domestic, production and municipal)
  - Based on observed data continue to refine the understanding of the causes of subsidence (water management vs tectonic)
  - Based on observed data quantify the amount of subsidence which causes impacts to infrastructure
  - Based on observed data consider establishing future subsidence thresholds as maximum amount of subsidence in critical areas of the Subbasin

Subsidence


Dunnigan Hills
1.8 cm/yr
North Yolo
2.5 cm/yr
East-Central Yolo
2.5 cm/yr
South Yolo
Zero subsidence
Clarksburg
Zero subsidence
Capay Valley
TBD
West-Central Yolo
1.8 cm/yr
Capay Valley
Dunnigan Hills
North Yolo
West-Central Yolo
Central Yolo
East-Central Yolo
South Yolo
Clarksburg
Woodland
Davis
Winters
Dixon
Vacaville
Fairfield
Nicolaus
Sacramento
West Sacramento
Elk Grove

Subsidence

Questions/Comments

GSP Development – GW/SW Interaction

SGMA Requirements

§ 354.28 Minimum Thresholds

(c)(6) Depletions of Interconnected Surface Water: The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.

Minimum thresholds shall be supported by the following:

(A) The location, quantity, and timing of depletions of interconnected surface water.

(B) A description of the groundwater and surface water model (or an equally effective method, tool, or analytical model) used to quantify surface water depletion.

SGMA Requirements

§ 354.34 Monitoring Network

(c)(6) Depletions of Interconnected Surface Water:

The monitoring network shall be able to characterize the following:

a. Flow conditions including surface water discharge, surface water head, and baseflow contribution.

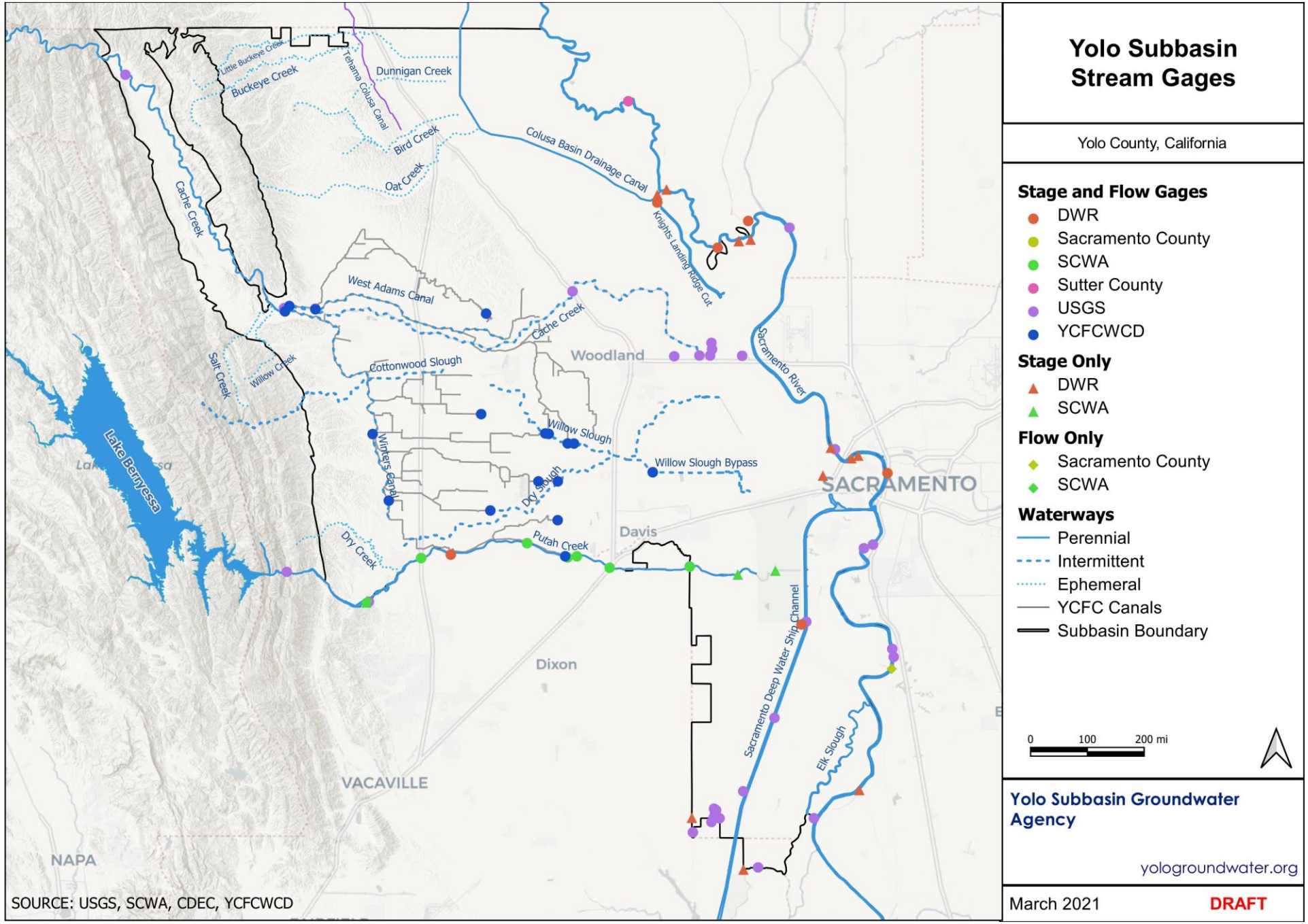
b. Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.

c. Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.

d. Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.

Definition:
Surface Water Types

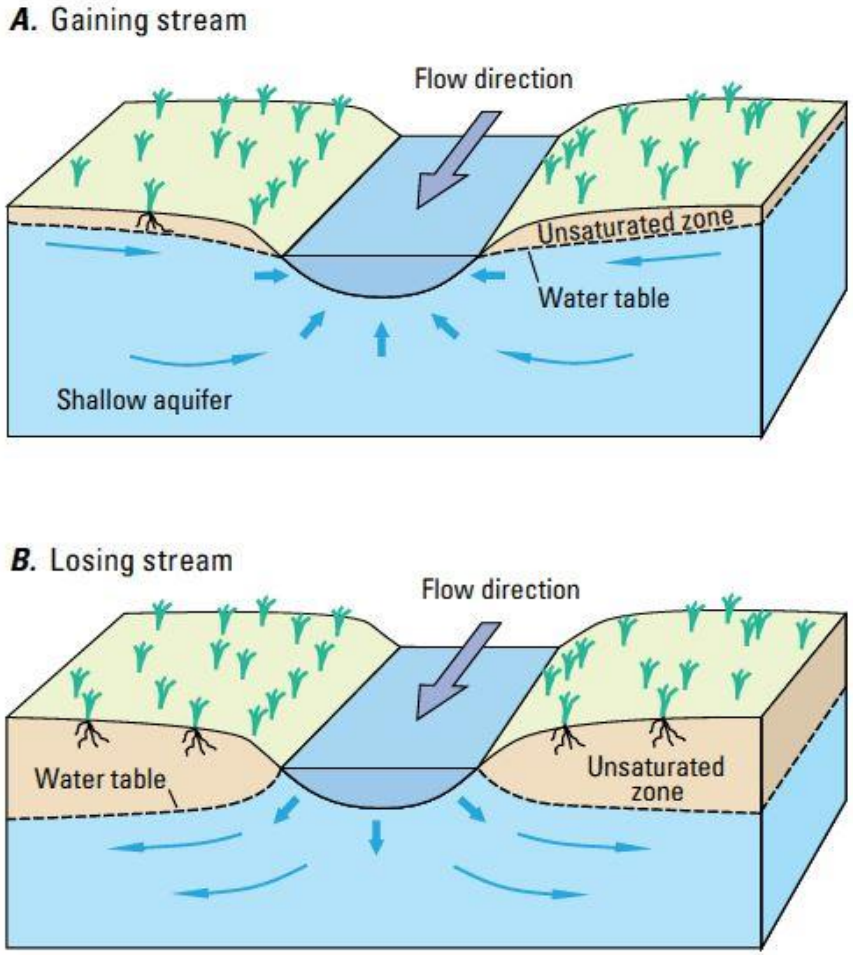
1. Perennial
2. Intermittent
3. Ephemeral


Yolo Subbasin Stream Gages
Yolo County, California
Stage and Flow Gages
DWR
Sacramento County
SCWA
Sutter County
USGS
YCFCWCD
Stage Only
DWR
SCWA
Flow Only
Sacramento County
SCWA
Waterways
Perennial
Intermittent
Ephemeral
YCFC Canals
Subbasin Boundary
0 100 200 mi
Yolo Subbasin Groundwater Agency
yologroundwater.org
March 2021
DRAFT
SOURCE: USGS, SCWA, CDEC, YCFCWCD
Little Buckeye Creek
Buckeye Creek
Tehama Colusa Canal
Dunnigan Creek
Bird Creek
Oat Creek
Cache Creek
Colusa Basin Drainage Canal
Knights Landing Ridge Cut
West Adams Canal
Cache Creek
Salt Creek
Willow Creek
Cottonwood Slough
Woodland
Sacramento River
Willow Slough
Willow Slough Bypass
Winters Canal
Dry Slough
Lake Berryessa
Putah Creek
Dry Creek
Davis
SACRAMENTO
Dixon
Sacramento Deep Water Ship Channel
Elk Slough
VACAVILLE
NAPA

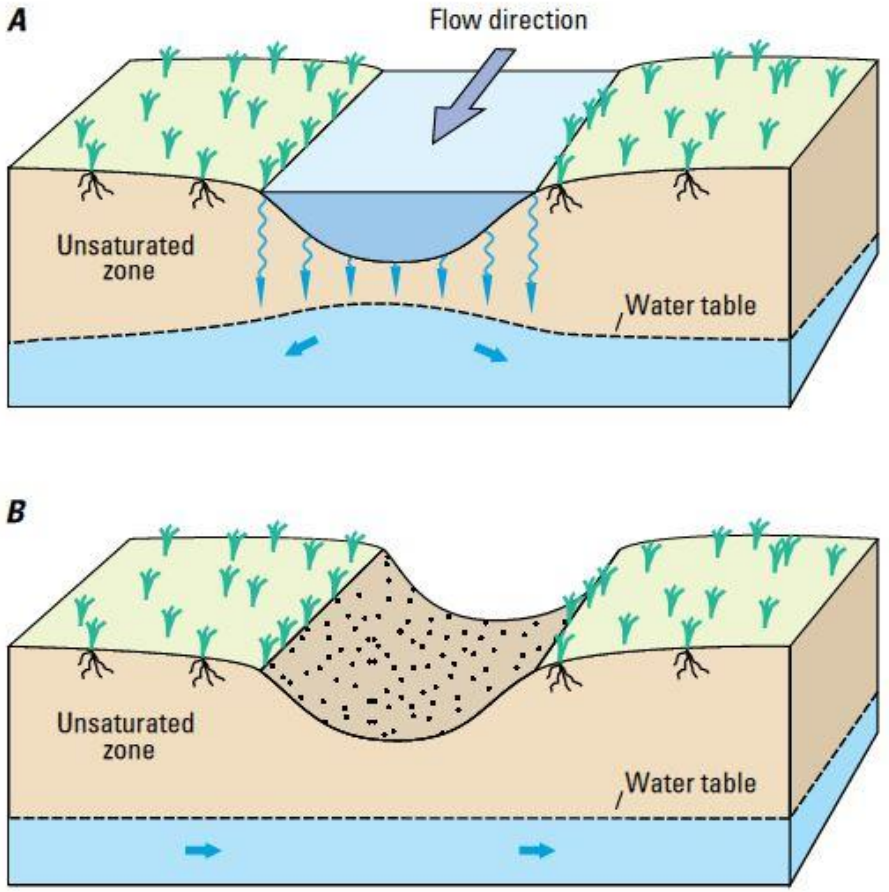
Definition:

Surface Water / Groundwater Interaction

Connected



Disconnected



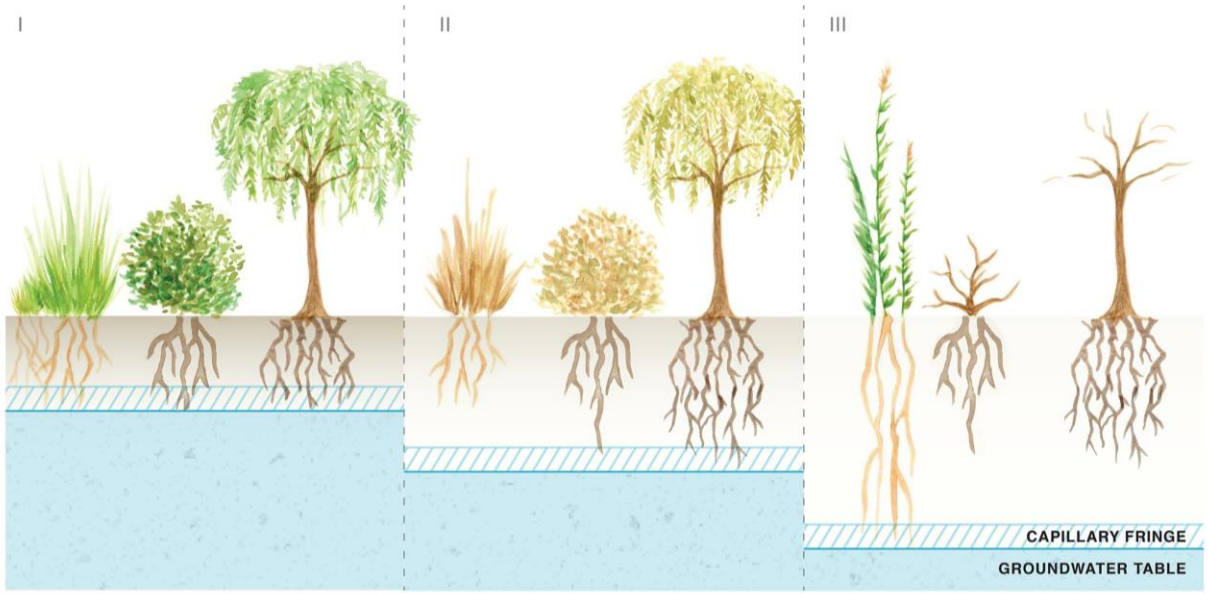
Definition:
Beneficial Uses/Users of Groundwater

- Agricultural users
- Domestic well owners
- Municipal well operators
- Public water systems
- Local land use planning agencies
- Environmental users of groundwater
- Surface water users, if there is a hydrologic connection between surface and groundwater bodies
- The federal government, including, but not limited to, the military and managers of federal lands
- California Native American tribes
- Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems
- Entities listed in Section 10927 that are monitoring and reporting groundwater elevations in all or a part of a groundwater basin managed by the groundwater sustainability agency.

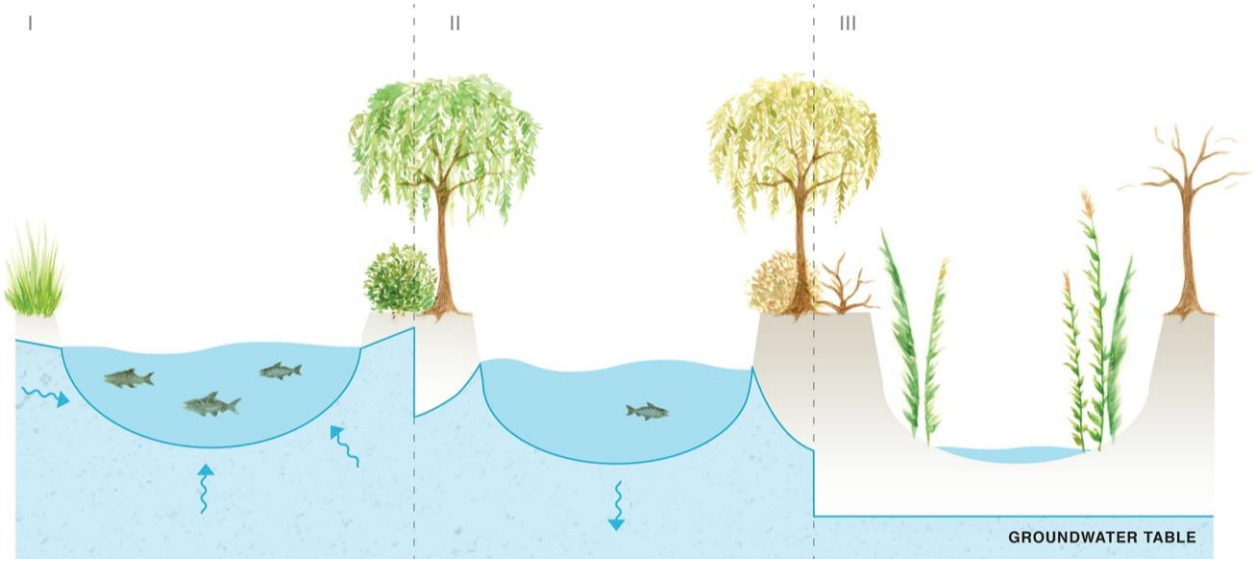
GDEs are a User of Groundwater (not a SMC)

Sustainability Indicators	 Lowering GW Levels	 Reduction of Storage	 Seawater Intrusion	 Degraded Quality	 Land Subsidence	 Surface Water Depletion
Metric(s) Defined in GSP Regulations	• Groundwater Elevation	• Extraction Volume	• Chloride concentration isocontour	• Migration of Plumes • Number of supply wells • Volume • Location of isocontour	• Rate and Extent of Land Subsidence	• Volume or rate of surface water depletion

Terrestrial GDE



Aquatic GDE



Sustainable Management Criteria (SMC)

SMC: Water Level

Minimum Threshold is the historic minimum level in WL Representative Wells

SMC: SW/GW Interaction

Minimum Threshold is the historic minimum level in SW/GW Representative Wells

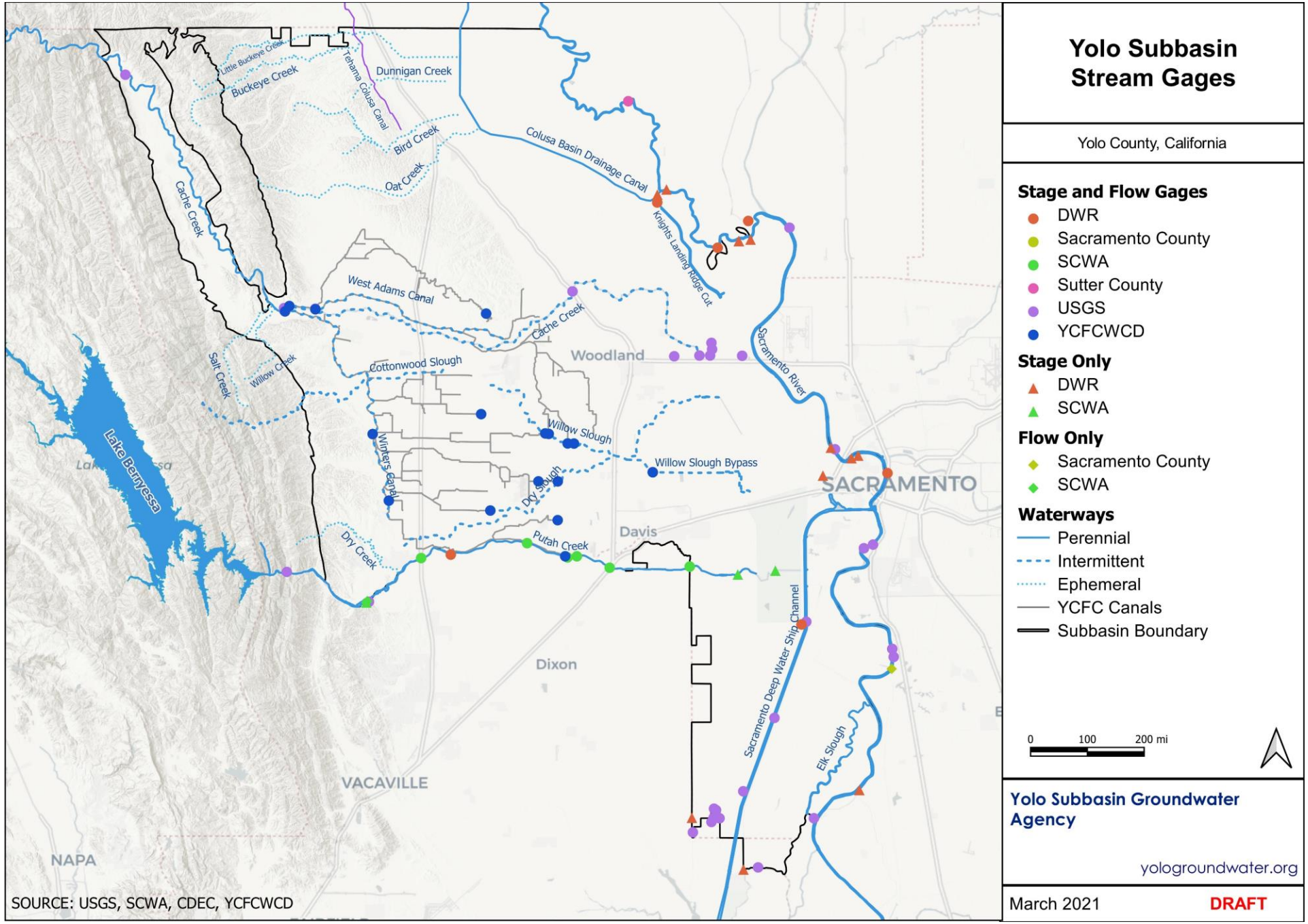
Two Sets of Representative Wells

1. Water Level
2. SW/GW Interaction

Existing Programs:
Perennial Waterways

Sacramento River

Putah Creek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SOURCE: USGS, SCWA, CDEC, YCFCWCD
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Oat Creek
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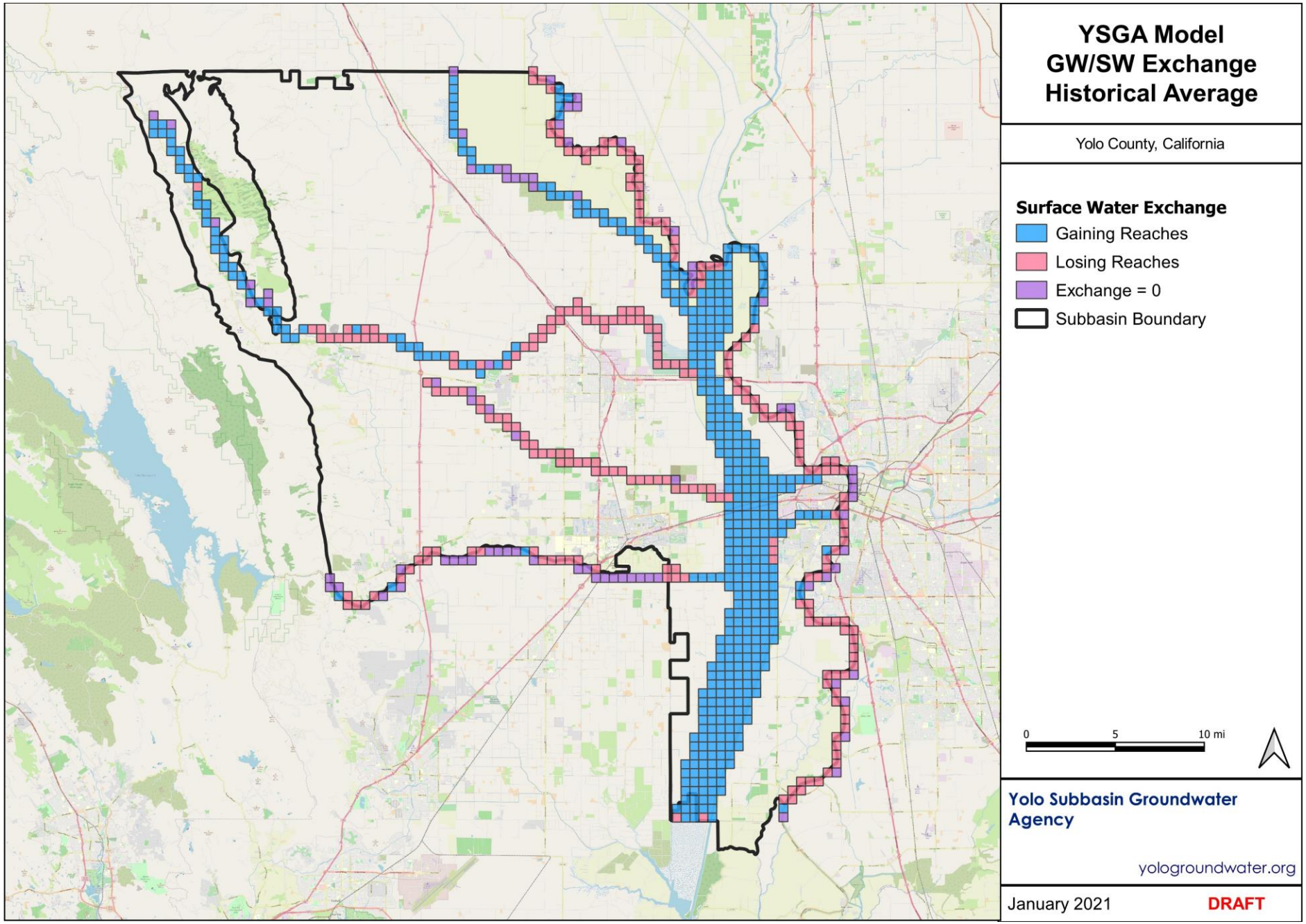
Colusa Basin Drainage Canal
Knights Landing Ridge Cut
West Adams Canal
Cache Creek
Woodland
Sacramento River
Salt Creek
Willow Creek
Cottonwood Slough
Willow Slough
Willow Slough Bypass
Winters Canal
Dry Slough
Lake Berryessa
Putah Creek
Dry Creek
Davis
SACRAMENTO
Dixon
Sacramento Deep Water Ship Channel
Elk Slough
VACAVILLE
NAPA

YSGA SW/GW Interaction Analysis

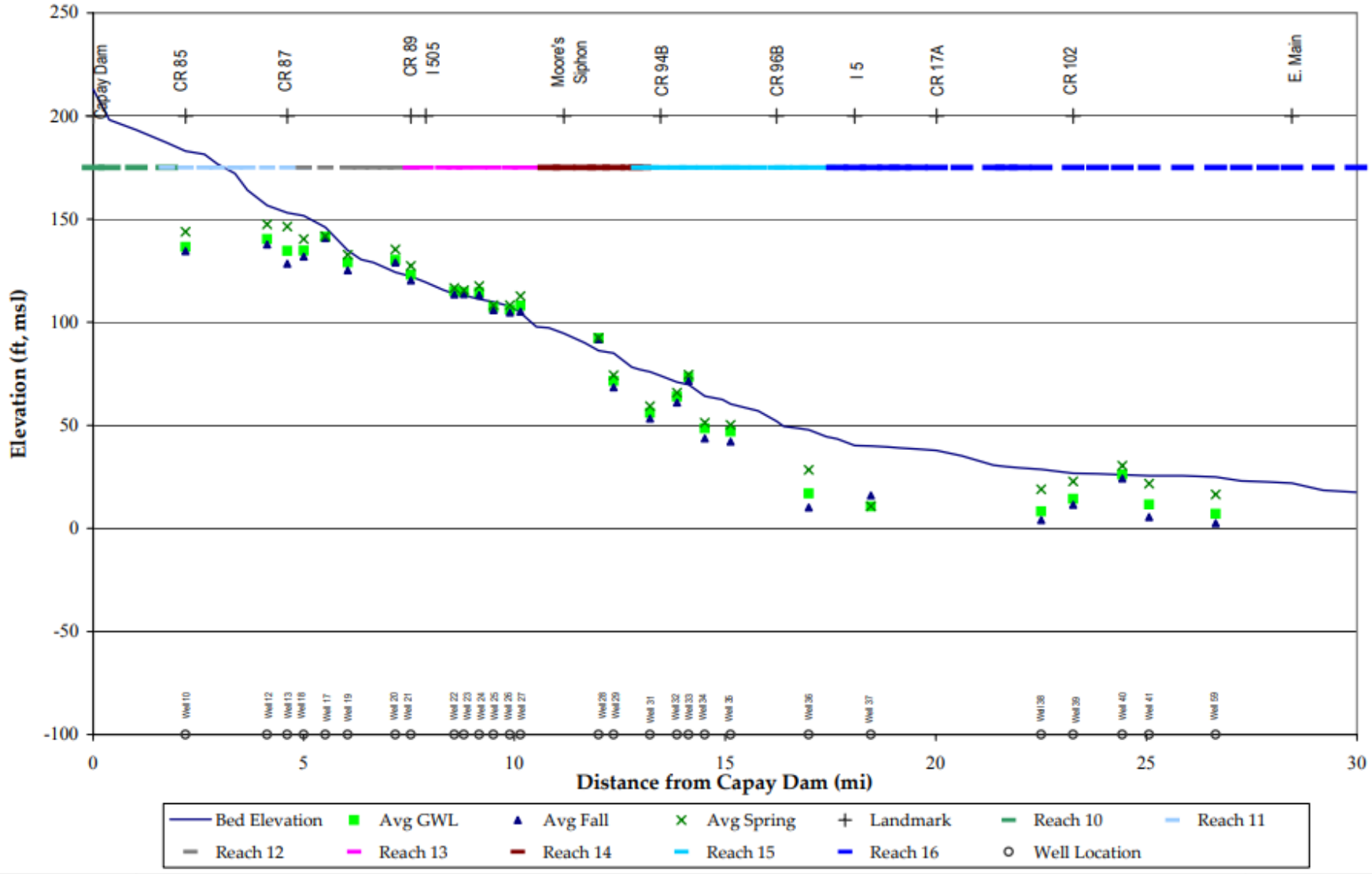
1. Quantification of Gains and Losses in acrefeet/year
2. Two sets of monitoring wells
   a) Representative water level (regular monitoring wells)
   b) Shallow aggregate mine monitoring
3. Thalweg intersection of elevation contours shows gaining and losing reaches.

Quantification of SW/GW Interaction

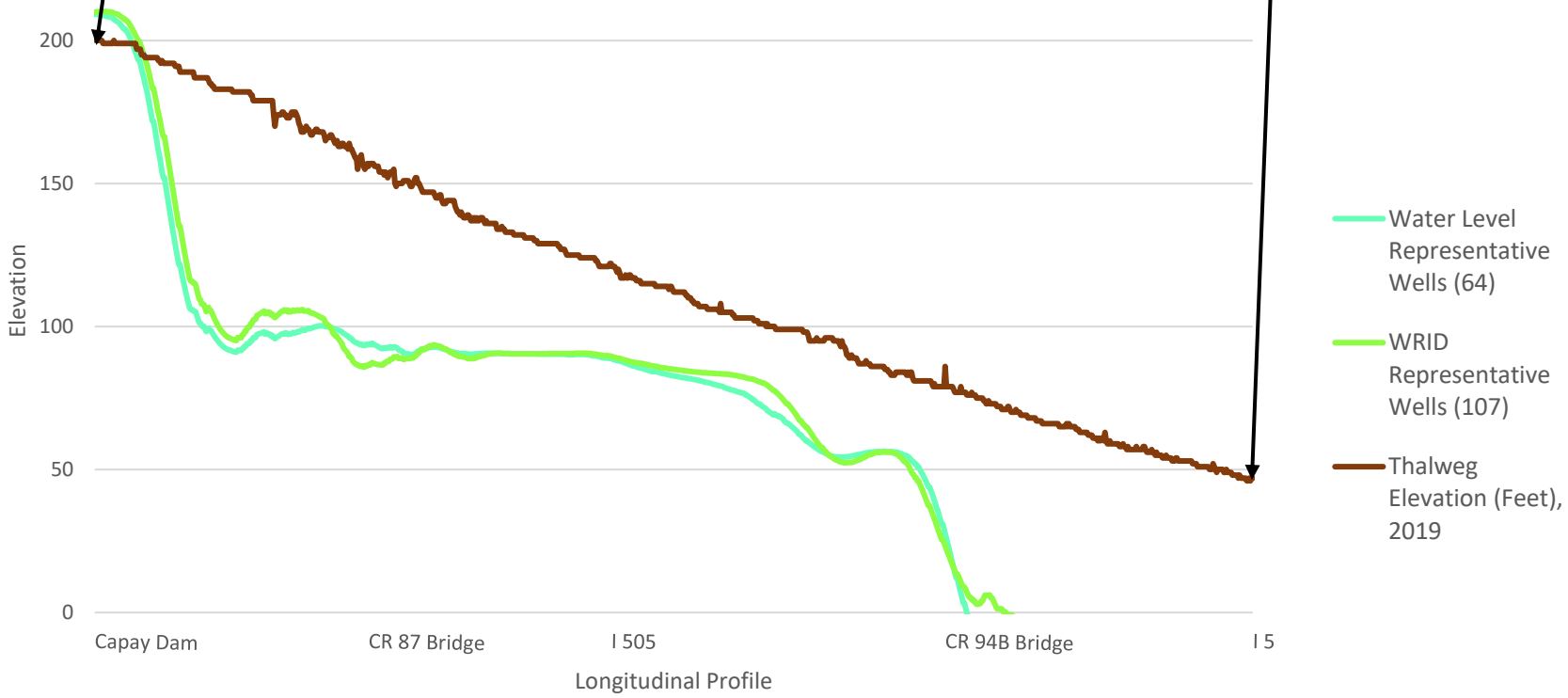
Losing (SW to GW)	*Gaining (GW to SW)*
• Cache Creek: 29 TAF • Putah Creek: 13.9 TAF • Sacramento River: 0.9 TAF	• Yolo Bypass: 25.7 TAF • Knights Landing Ridge Cut: 1.5 TAF • Colusa Basin Drain: 2 TAF


YSGA Model
GW/SW Exchange
Historical Average
Yolo County, California
Surface Water Exchange
Gaining Reaches
Losing Reaches
Exchange = 0
Subbasin Boundary
0
5
10 mi
Yolo Subbasin Groundwater Agency
yologroundwater.org
January 2021
DRAFT

Analysis with Water Level Representative Wells



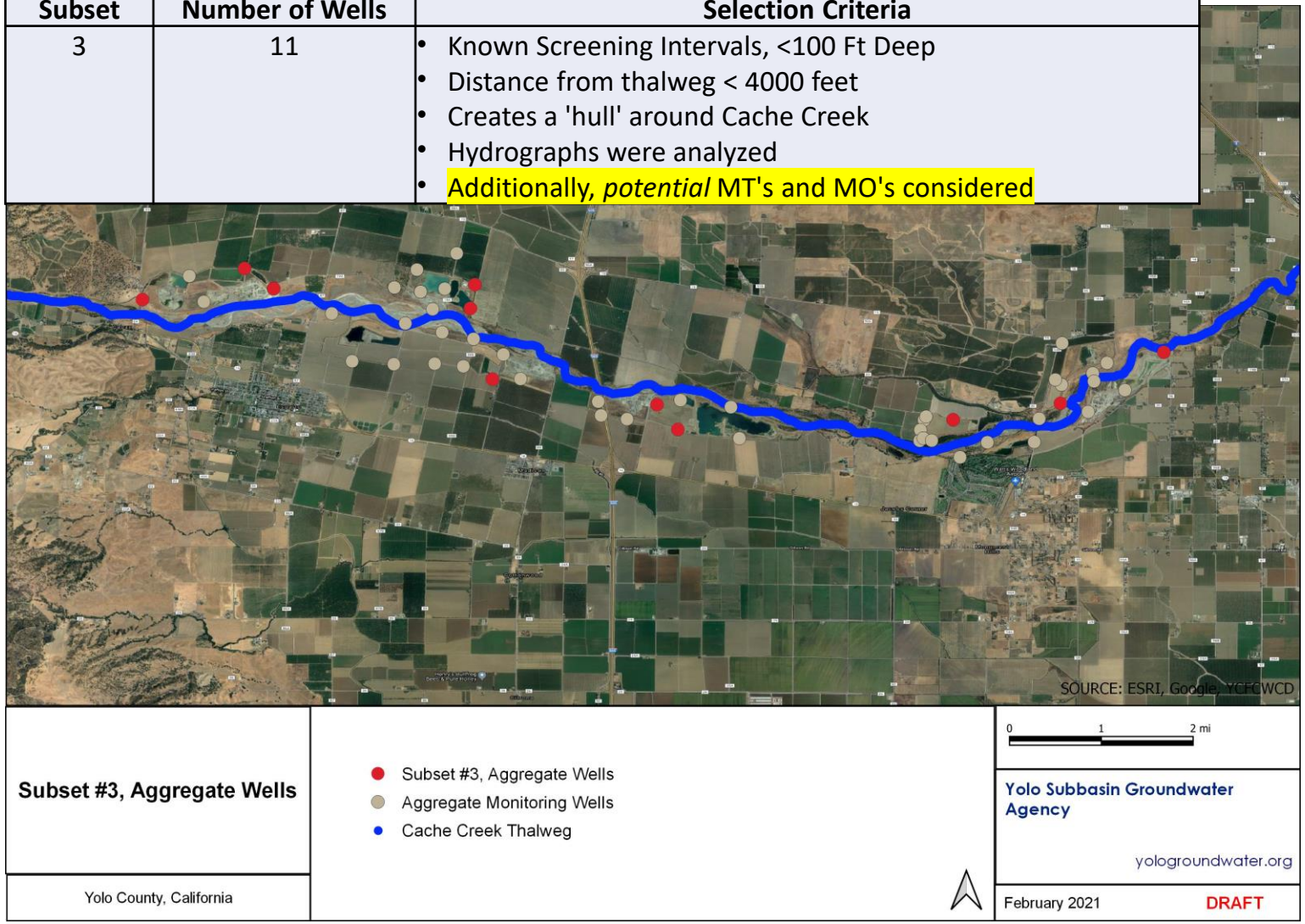
RIME	YOLO COUNTY INTEGRATED GROUNDWATER AND SURFACE WATER MODEL (YCIGSM)	APRIL 2006
	Longitudinal Profile of Cache Creek	FIGURE 4.2

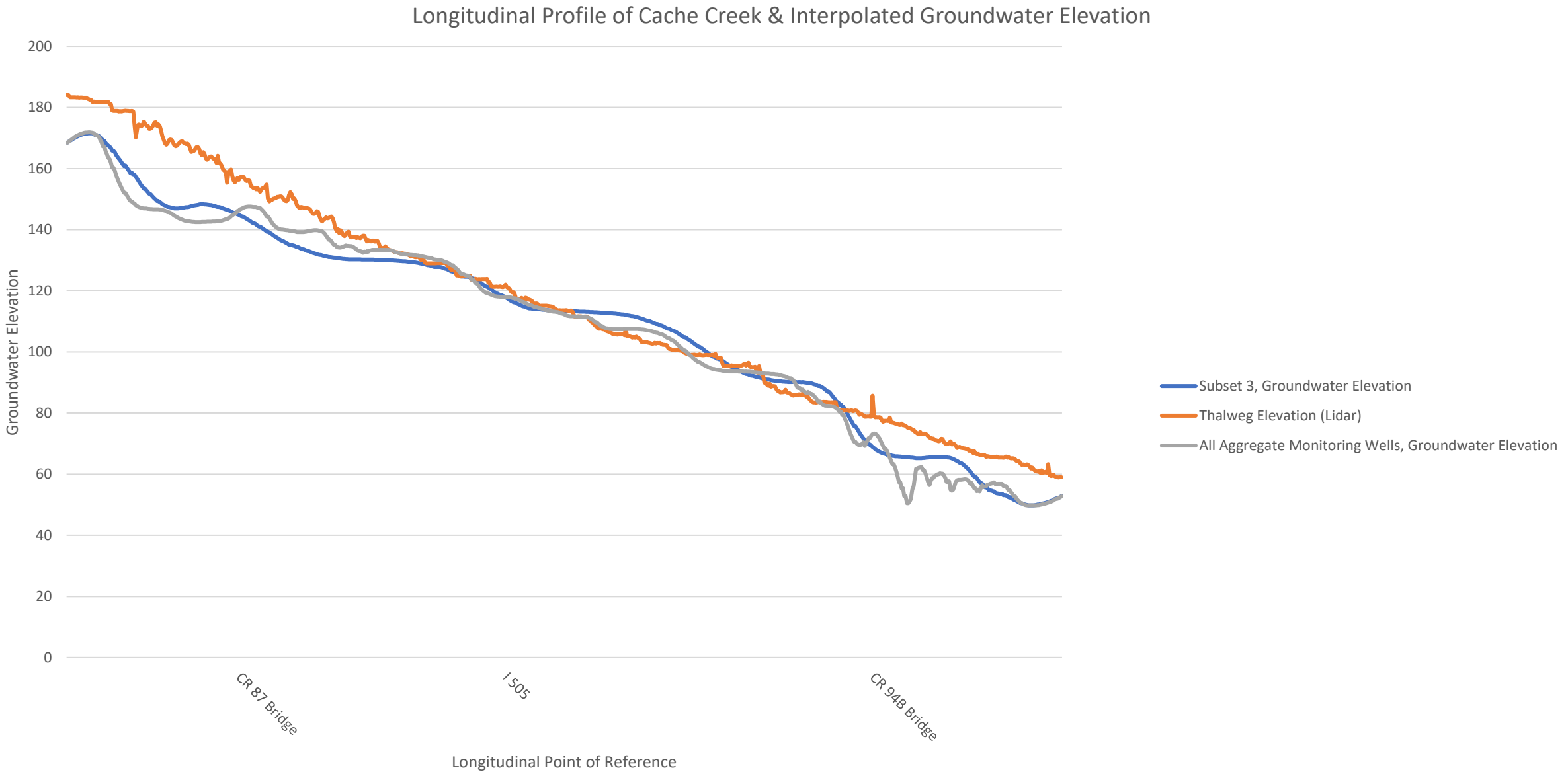

200
150
100
50
0
Elevation
Capay Dam
CR 87 Bridge
I 505
CR 94B Bridge
I 5
Longitudinal Profile
Water Level Representative Wells (64)
WRID Representative Wells (107)
Thalweg Elevation (Feet), 2019

Groundwater Comes to the Surface: Cache Creek

Analysis with special aggregate mining monitoring wells

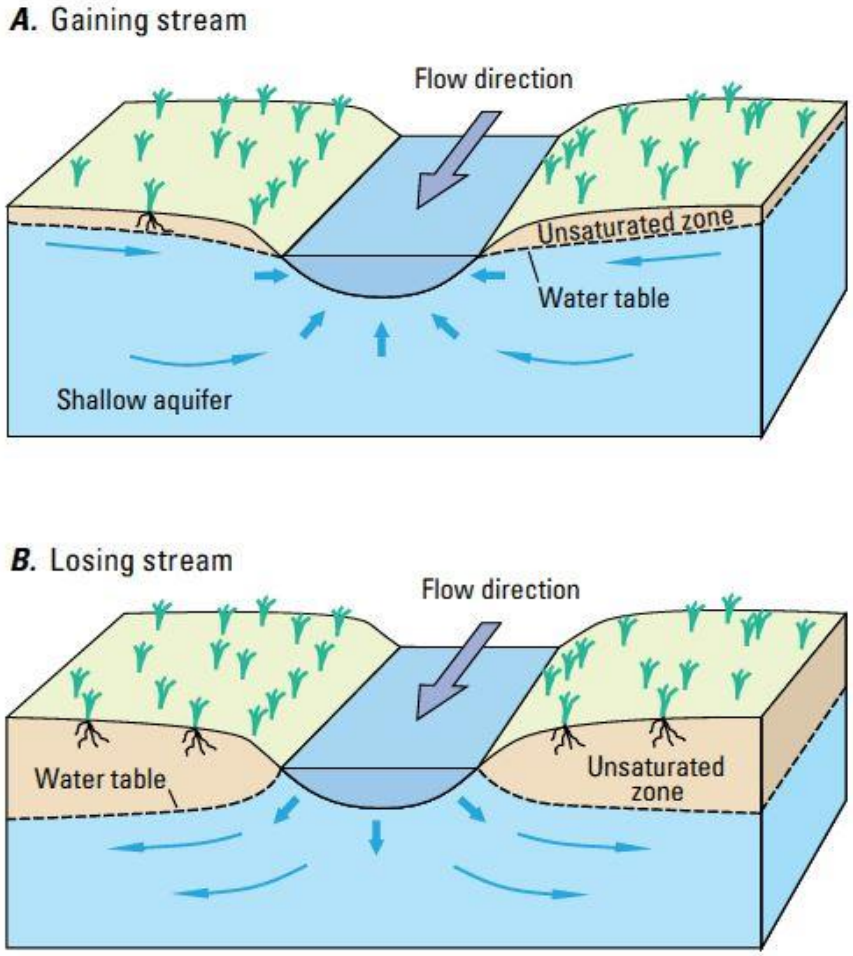
Subset	Number of Wells	Selection Criteria
3	11	• Known Screening Intervals, <100 Ft Deep • Distance from thalweg < 4000 feet • Creates a 'hull' around Cache Creek • Hydrographs were analyzed • Additionally, *potential* MT's and MO's considered



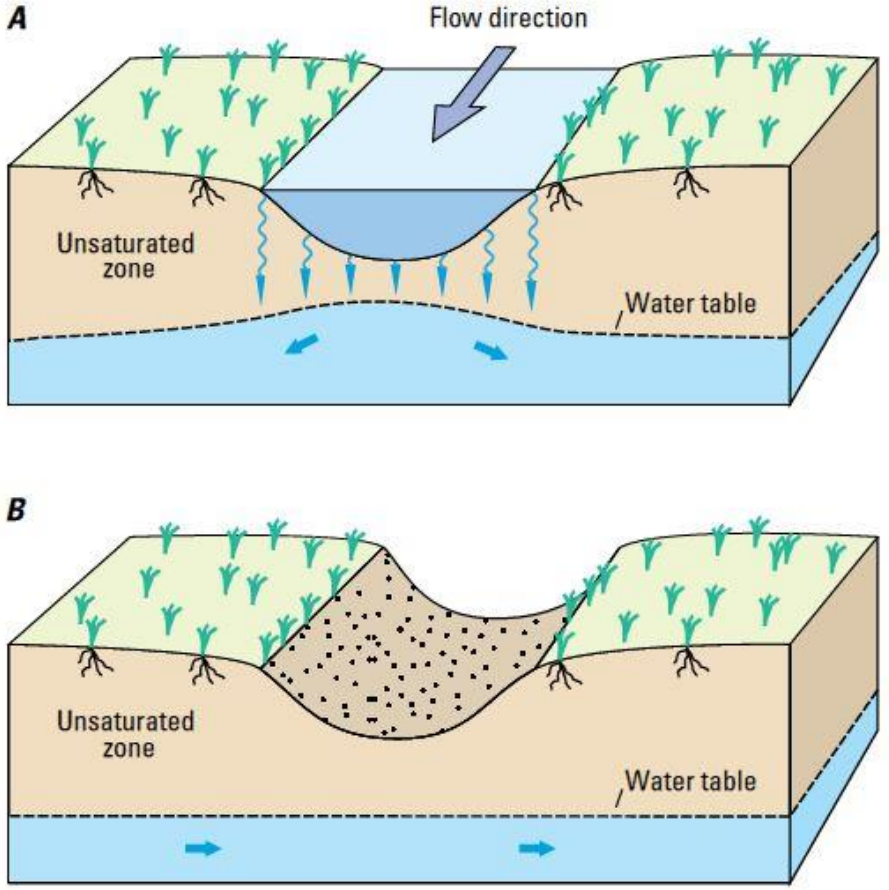

Longitudinal Profile of Cache Creek & Interpolated Groundwater Elevation
Groundwater Elevation
200
180
160
140
120
100
80
60
40
20
0
CR 87 Bridge
I 505
CR 94B Bridge
Longitudinal Point of Reference
Subset 3, Groundwater Elevation
Thalweg Elevation (Lidar)
All Aggregate Monitoring Wells, Groundwater Elevation

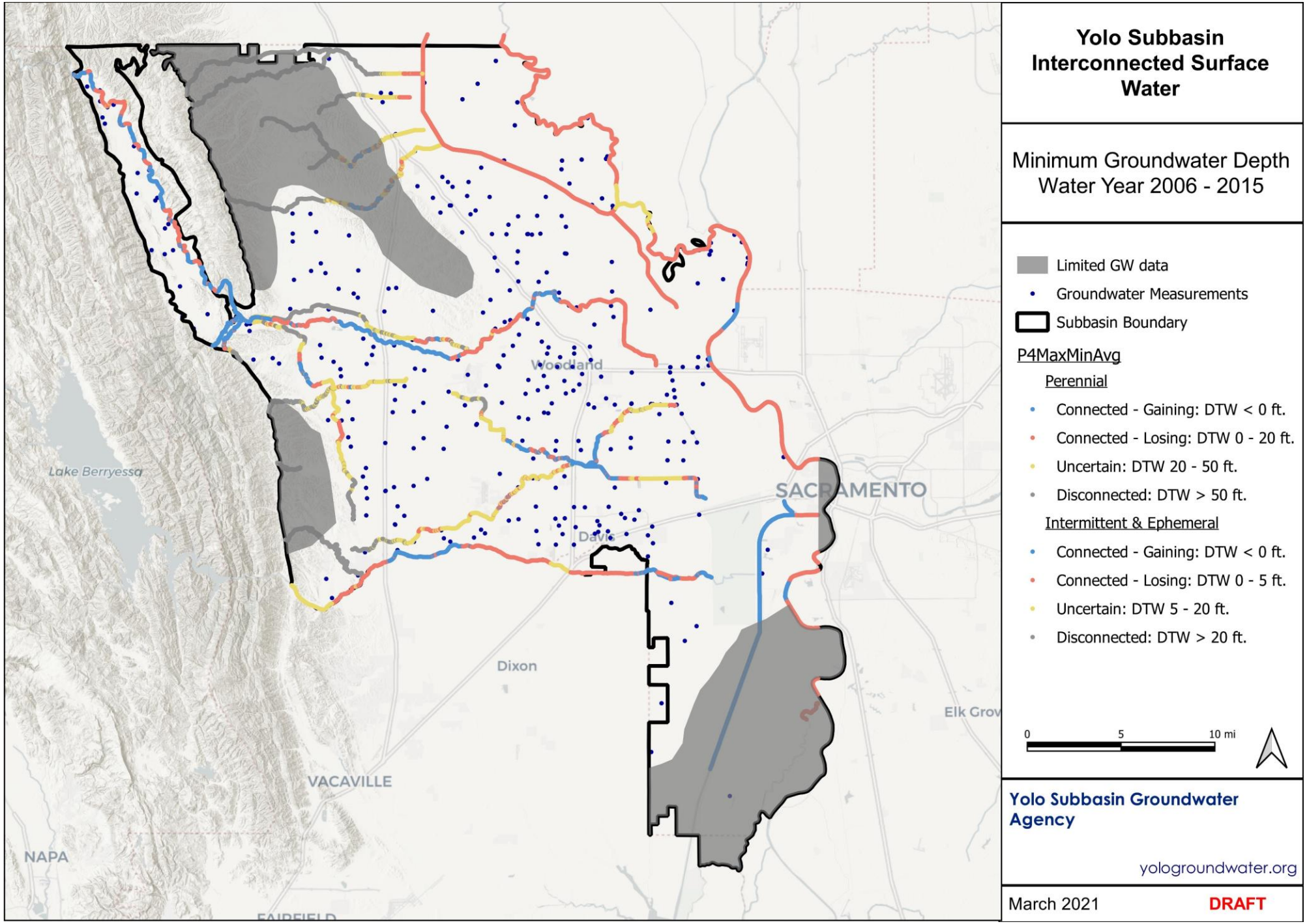
Basin-wide Interconnected Surface Water

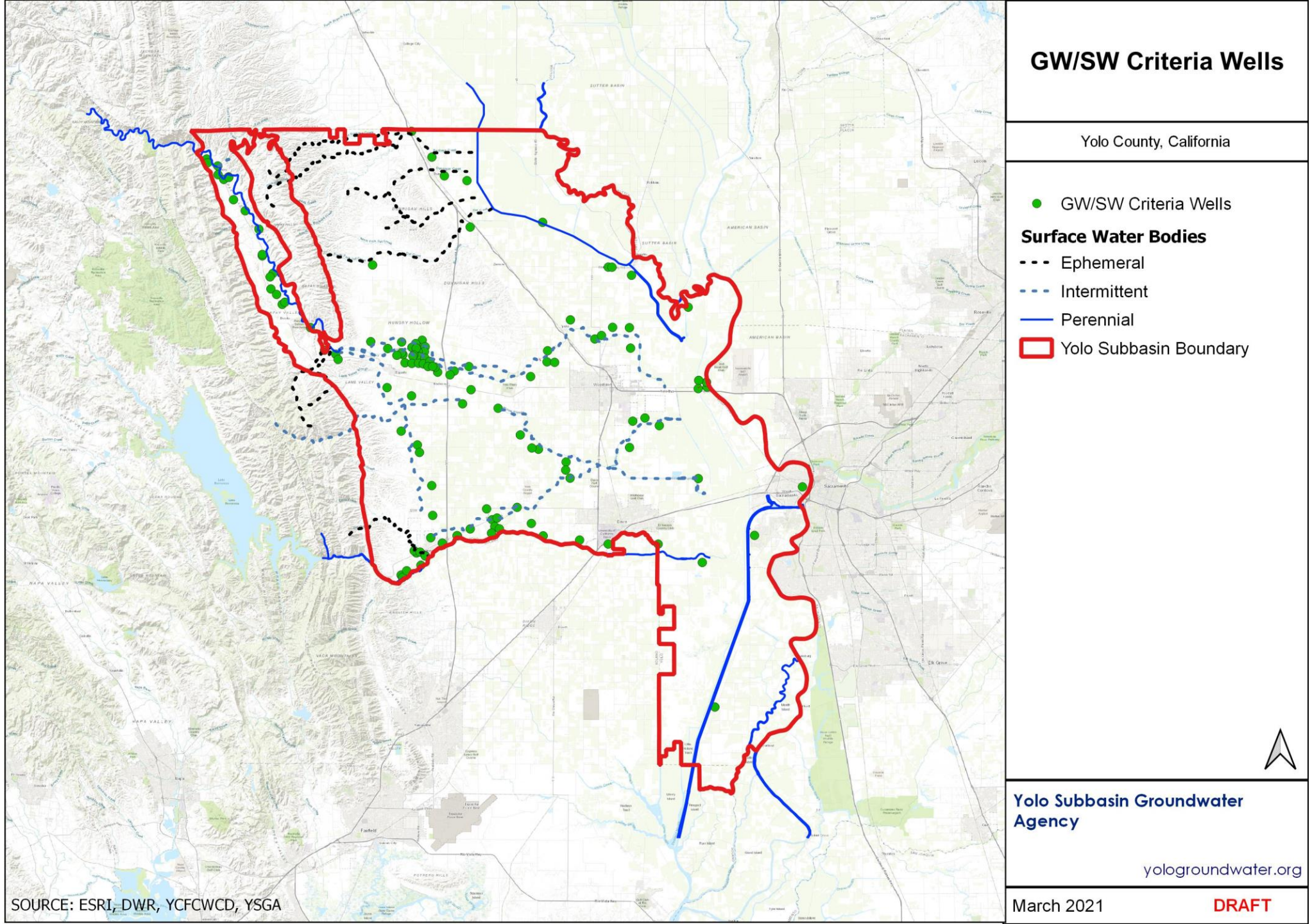
Connected

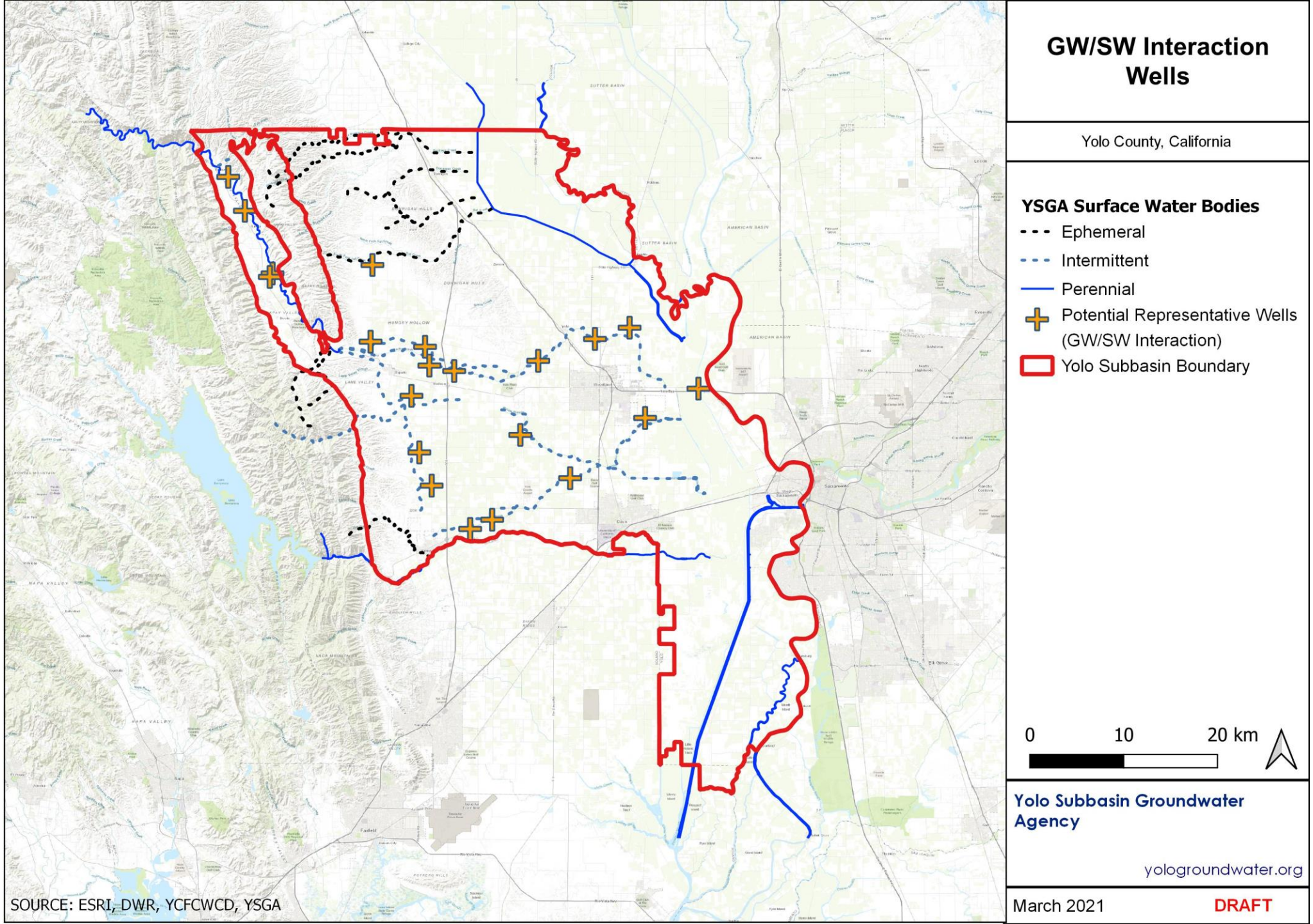


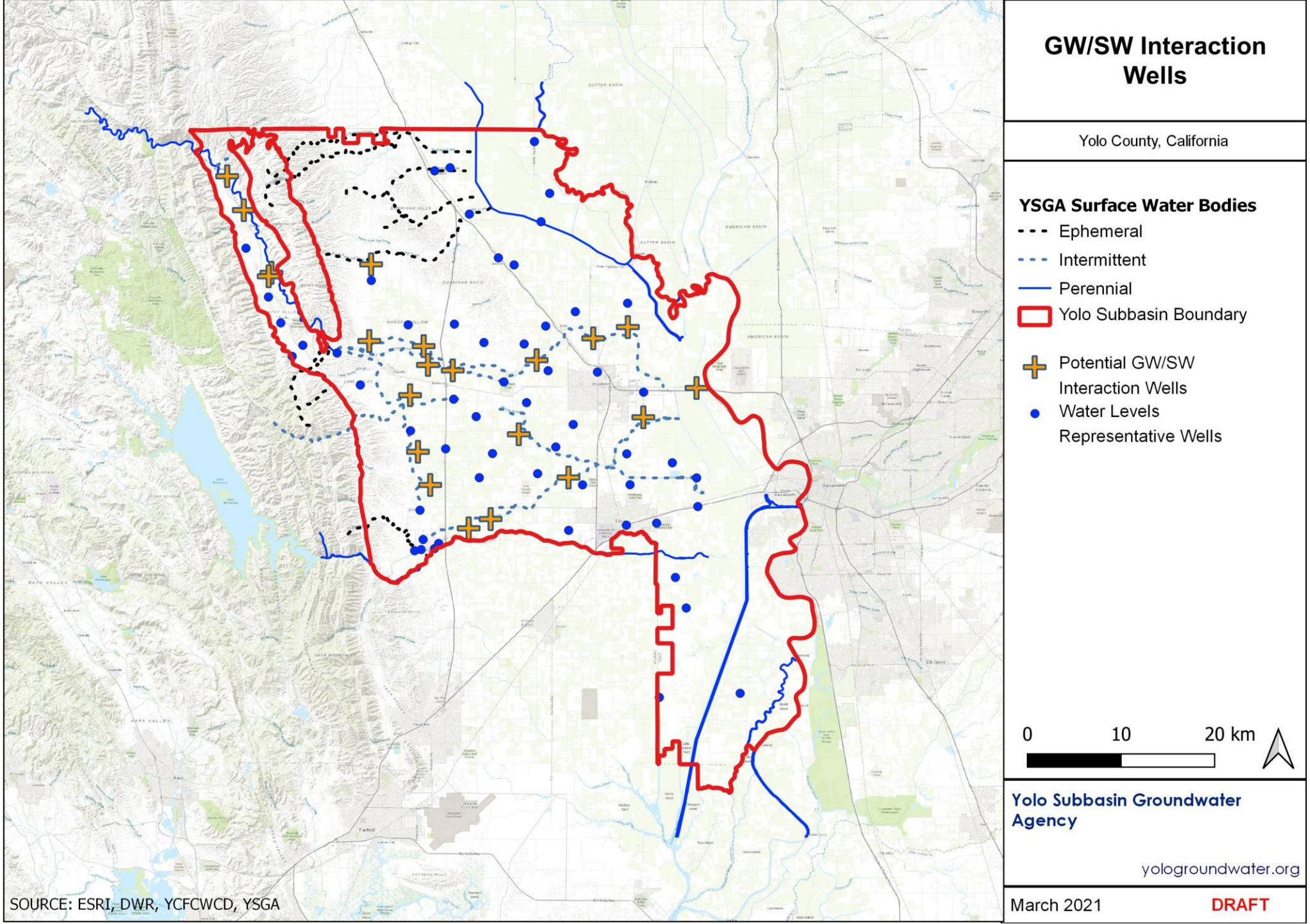
Disconnected



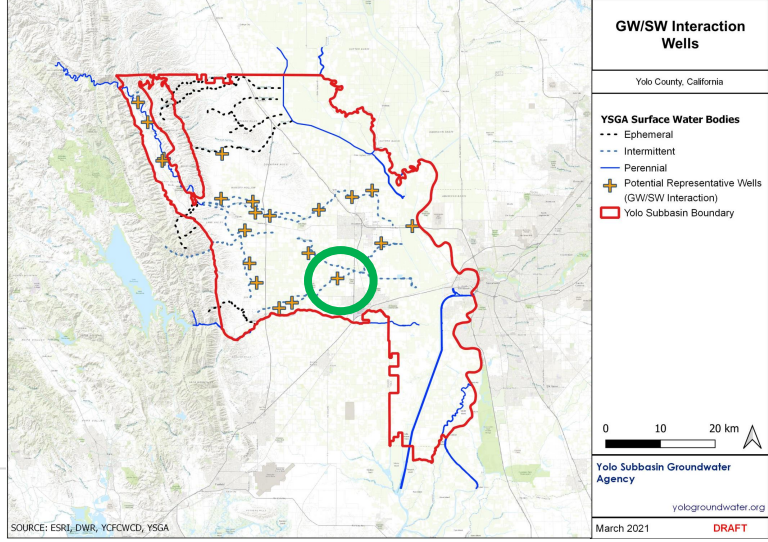

Yolo Subbasin Interconnected Surface Water
Minimum Groundwater Depth Water Year 2006 - 2015
Limited GW data
Groundwater Measurements
Subbasin Boundary
P4MaxMinAvg
Perennial
Connected - Gaining: DTW < 0 ft.
Connected - Losing: DTW 0 - 20 ft.
Uncertain: DTW 20 - 50 ft.
Disconnected: DTW > 50 ft.
Intermittent & Ephemeral
Connected - Gaining: DTW < 0 ft.
Connected - Losing: DTW 0 - 5 ft.
Uncertain: DTW 5 - 20 ft.
Disconnected: DTW > 20 ft.
0
5
10 mi
Yolo Subbasin Groundwater Agency
yologroundwater.org
March 2021
DRAFT
Woodland
Lake Berryessa
SACRAMENTO
Davis
Dixon
Elk Grov
VACAVILLE
NAPA

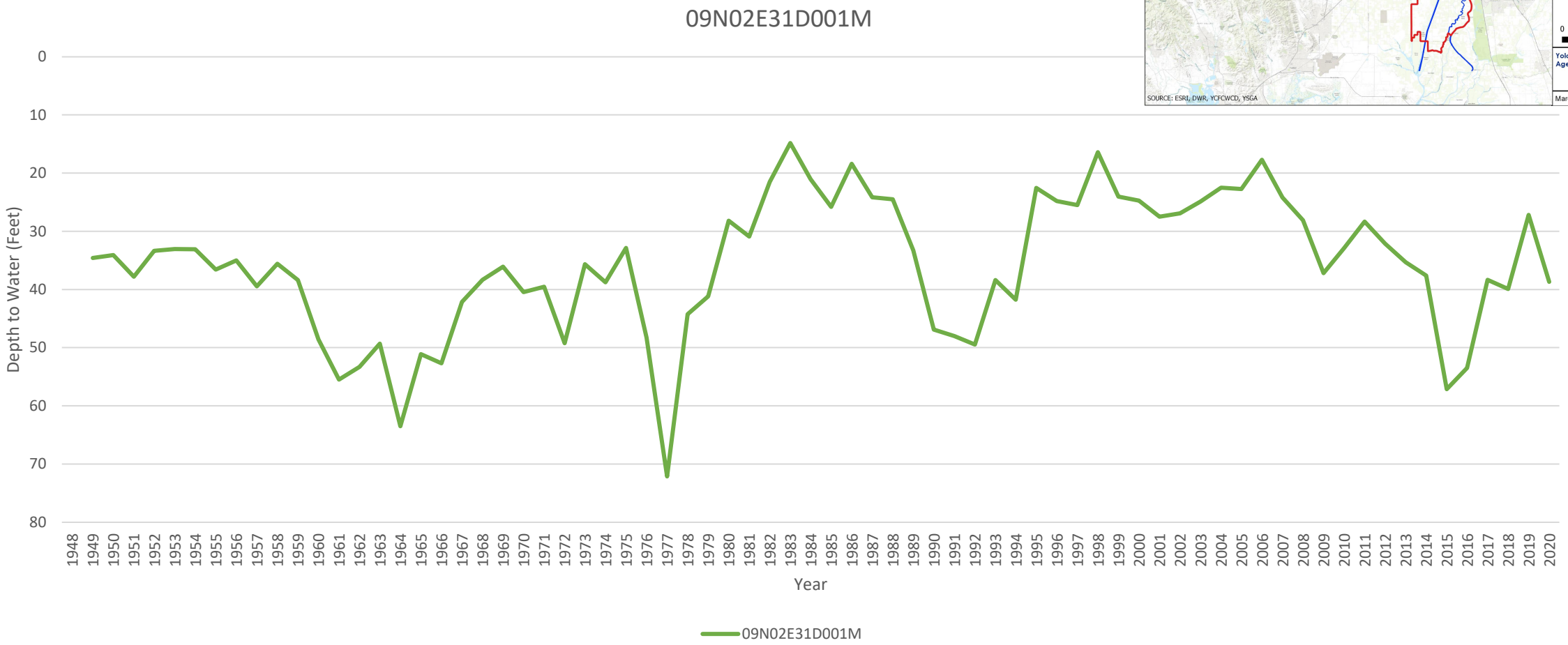

GW/SW Criteria Wells
Yolo County, California
GW/SW Criteria Wells
Surface Water Bodies
Ephemeral
Intermittent
Perennial
Yolo Subbasin Boundary
Yolo Subbasin Groundwater Agency
yologroundwater.org
March 2021
DRAFT
SOURCE: ESRI, DWR, YCFCWCD, YSGA


GW/SW Interaction Wells
Yolo County, California
YSGA Surface Water Bodies
Ephemeral
Intermittent
Perennial
Potential Representative Wells (GW/SW Interaction)
Yolo Subbasin Boundary
0
10
20 km
Yolo Subbasin Groundwater Agency
yologroundwater.org
March 2021
DRAFT
SOURCE: ESRI, DWR, YCFCWCD, YSGA


GW/SW Interaction Wells
Yolo County, California
YSGA Surface Water Bodies
Ephemeral
Intermittent
Perennial
Yolo Subbasin Boundary
Potential GW/SW Interaction Wells
Water Levels Representative Wells
0
10
20 km
Yolo Subbasin Groundwater Agency
yologroundwater.org
March 2021
DRAFT
SOURCE: ESRI, DWR, YCFCWCD, YSGA

Hydrograph


GW/SW Interaction Wells
Yolo County, California
YSGA Surface Water Bodies
Ephemeral
Intermittent
Perennial
Potential Representative Wells (GW/SW Interaction)
Yolo Subbasin Boundary
0 10 20 km
Yolo Subbasin Groundwater Agency
yologroundwater.org
SOURCE: ESRI, DWR, YCFCWCD, YSGA
March 2021
DRAFT


09N02E31D001M
Depth to Water (Feet)
0
10
20
30
40
50
60
70
80
1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Year
09N02E31D001M

Draft Chapters of the GSP – Basin Setting

Scheduling Focused Workshops

Projects/Management Actions

PROJECTS

- Excess storm flow diversions into canals, sloughs, etc. (China Slough to Zamora)
- Water transfers/imported water supplies
- Outreach to YCFC&WCD service area landowners: optimized conjunctive management

MANAGEMENT ACTIONS

- Maintain and enhance existing groundwater monitoring network
- Continue to coordinate with member entities, landowners, beneficial users, etc.
- Improve public access to groundwater data - transparency
- Gather information on known data gaps
  - Groundwater-dependent ecosystems (GDEs)
  - Environment beneficial users
  - Surface water groundwater interaction
  - Dunnigan Hills MA, etc.
- Adaptive Management

Projects/Management Actions

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BOD Meeting Agenda