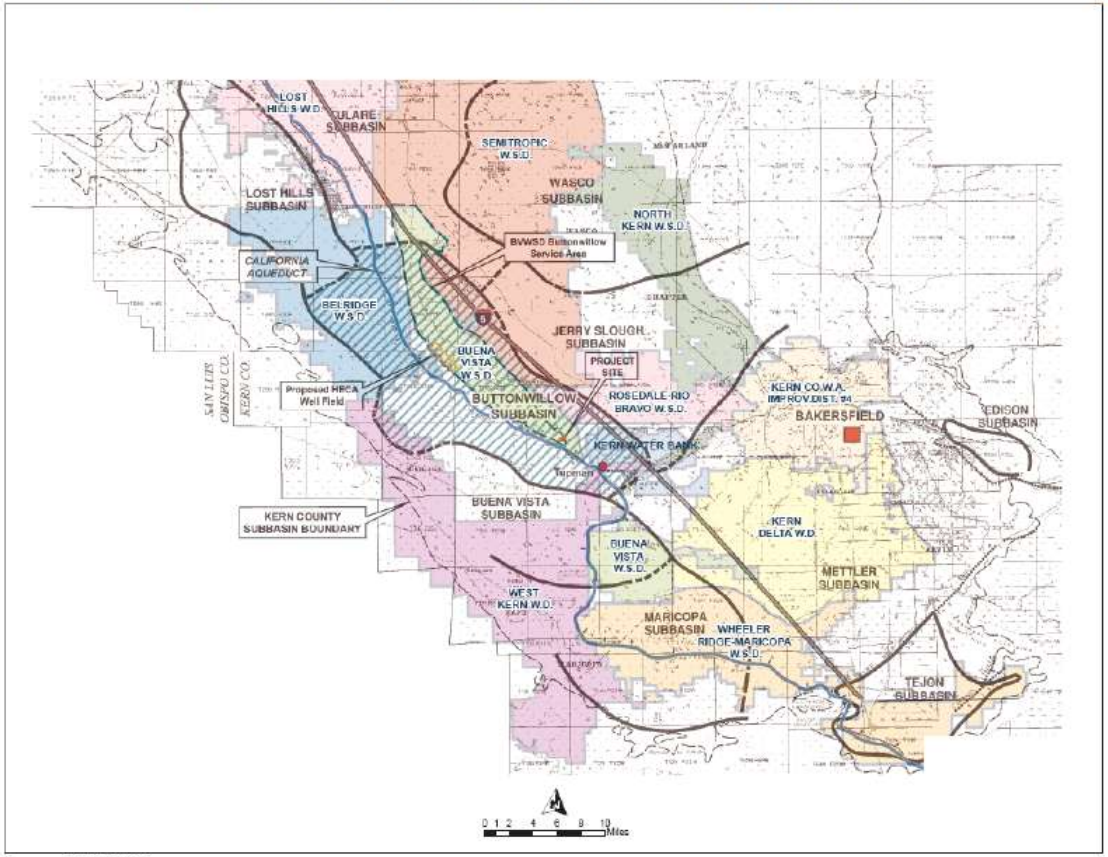
HECA Water Workshop

California Energy Commission
Sacramento, CA

February 20, 2013

URS

SOIL&WATER Figure 1: Kern Water Districts and Subbasins



Source: FEIR 2009

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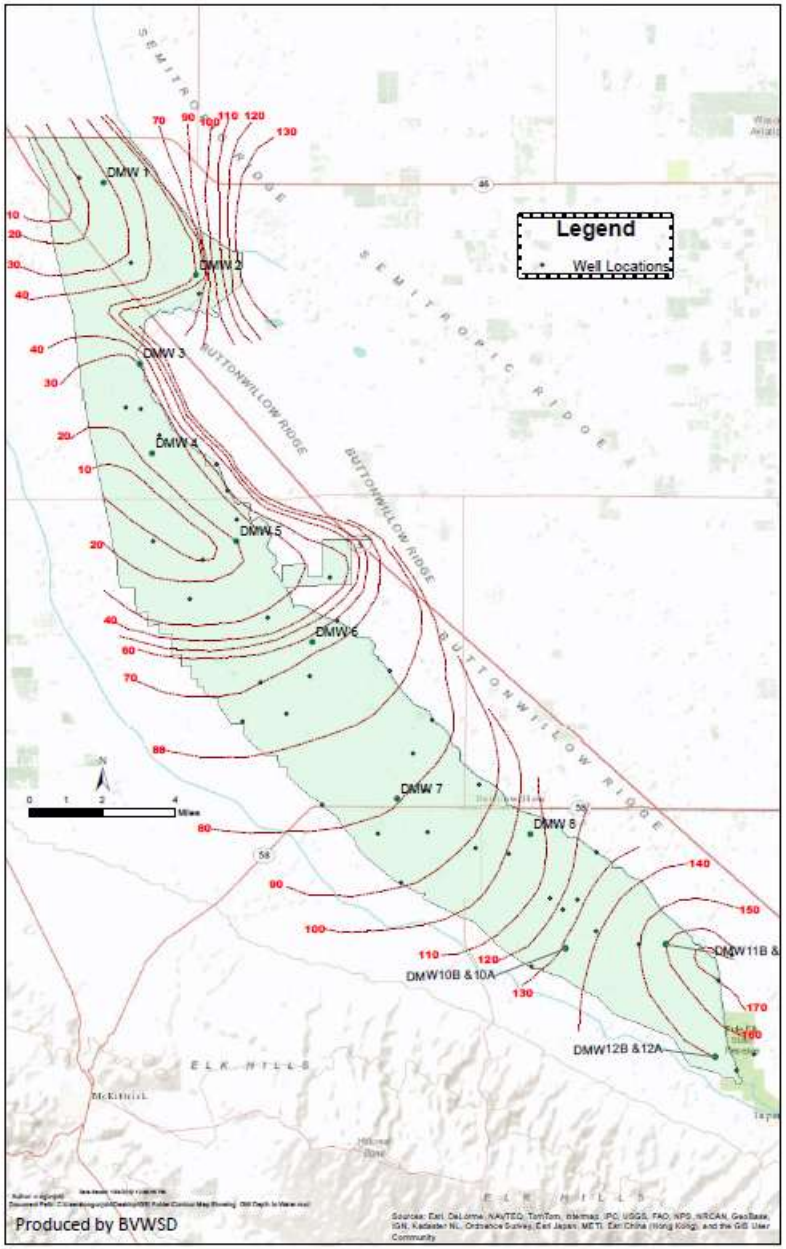
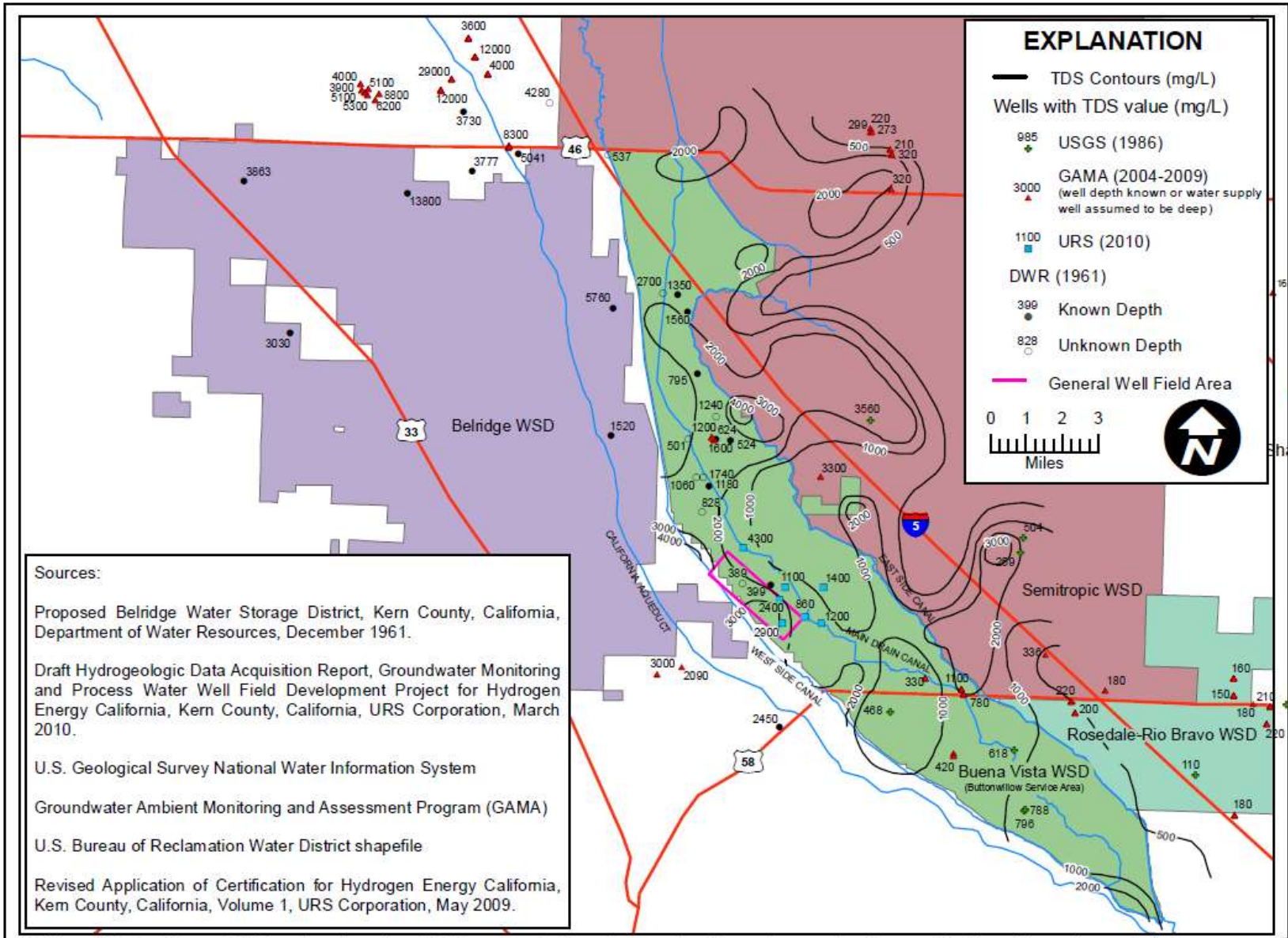
Map Showing Contours of Depth to Water Level- Pumping Zone (Ft.)





Soil and Water Figure 8. Map showing deep TDS concentrations in samples from deep and unknown depth wells and reported 1970-2007 composite TDS concentration contours for the pumped groundwater zone.

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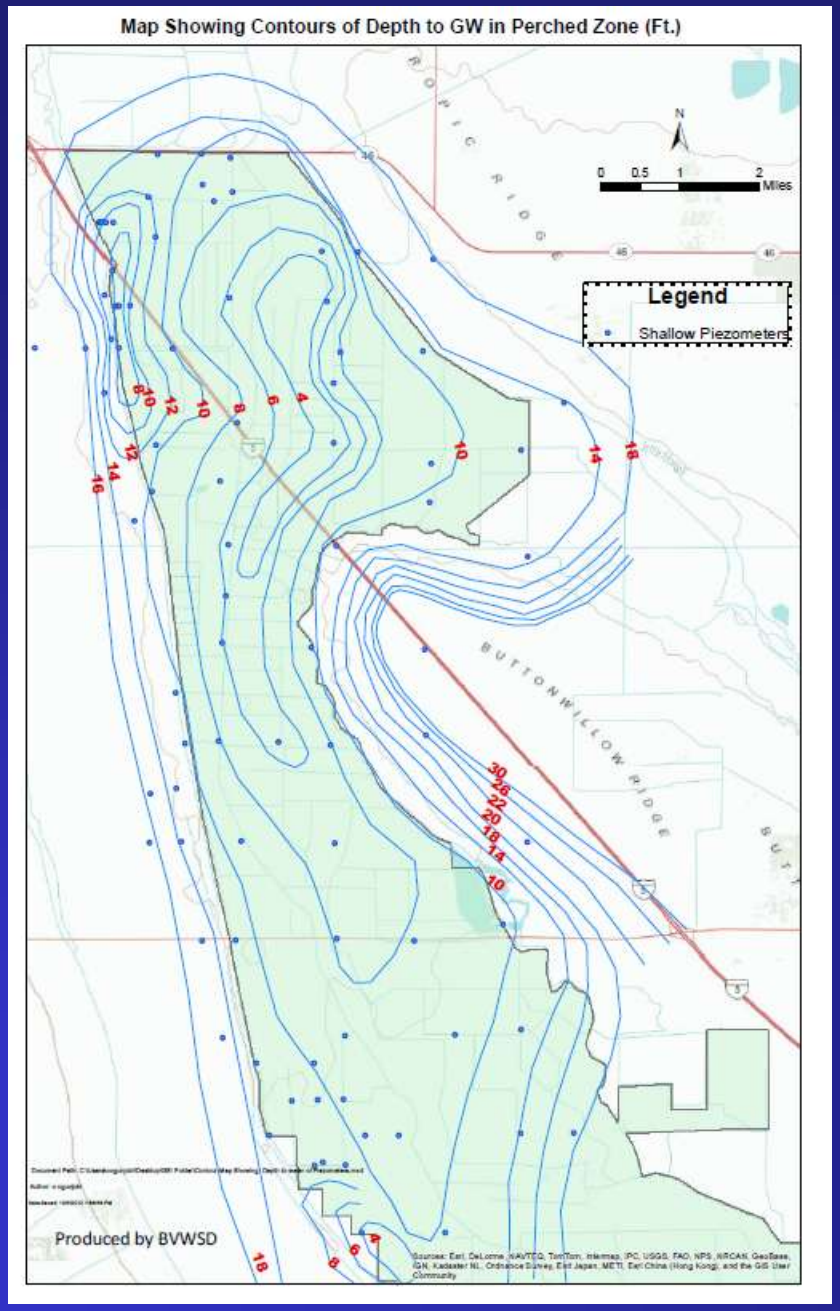
Map Showing Contours of Depth to GW in Perched Zone (Ft.)
N
0 0.5 1 2
Miles
Legend
Shallow Piezometers
BUTTONWILLOW RIDGE
Produced by BVWSD

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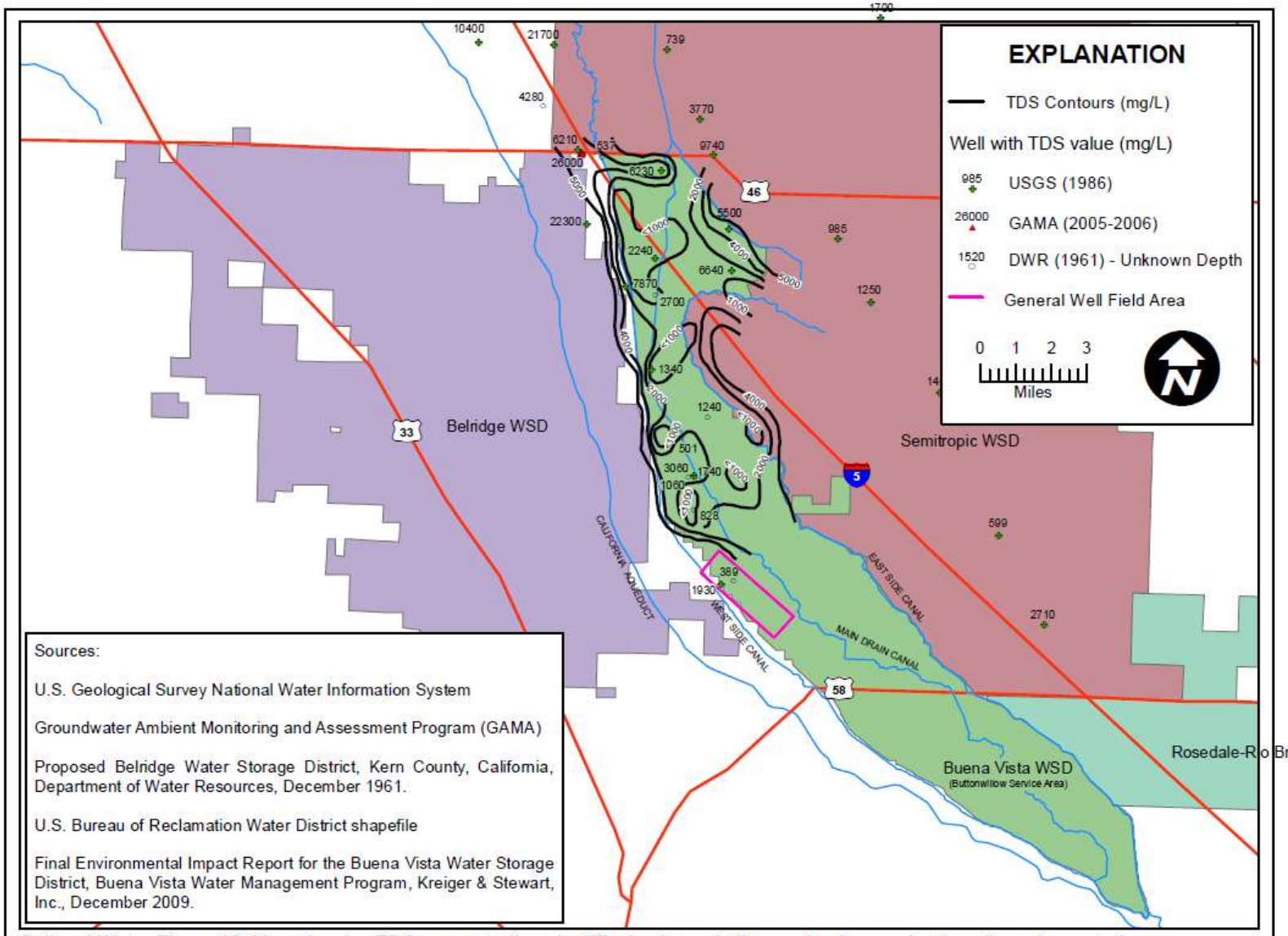

Soil and Water Figure 10. Map showing TDS concentrations in samples from shallow and unknown depth wells and reported concentration contours for the shallow perched aquifer.

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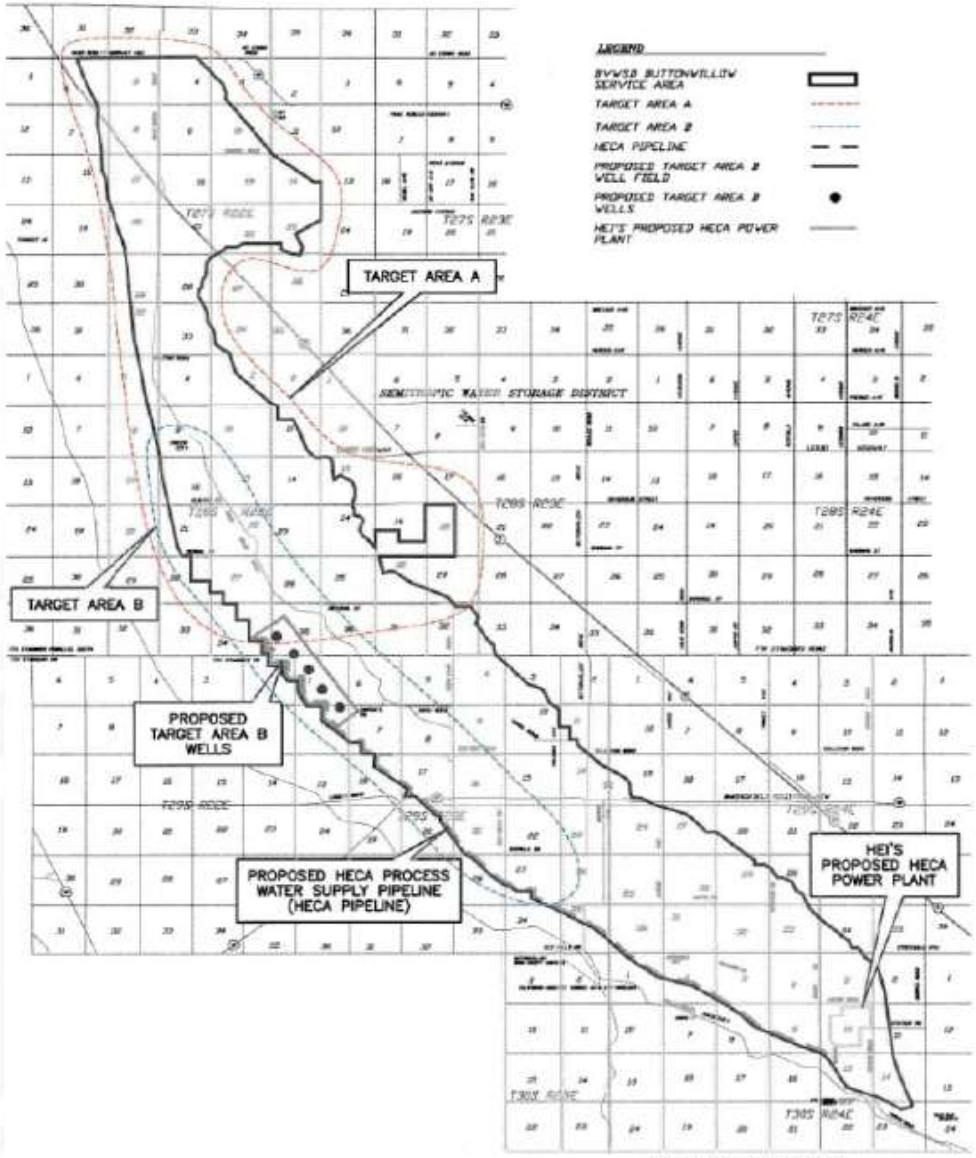
SOIL&WATER Figure 2: Brackish Groundwater Remediation Project



Buttonwillow Service Area

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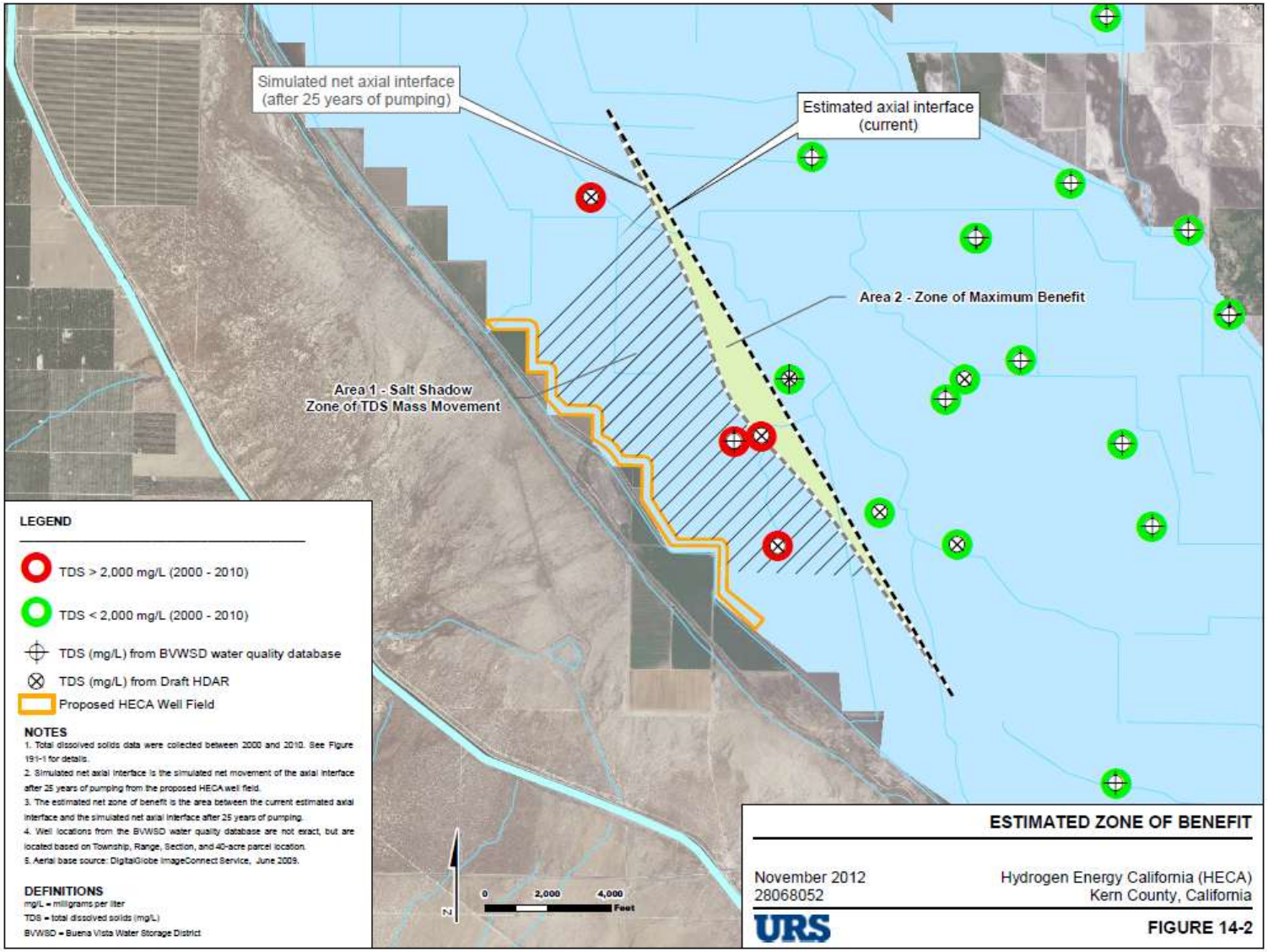
Simulated net axial interface
(after 25 years of pumping)
Estimated axial interface
(current)
Area 2 - Zone of Maximum Benefit
Area 1 - Salt Shadow
Zone of TDS Mass Movement
LEGEND
TDS > 2,000 mg/L (2000 - 2010)
TDS < 2,000 mg/L (2000 - 2010)
TDS (mg/L) from BVWSD water quality database
TDS (mg/L) from Draft HDAR
Proposed HECA Well Field
NOTES
1. Total dissolved solids data were collected between 2000 and 2010. See Figure 191-1 for details.
2. Simulated net axial interface is the simulated net movement of the axial interface after 25 years of pumping from the proposed HECA well field.
3. The estimated net zone of benefit is the area between the current estimated axial interface and the simulated net axial interface after 25 years of pumping.
4. Well locations from the BVWSD water quality database are not exact, but are located based on Township, Range, Section, and 40-acre parcel location.
5. Aerial base source: DigitalGlobe ImageConnect Service, June 2009.
DEFINITIONS
mg/L = milligrams per liter
TDS = total dissolved solids (mg/L)
BVWSD = Buena Vista Water Storage District
N
0
2,000
4,000
Feet
ESTIMATED ZONE OF BENEFIT
November 2012
28068052
Hydrogen Energy California (HECA)
Kern County, California
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FIGURE 14-2

Groundwater Flow Model Discussion Technical Points

- Boundary Conditions
- Groundwater Recharge
- Specific Yield & Specific Storage
- Anisotropy

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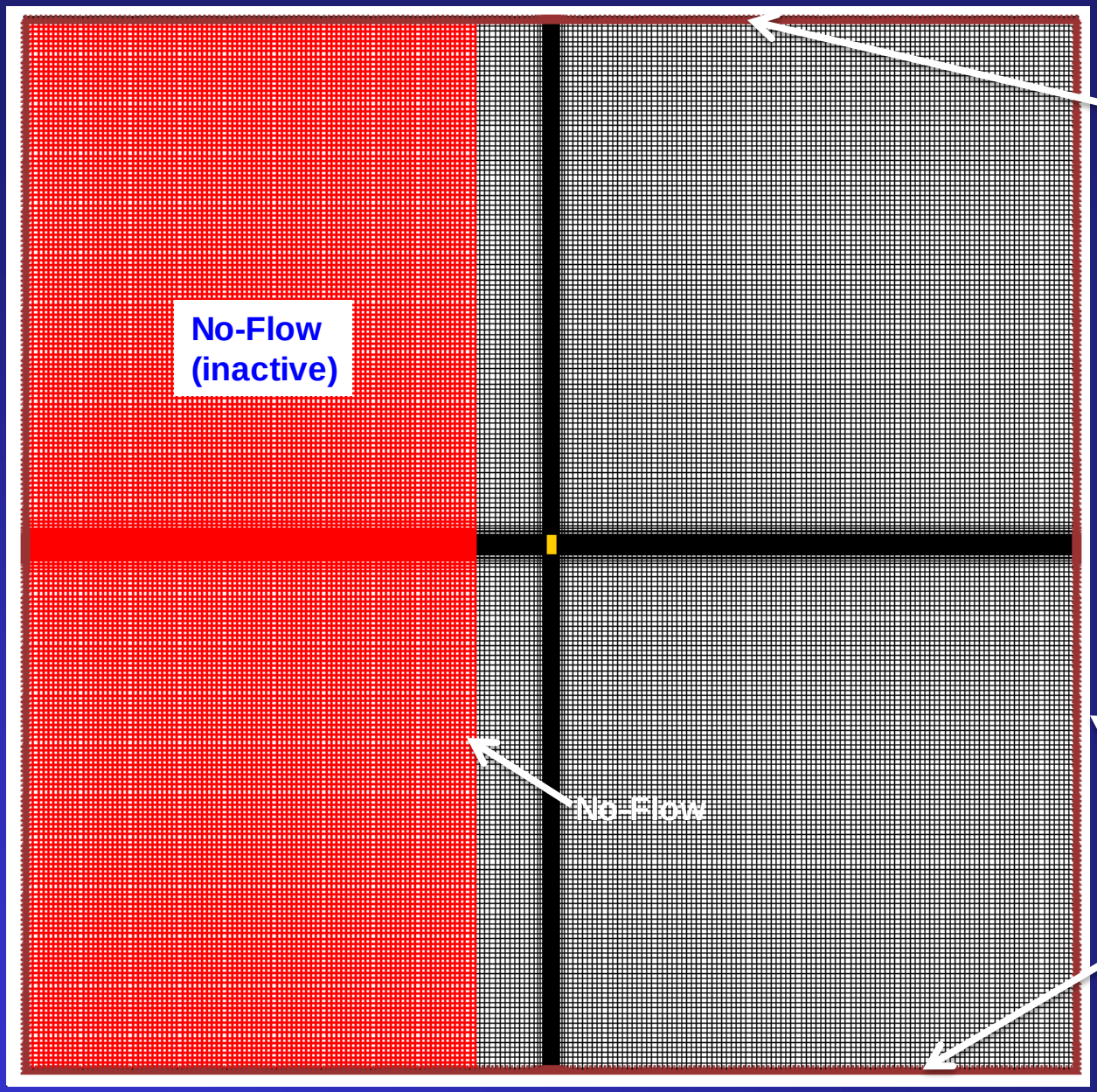
Boundary Conditions

	URS	CEC
Model Value	General Head (all 4 sides)	No Flow (Western Boundary)
Rationale	Model domain is 100 x 100 miles, which far exceeds the project well field pumping influence. Therefore, the model boundary does not have an effect on groundwater response in the project area.	To represent the contact between the water bearing alluvium and essentially non-water bearing marine rocks of the Coast Ranges. Contact is ~6 miles west of the project well field.

CEC



Grid Size:
Min: 20 by 20 ft (at wells)
Max: 2500 by 2500 ft (edges)

Rows: 329
Columns: 247
Layers: 3

Model domain (100 by 100 Miles), finite-difference discretization, and BC
(in Model Layer 1 – Unconfined 0 to 300' bgs)

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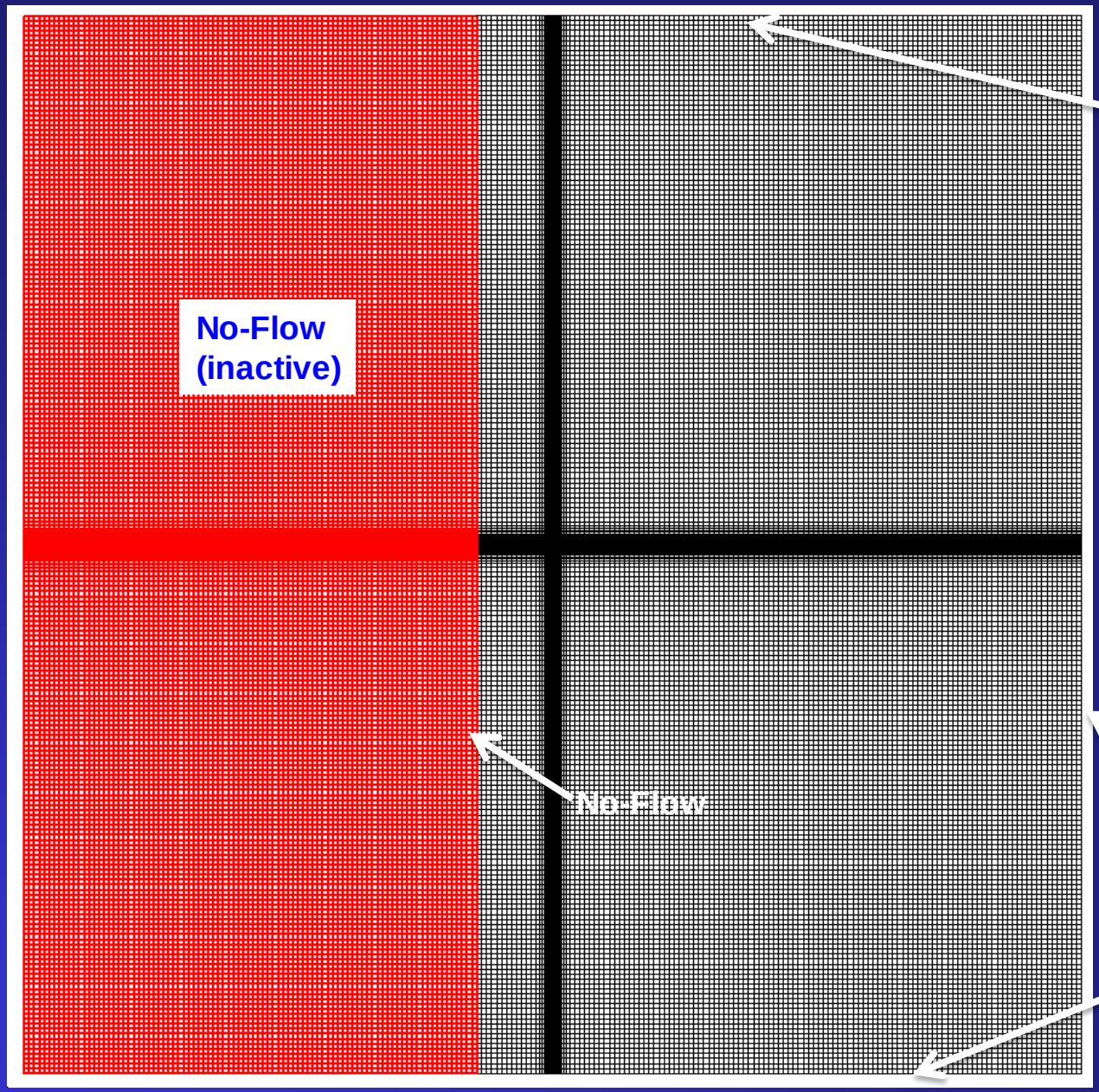
CEC



Grid Size:
Min: 20 by 20 ft (at wells)
Max: 2500 by 2500 ft (edges)

Rows: 329
Columns: 247
Layers: 3

Model domain (100 by 100 Miles), finite-difference discretization, and BC (in Model Layers 2 [300 to 600' bgs] and 3 [600 to 2,000' bgs])

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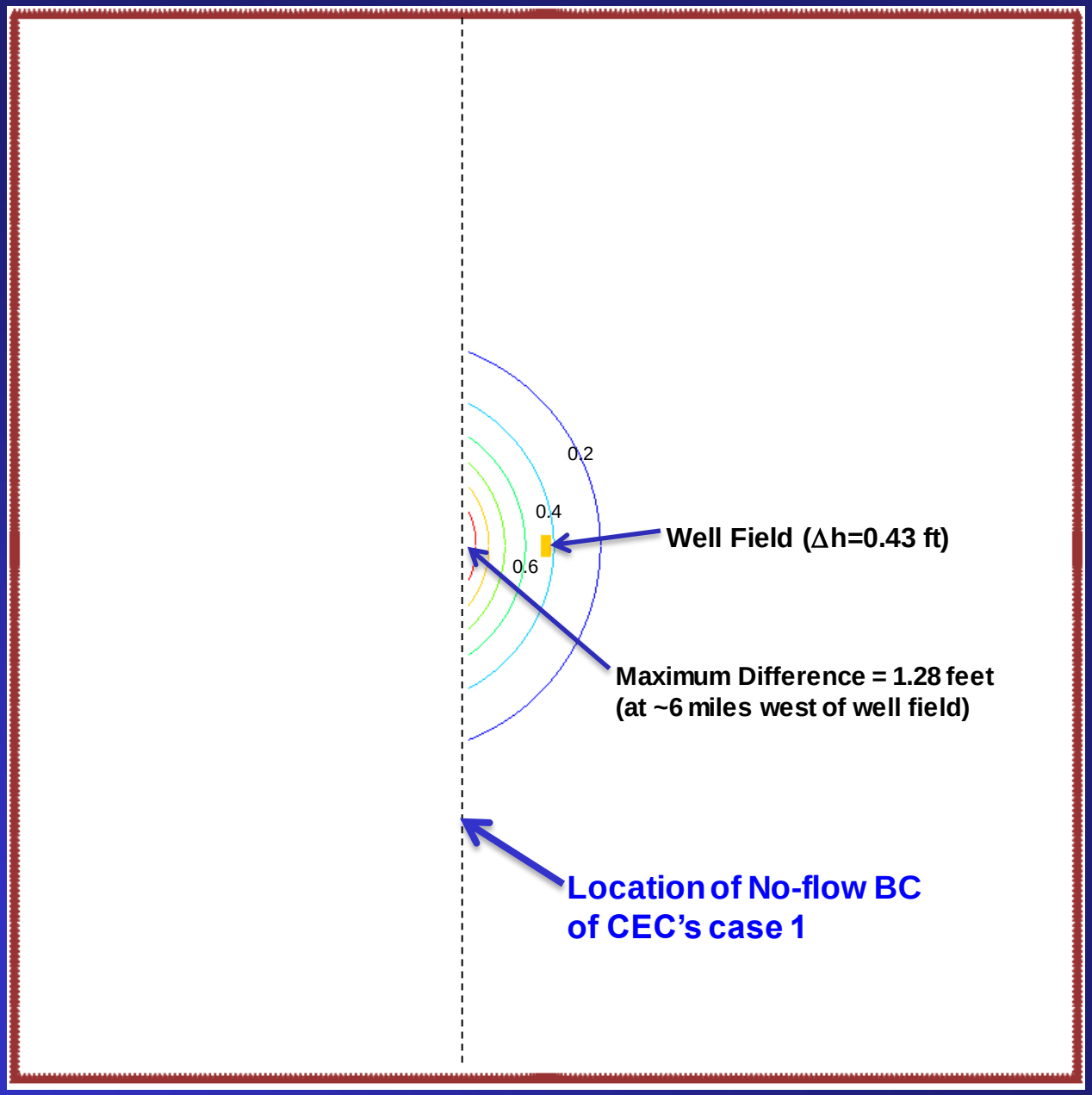
Comparison of CEC's & URS' Model results:

CEC's: No-flow BC
URS': GHB



Difference of modeled drawdown between with and without no-flow BC in the west (T=25 years) (Difference between model results of CEC and URS case of no-recharge)

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Boundary Conditions

Conclusions:

- No difference between no flow and general head boundary condition in the eastern, northern, and southern edges of the model domain.
- Difference in drawdown between general head and no flow boundary condition in the western edge of the model domain is small (max diff. is 1.23 feet at ~6 miles west of pumping wells).

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Groundwater Recharge

	URS	CEC
Model Value	Included (7,500 afy)	Not Included
Rationale	The model simulates 7,500 afy recharge based on BVWSD's positive water balance. BVWSD projects 25,000 afy recharge in excess of overall BSA GW pumping. With BGRP/HECA, GW pumping increases by 7,500 afy and the recharge projection would drop by 7,500 afy (resulting in new projected recharge over the BSA of 17,500 afy). BVWSD Water Management Plan (WMP) would apply it's positive water balance over total GW pumping with implementation of the BGRP/HECA Area B component.	Recharge is not consistent with the superposition model approach. The project will add 7,500 afy pumping. But, the project does not add 7,500 afy recharge.

Comparison of Modeled Drawdowns at Selected Locations and Distances from Well Field without and with recharge of 7,500 afy

Results	Model Simulation								
	Base Case	Sensitivity Simulation							
		Sand %		Anisotropy		Specific Yield		Specific Storage	
		Lower End	Upper End	Lower End	Upper End	Lower End	Upper End	Lower End	Upper End
Drawdown (ft)									
Pumping Wells (without recharge)	**40.6**	51.6	33.6	35.7	43.2	40.7	40.5	40.7	40.5
With Recharge	**36.9**	47.0	30.5	32.3	39.2	36.9	36.9	36.9	36.9
Difference in drawdown (ft)	**3.7**	4.6	3.1	3.4	4	3.8	3.6	3.8	3.6
200 feet east of pumping wells (w/out recharge)	**21.9**	27.3	18.3	17.5	24.3	22.0	21.8	22.0	21.8
With Recharge	**18.5**	23.2	15.4	14.3	20.6	18.5	18.4	18.5	18.5
Difference in drawdown (ft)	**3.4**	4.1	2.9	3.2	3.7	3.5	3.4	3.5	3.3
1/2 mile east of pumping wells (w/out recharge)	**8.7**	10.6	7.4	6.8	9.9	8.8	8.6	8.8	8.6
With Recharge	**5.5**	6.5	4.4	3.6	6.2	5.2	5.2	5.2	5.2
Difference in drawdown (ft)	**3.2**	4.1	3	3.2	3.7	3.6	3.4	3.6	3.4
1 mile east of pumping wells (w/out recharge)	**5.5**	6.7	4.8	4.8	6.2	5.6	5.5	5.6	5.5
With Recharge	**2.0**	2.4	1.7	1.5	2.4	2.0	2.0	2.0	2.0
Difference in drawdown (ft)	**3.5**	4.3	3.1	3.3	3.8	3.6	3.5	3.6	3.5
Distance from well field (miles) without recharge									
2.0 ft drawdown contour line	**4.67**	5.34	4.02	4.71	4.67	4.95	4.50	4.91	4.47
1.0 ft drawdown contour line	**9.05**	9.45	8.63	9.15	9.05	9.65	8.77	9.52	8.68

Notes:

The table is a comparison of model results without recharge to those with recharge (7,500 afy) as presented in the HECA May 2009 AFC Appendix O Table 2.
Model results with recharge indicated that times to maximum drawdown occurred in a range of between 5 and 23 years depending on location and sensitivity simulation.
Model results without recharge are all at the end of pumping year 25 (maximum drawdown from pumping) since none of the drawdowns reach steady state w/only drawdowns near the pumping well approaching steady state.
Without recharge the 2.0 and 1.0 foot contours keep expanding through the end of the 25 year simulation.

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Specific Yield

Specific Yield

	URS	CEC
Model Value	0.18	0.007
Rationale	Based on information from Sierra Scientific Services, specific yield of the local aquifer system ranges from 0.15 to 0.20. This is typical for an unconfined aquifer. A mid-range value was used in the model for the Base Case, noting that sensitivity analysis were also run and provided in the AFC GW Model Appendix (N-2 in May 2012 and O in May 2009)	Geometric mean of storage coefficients from URS' aquifer test analyses.

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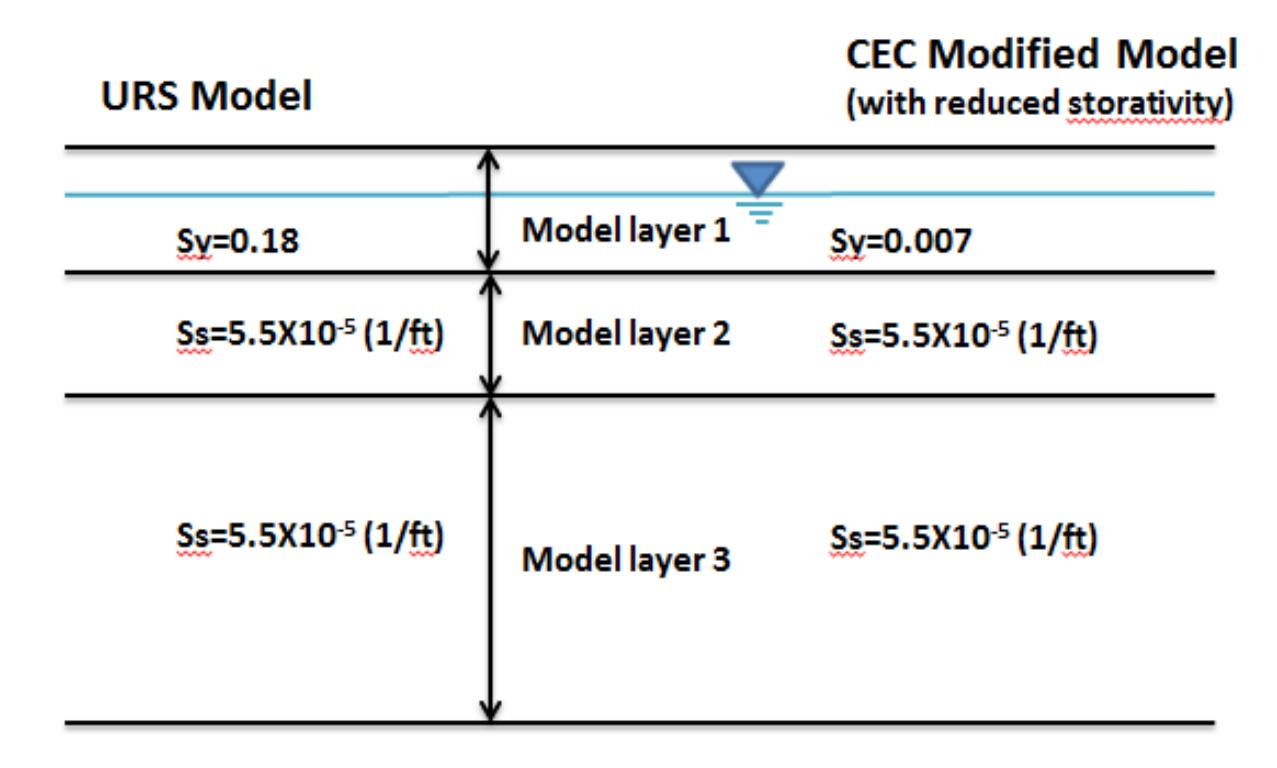

- In MODFLOW, specific yield (Sy) is always used in the model layer containing the water table (unconfined). It is not appropriate to apply as Ss value to an unconfined condition.
- In MODFLOW, specific storage (Ss) is always used for model layer where water table is above the layer' top elevations (confined).

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Specific Yield

Conclusions:

- CEC's use of 0.007 is inappropriate for the top, unconfined, model layer (0 to 300' bgs with water table ~50' bgs).
- As stated in HDAR findings, the distribution of storativity values is bimodal: some wells had lower values some wells had higher values. Therefore, use of 0.007 to represent top model layer (unconfined) is inappropriate.
- Sy of 0.007 is not supported by what BVWSD has observed with long term agricultural well pumping. If it were 0.007, the aquifer system would have been dried out by now. As such the CEC modification is not realistic or usable when trying to approximate local aquifer conditions.

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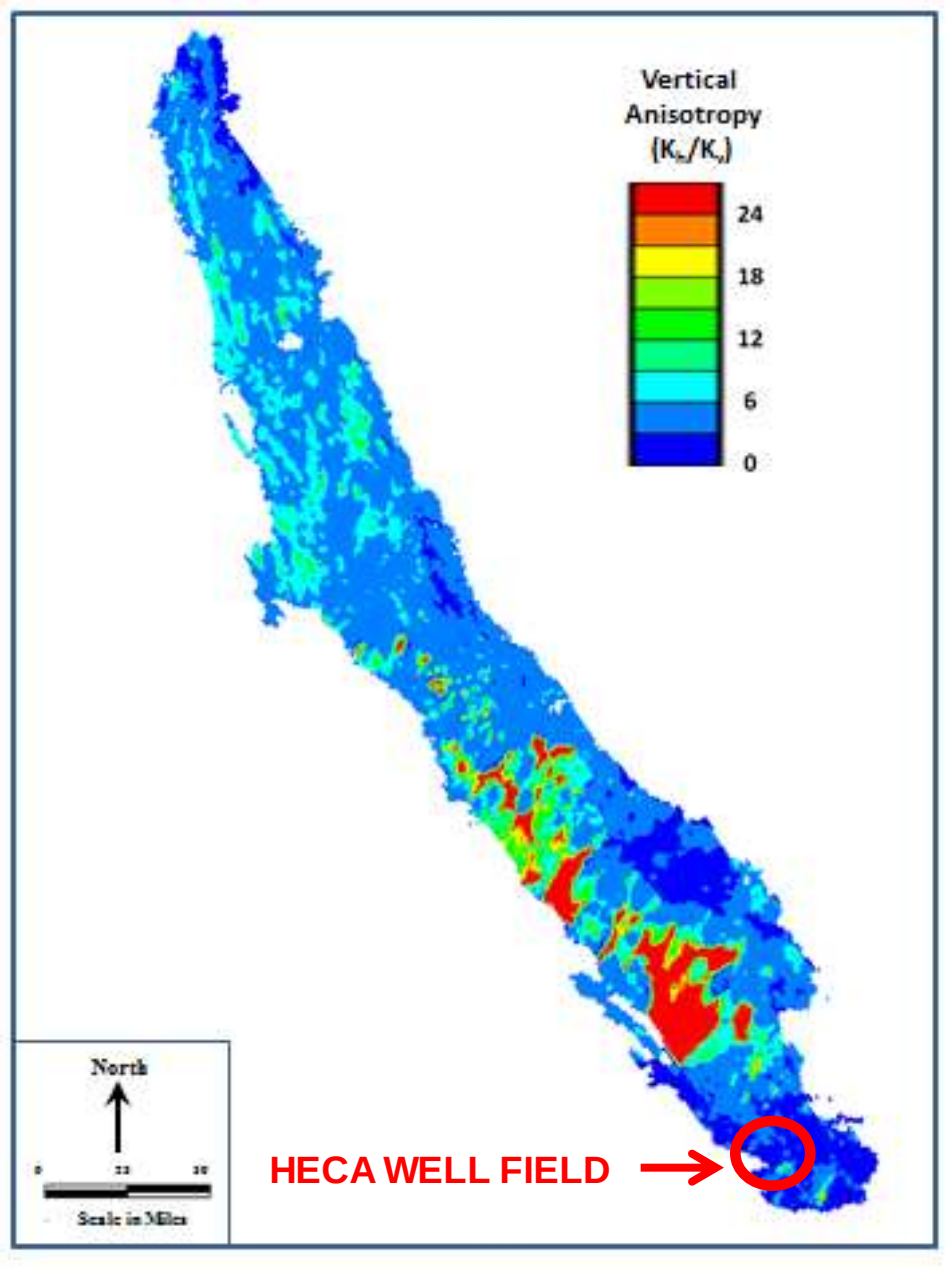
Anisotropy

	URS	CEC
Model Value	30	1,000
Rationale	Typical range is 10 to 50. A mid-range value was used for the Base Case.	Based on Belitz and others (1993)

- Belitz and others (1993)
  - Study area is in northern Fresno County, ~150 miles north of the project site, thus is not necessarily correlatable to the BGRP/HECA study area.
  - The CEC model modification assumes the presence of a Corcoran Clay equivalent (CCE). Local geologic and geophysical logs do not support CCE presence. When observed clay lenses appeared to be of limited extent (not laterally continuous) and thicknesses most a depths of ~600 to 700 feet bgs.



- USGS CVHM Model (2009)
- Maximum Anisotropy ~27
- Anisotropy in the vicinity of the HECA well field <10

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Model grid and locations of cross-sections A-A' and B-B'

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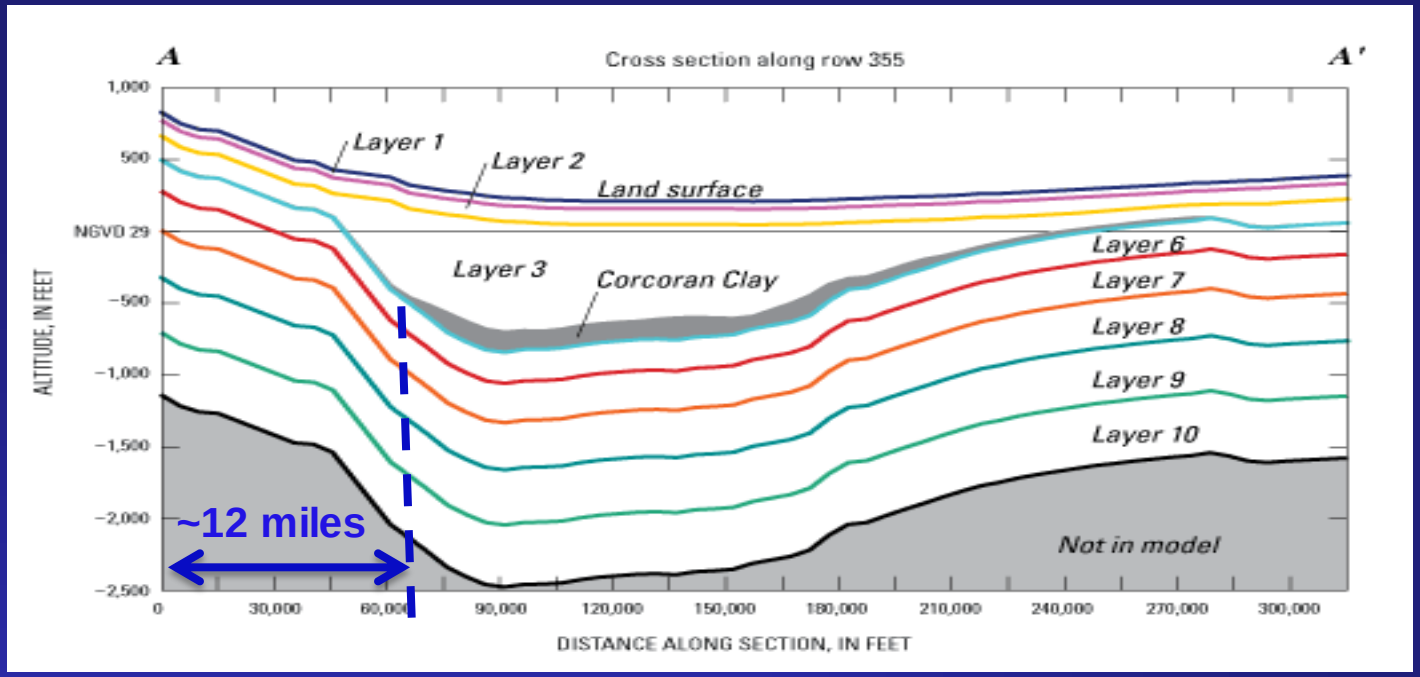

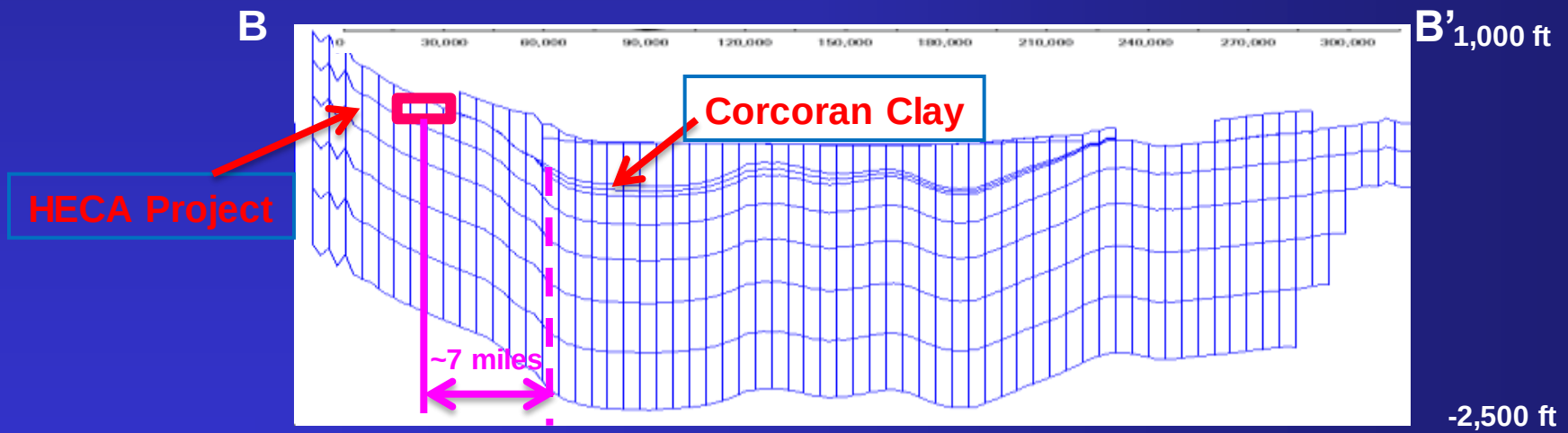

Model layers at cross-sections A-A' and B-B'

Note:
Corcoran clay is absent underneath HECA project (~7 mile away)

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Anisotropy

Conclusions:

- CECs selection of an anisotropic ratio of 1,000 is poorly justified and not remotely close to the hydrogeologic conditions in the study area.
- The CEC suggested anisotropic ratio forces an extreme condition simulating drawdown and drawdown geometry that is erroneous and misleading . This led to incorrect calculated impacts.
- BVWSD observations on how their GW system has responded to agricultural pumping (volumes far greater than BGRP 7,500 afy) verify that CEC selection of an anisotropic ratio of 1,000 is not valid.

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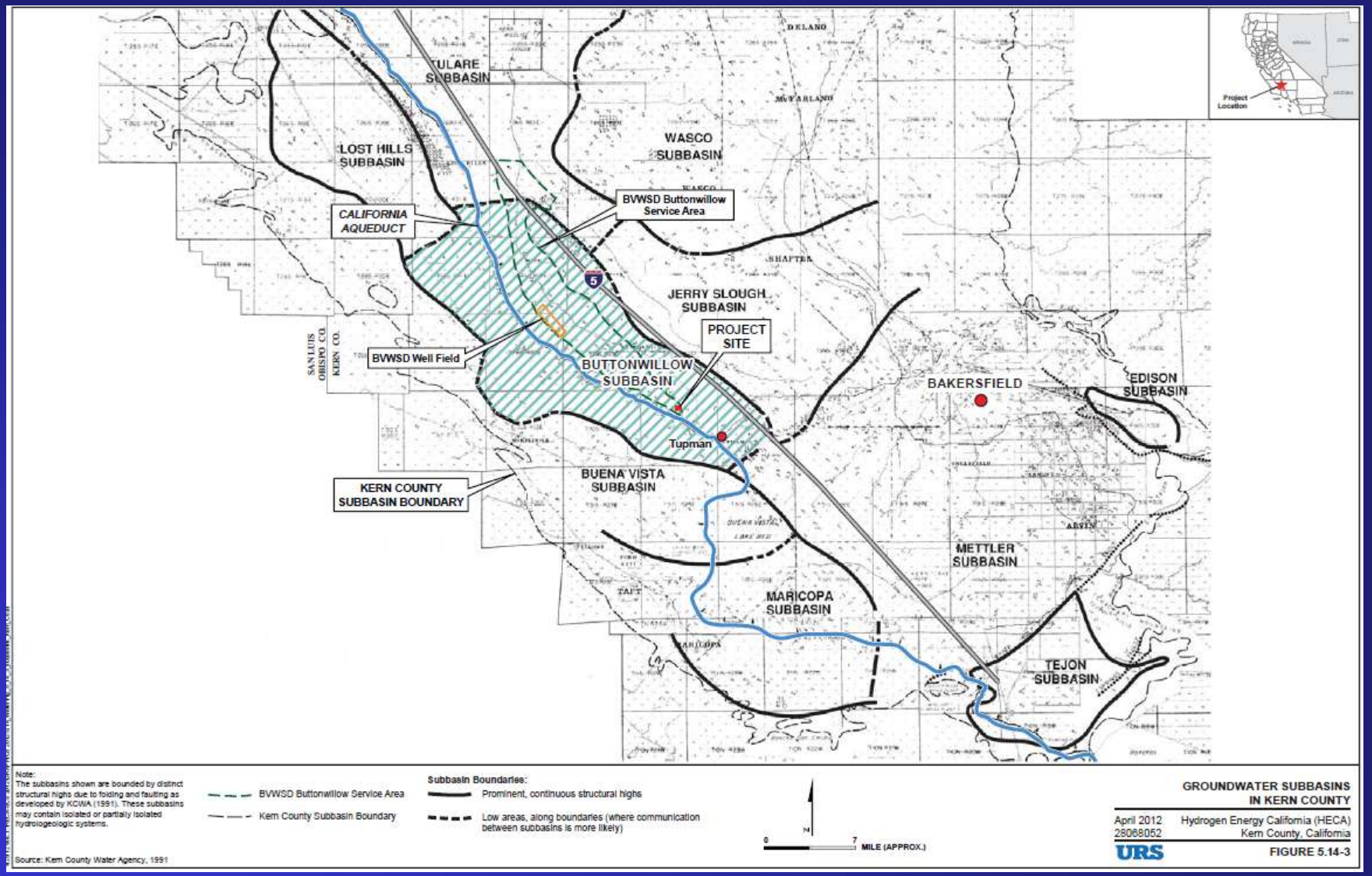
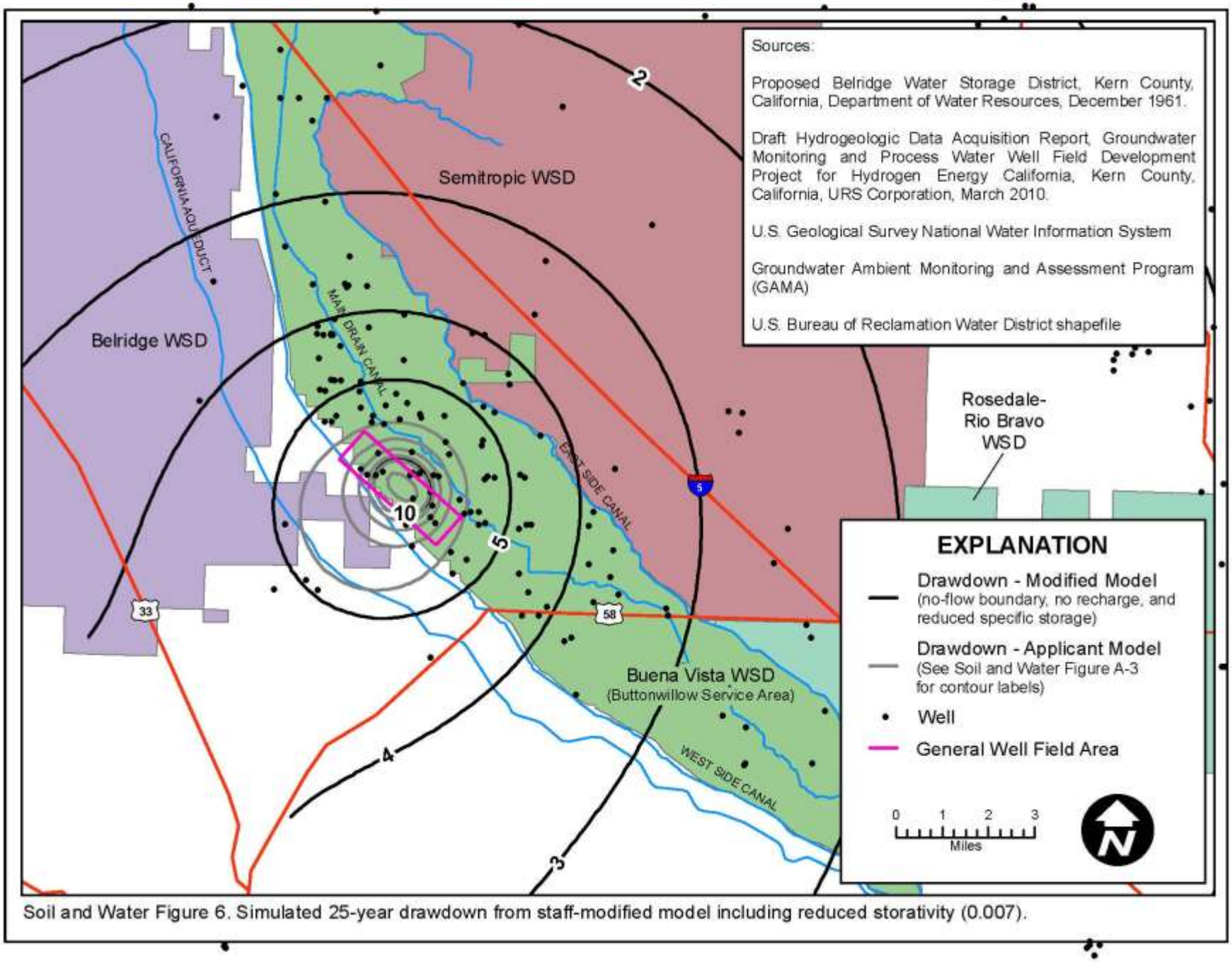
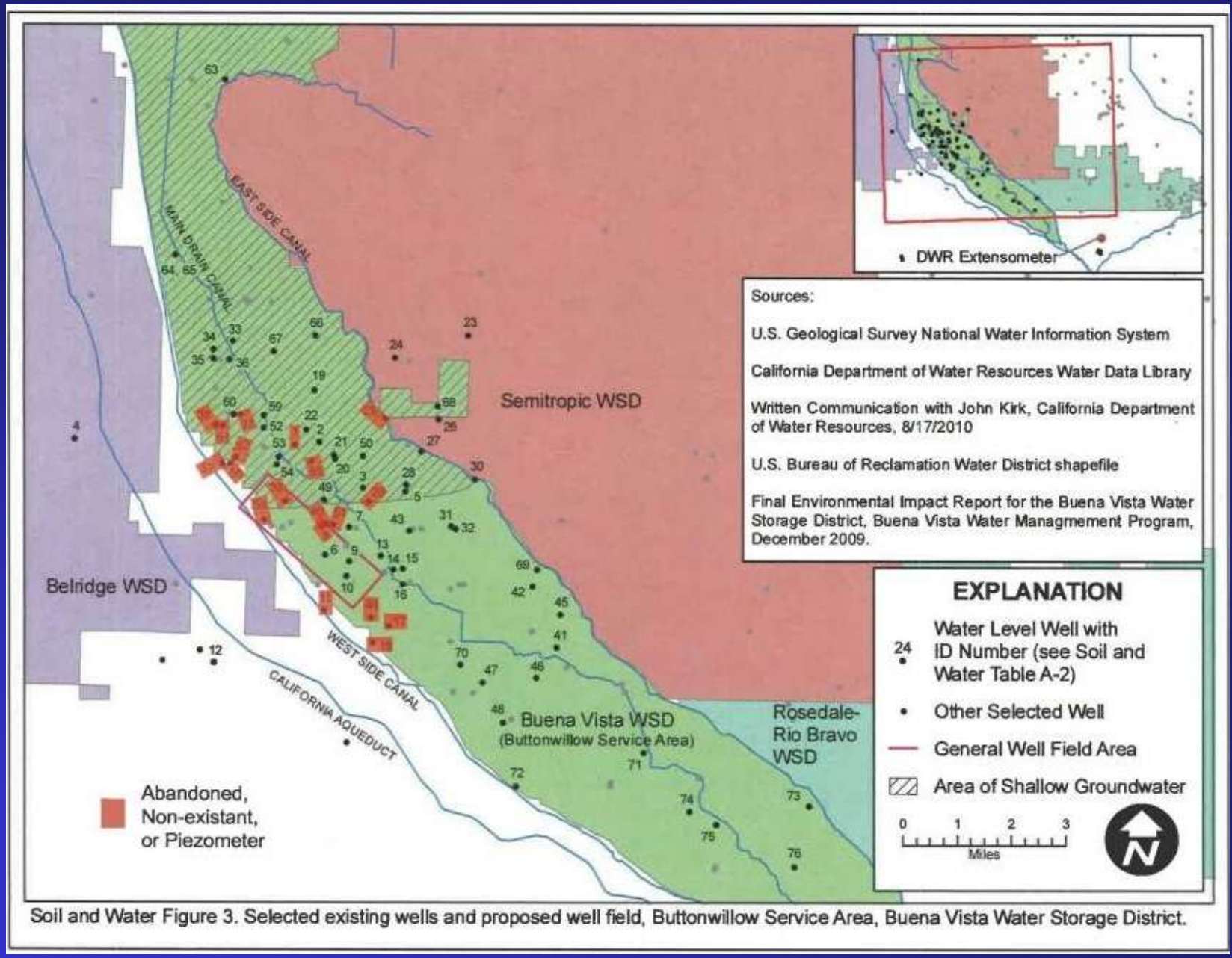

TULARE SUBBASIN
LOST HILLS SUBBASIN
WASCO SUBBASIN
DELANO
MCFARLAND
SHAFTER
CALIFORNIA AQUEDUCT
BVWSD Buttonwillow Service Area
JERRY SLOUGH SUBBASIN
PROJECT SITE
BVWSD Well Field
BUTTONWILLOW SUBBASIN
SAN LUIS OBISPO CO.
KERN CO.
BAKERSFIELD
EDISON SUBBASIN
Tupman
BUENA VISTA SUBBASIN
KERN COUNTY SUBBASIN BOUNDARY
METTLER SUBBASIN
ARVIN
TAFT
MARICOPA SUBBASIN
TEJON SUBBASIN
Project Location
Note:
The subbasins shown are bounded by distinct structural highs due to folding and faulting as developed by KCWA (1991). These subbasins may contain isolated or partially isolated hydrologeologic systems.
BVWSD Buttonwillow Service Area
Kern County Subbasin Boundary
Subbasin Boundaries:
Prominent, continuous structural highs
Low areas, along boundaries (where communication between subbasins is more likely)
0
7
MILE (APPROX.)
Source: Kern County Water Agency, 1991
GROUNDWATER SUBBASINS IN KERN COUNTY
April 2012
28068052
Hydrogen Energy California (HECA)
Kern County, California
URS
FIGURE 5.14-3



Soil and Water Figure 6. Simulated 25-year drawdown from staff-modified model including reduced storativity (0.007).



Soil and Water Figure 3. Selected existing wells and proposed well field, Buttonwillow Service Area, Buena Vista Water Storage District.

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Map Number	Applicant's Model		Modified Model BC and Recharge		Modified Model with Reduced Storativity		Modified Model with Reduced Storativity and Vertical Conductivity	
	simulated drawdown, in feet							
	original	spatial correction	original	spatial correction	original	spatial correction	original	spatial correction
1	3.1		4.1		5.6		11.3	
2	0.9	0.0	4.1	3.9	5.5	5.8	11.3	10.5
3	-0.4	0.0	4.7	4.3	6.1	6.2	13.1	12.5
4	0.1	0.0	2.4	2.7	3.9	4.2	5.4	6.5
5	-0.4	0.0	3.9	3.6	5.3	4.9	10.7	9.5
6	6.8	3.5	15.8	5.7	17.3	9.8	34.2	21.0
7	-0.7	1.2	7.7	5.2	9.1	8.2	21.3	16.5
8	0.1		12.0		13.5		29.7	
9	1.0	1.4	7.6	5.2	9.1	8.6	21.0	17.5
10	-0.6	1.5	6.8	5.2	8.3	8.4	19.0	17.0
11	-0.2		5.4		6.9		15.3	
12	-0.1	1.0	3.6	3.9	5.1	6.0	8.8	9.8
13	5.5	0.0	5.3	4.3	6.8	7.0	15.0	13.0
14	0.1	0.0	4.6	4.0	6.1	6.0	12.9	11.0
15	0.7	0.0	4.2	3.8	5.6	5.6	11.4	10.0
16	0.9	0.0	4.3	3.8	5.8	5.4	11.9	9.8
17	0.5	0.0	4.0	3.7	5.5	5.4	10.9	9.7
18	0.3		3.9		5.4		10.5	
19	12.0	0.0	3.1	3.2	4.5	4.6	7.6	8.5
20	8.1		4.4		5.8		12.3	
21	3.9	0.0	4.4	4.0	5.8	6.2	12.2	11.5
22	2.1	0.0	3.9	3.8	5.3	5.4	10.4	9.9
23	1.3	0.0	2.2	2.1	3.5	3.4	5.1	4.8
24	-0.6	0.0	2.6	2.6	3.9	3.9	6.1	6.5
25	-0.3		3.2		4.6		8.0	
26	-0.5	0.0	3.2	2.7	4.6	4.0	8.1	7.2
27	-0.5	0.0	3.2	3.0	4.6	4.5	8.1	7.8
28	-0.4		4.0		5.4		10.8	
29	-0.5		5.3		6.7		15.1	
30	-0.1	0.0	3.0	2.7	4.4	4.0	7.4	7.1
31	-0.1	0.0	3.4	3.1	4.9	4.5	8.9	8.4
32	2.9	0.0	3.3	3.0	4.7	4.5	8.4	8.1
33	0.3	0.0	2.5	2.7	3.9	4.0	5.9	7.0
34	0.3	0.0	2.6	2.8	4.0	4.1	6.1	7.0
35	0.7	0.0	2.7	2.8	4.1	4.2	6.2	7.5
36	0.2	0.0	2.8	2.8	4.2	4.2	6.7	7.7
37	0.1		3.5		4.9		8.8	
38	0.7		3.3		4.7		8.3	
39	-0.4		6.6		8.1		18.6	
40	-0.4		10.7		12.2		27.4	
41	-0.2	0.0	2.3	2.2	3.6	3.5	5.1	4.8
42	2.8	0.0	2.4	2.4	3.8	3.7	5.6	6.5
43	0.2	0.0	4.0	3.7	5.4	5.0	10.9	9.7
44	0.7		4.4		5.9		12.1	
45	2.6	0.0	2.3	2.2	3.7	3.5	5.4	4.8
46	-0.2	0.0	2.3	2.2	3.7	3.6	5.3	4.9
47	-0.1	0.0	2.6	2.6	4.0	3.9	6.0	6.3
48	0.5	0.0	2.4	2.3	3.8	3.7	5.5	5.1
49	-0.4	1.6	6.7	5.2	8.2	8.4	19.0	17.5
50	3.8	0.0	4.0	3.8	5.5	5.5	11.0	9.9
51	-0.4	1.9	9.3	7.2	10.8	9.0	24.9	16.5
52	0.5	0.0	3.8	3.8	5.2	5.5	10.0	9.9
53	1.5		4.5		5.9		12.5	
54	0.8		4.6		6.1		12.9	
55	0.4		4.6		6.1		12.9	
56	0.1		4.0		5.5		10.9	
57	-0.3		3.7		5.1		9.6	
58	-0.3		6.1		7.6		17.3	
59	0.6	0.0	3.4	3.6	4.8	4.9	8.6	9.5
60	0.6		3.2		4.7		8.1	
61	-0.5		3.3		4.7		8.2	
62	0.5		4.0		5.5		10.8	
Maximum	12.0	3.5	15.8	7.2	17.3	9.8	34.2	21.0
Minimum	-0.7	0.0	2.2	2.1	3.5	3.4	5.1	4.8
Average	1.0	0.3	4.5	3.5	5.9	5.3	11.7	9.7
#> 15 FT	0	0	1	0	1	0	13	5

(REVISED) SOIL&WATER Table 3: drawdown at select well locations simulated by applicant's model and three modified models

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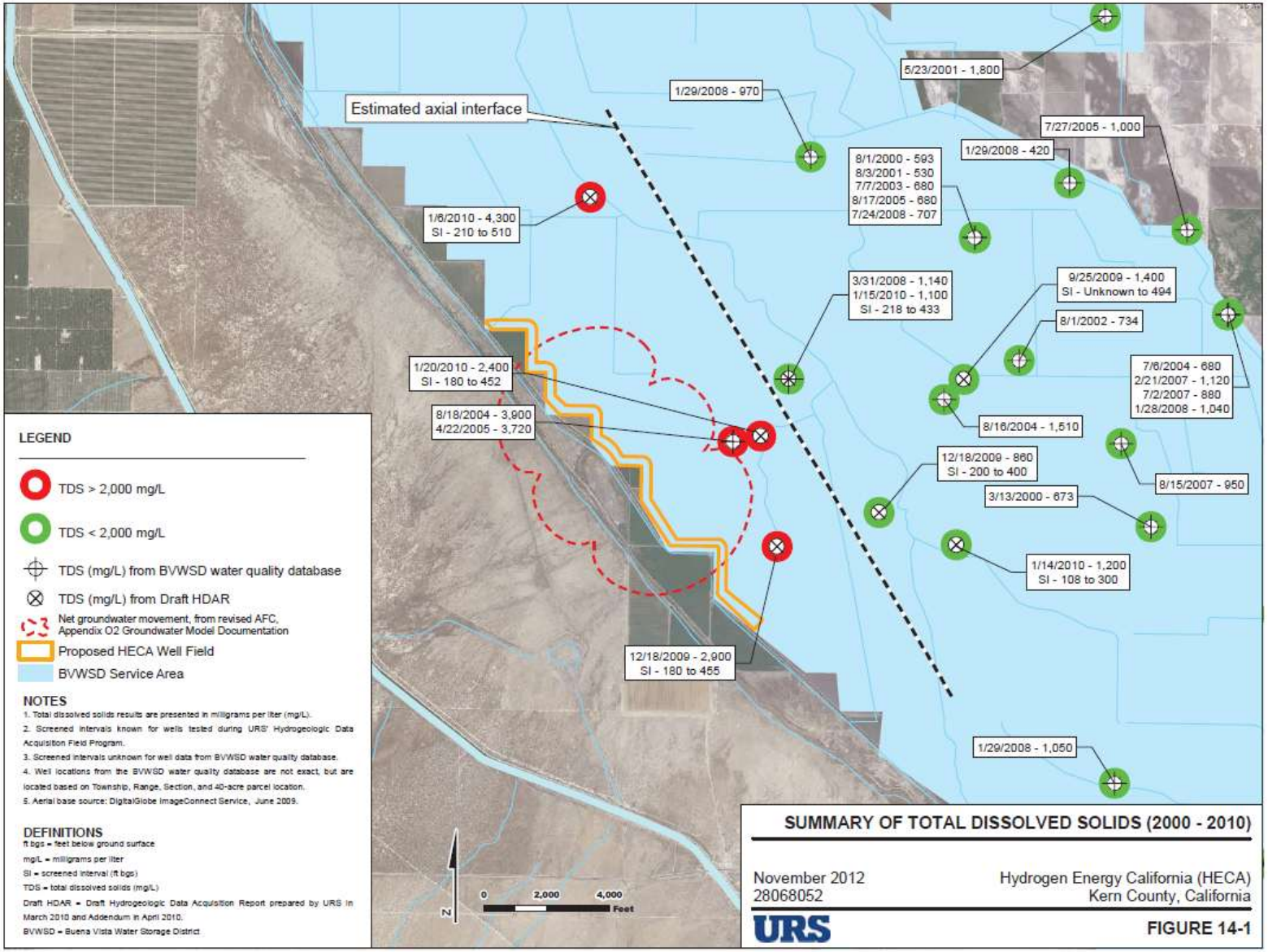
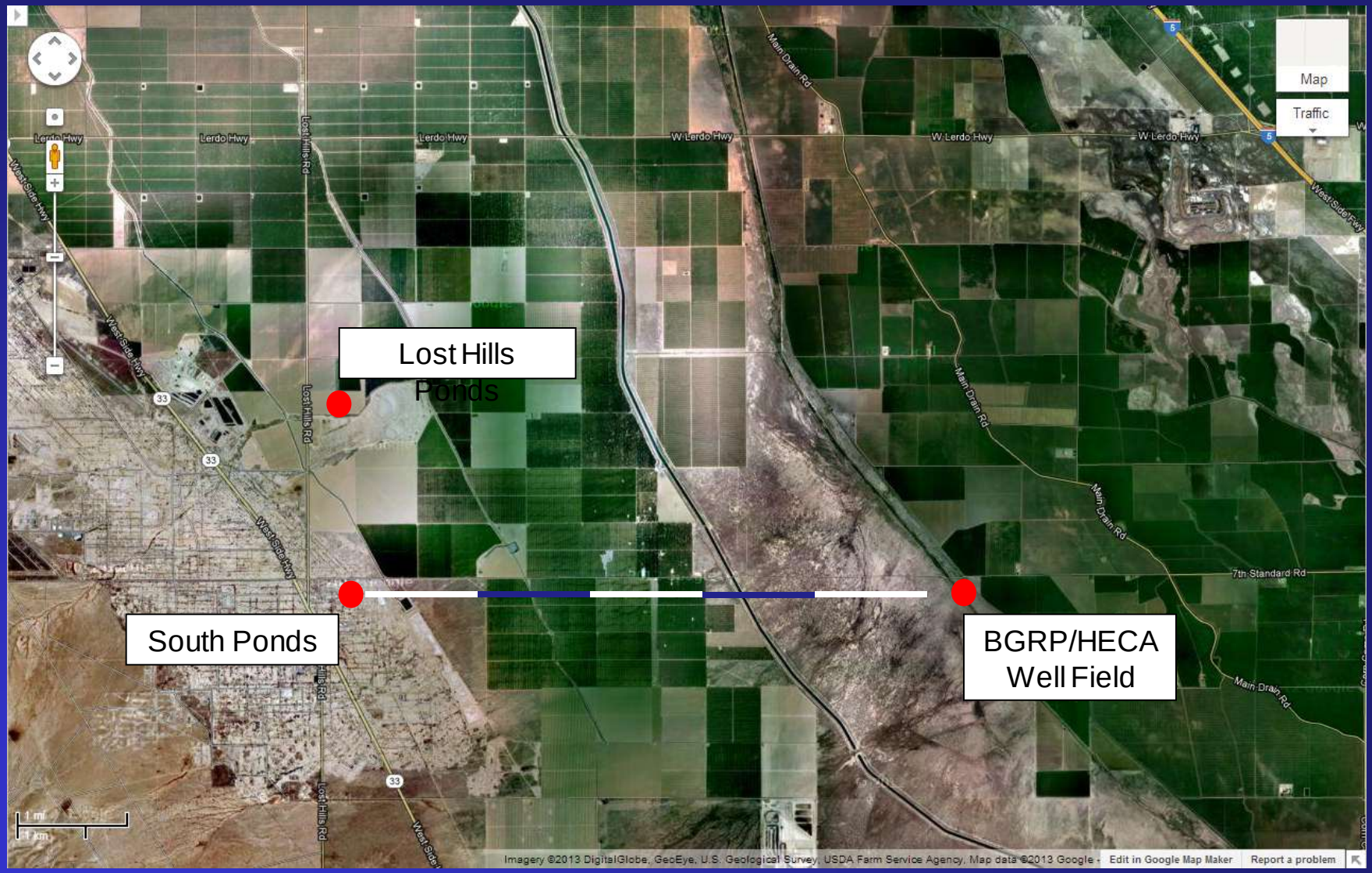

Estimated axial interface
5/23/2001 - 1,800
1/29/2008 - 970
7/27/2005 - 1,000
1/29/2008 - 420
8/1/2000 - 593
8/3/2001 - 530
7/7/2003 - 680
8/17/2005 - 680
7/24/2008 - 707
1/6/2010 - 4,300
SI - 210 to 510
3/31/2008 - 1,140
1/15/2010 - 1,100
SI - 218 to 433
9/25/2009 - 1,400
SI - Unknown to 494
8/1/2002 - 734
7/6/2004 - 680
2/21/2007 - 1,120
7/2/2007 - 880
1/28/2008 - 1,040
1/20/2010 - 2,400
SI - 180 to 452
8/18/2004 - 3,900
4/22/2005 - 3,720
8/16/2004 - 1,510
12/18/2009 - 860
SI - 200 to 400
8/15/2007 - 950
3/13/2000 - 673
1/14/2010 - 1,200
SI - 108 to 300
12/18/2009 - 2,900
SI - 180 to 455
1/29/2008 - 1,050
LEGEND
TDS > 2,000 mg/L
TDS < 2,000 mg/L
TDS (mg/L) from BVWSD water quality database
TDS (mg/L) from Draft HDAR
Net groundwater movement, from revised AFC, Appendix O2 Groundwater Model Documentation
Proposed HECA Well Field
BVWSD Service Area
NOTES
1. Total dissolved solids results are presented in milligrams per liter (mg/L).
2. Screened intervals known for wells tested during URS' Hydrogeologic Data Acquisition Field Program.
3. Screened intervals unknown for well data from BVWSD water quality database.
4. Well locations from the BVWSD water quality database are not exact, but are located based on Township, Range, Section, and 40-acre parcel location.
5. Aerial base source: DigitalGlobe ImageConnect Service, June 2009.
DEFINITIONS
ft bgs = feet below ground surface
mg/L = milligrams per liter
SI = screened interval (ft bgs)
TDS = total dissolved solids (mg/L)
Draft HDAR = Draft Hydrogeologic Data Acquisition Report prepared by URS in March 2010 and Addendum in April 2010.
BVWSD = Buena Vista Water Storage District
N
0
2,000
4,000
Feet
SUMMARY OF TOTAL DISSOLVED SOLIDS (2000 - 2010)
November 2012
28068052
Hydrogen Energy California (HECA)
Kern County, California
URS
FIGURE 14-1

AERA Location (~5 miles west of the BGRP/HECA Well Field)



URS

BUENA VISTA WSD WATER BALANCE

	[1]	[2]	[3]	[4]	[5]	[6]	[8]	[9]	[10]	[11]	[12]	[14]	[15]	[16]	[17]	[18]	[19]	[20]
YEAR	KR A-J RUNOFF % OF AVG	WATER SUPPLY							TOTAL WATER SUPPLY	WATER DEMANDS							ANNUAL BALANCE	ACCUM BALANCE
		KR SUPPLY (AF)	FK SUPPLY (AF)	SWP SUPPLY (AF)	SWP - A21 SUPPLY (AF)	OTHER SUPPLY (AF)	SAFE YIELD MINOR STREAMS (AF)	SAFE YIELD PRECIP (AF)	(AF)	CROP USE (AF)	INDUSTRIAL USE (AF)	PROJECT USE (AF)	EVAP LOSS (AF)	GOOSE LAKE OUTFLOW (AF)	MOU LOSS (AF)	WATER USE (AF)	(AF)	(AF)
1970	69	120,361	7,310	10,284	-			17,647	155,602	105,076			2,332	9,086		116,494	39,108	39,108
1971	53	81,466	7,787	14,636	-			18,860	122,751	105,076			2,177	4,897		112,150	10,601	49,709
1972	28	32,853		35,206	2,700			9,879	80,638	99,391			2,288	740		102,419	(21,781)	27,927
1973	156	149,082	746	5,548	-			24,884	180,260	111,640			2,128	12,137		125,905	54,355	82,282
1974	115	160,269	14,771	20,875	-			25,217	221,132	115,768			2,122	6,121		124,011	97,121	179,403
1975	83	138,779		32,464	-			15,850	187,093	121,174			2,153	7,384		130,711	56,382	235,784
1976	23	40,747		25,137	-			18,086	83,970	115,063			2,138	4,463		121,664	(37,694)	198,090
1977	21	5,310		4,912	-			19,061	29,283	111,616			2,068	420		114,104	(84,821)	113,270
1978	236	238,040		969	-			36,914	275,923	120,059			2,017	13,677		135,953	139,970	253,240
1979	90	132,920	9,913	30,009	24,391			22,018	219,251	111,286			1,935	12,807		126,028	93,223	346,463
1980	213	271,540		856	-			20,889	293,285	112,780			1,880	18,295		132,955	160,330	506,793
1981	54	64,454		62,000	11,692			21,506	159,652	112,536			2,157	12,351		127,044	32,608	539,401
1982	172	182,654	34,882	14,200	15,976			25,581	273,293	112,883	703		1,852	15,904		131,342	141,951	681,351
1983	333	270,855	26,084	1,579	-			32,075	330,593	97,927	1,103	20,888	1,955	13,264		135,137	195,456	876,808
1984	91	154,914	2,289	55,937	-			11,821	224,961	109,366	1,148		2,252	16,478		129,244	95,717	972,524
1985	91	132,534		23,136	205			13,122	168,999	106,262	1,363		1,965	16,123		125,713	43,286	1,015,810
1986	191	230,925	10,276	1,438	-			18,601	261,240	103,154	960	2,041	2,043	24,589		132,787	128,453	1,144,264
1987	46	78,835		21,896	-			19,433	120,164	99,168	927	6,000	1,937	14,916		122,948	(2,784)	1,141,479
1988	35	50,470		25,328	-			14,655	90,453	103,320	690	5,000	2,103	16,309		127,422	(36,969)	1,104,511
1989	51	59,021		26,893	-			9,446	95,360	100,317	643	3,138	2,037	5,080		111,215	(15,855)	1,088,655
1990	25	21,124		4,885	-			11,723	37,732	105,159	555	2,242	2,039	4,165		114,160	(76,428)	1,012,227
1991	60	56,963		1,286	-			21,617	79,868	105,075	663	4,410	2,055	4,558		116,761	(36,873)	975,354
1992	39	42,594		1,824	-			27,647	72,065	110,298	549	4,004	2,082	3,927		120,860	(48,796)	926,558
1993	126	90,385	9,832	57,230	-			26,198	183,645	113,622	529		1,968	8,641		124,760	58,885	985,443
1994	41	73,712		11,267	5,403			22,341	112,723	103,758	536		2,167	8,404		114,865	(2,142)	983,302
1995	200	293,072	12,451	21,300	-			33,072	359,895	112,902	649	2,000	1,895	28,394	3,997	149,837	210,059	1,193,360
1996	129	222,028	15,938	29,900	-			27,299	295,165	113,409	1,241	7,467	2,114	23,555	1,474	149,260	145,905	1,339,265
1997	123	221,942	19,456	21,300	-			20,172	282,870	106,883	1,406	7,080	1,974	28,118	2,813	148,274	134,596	1,473,861
1998	245	307,672	22,339	21,300	-			46,520	397,831	113,188	1,384	1,309	1,901	31,760	5,503	155,045	242,786	1,716,647
1999	54	55,237	13,701	46,300	1,107			20,472	136,817	106,919	1,232		1,796	23,067	13	133,027	3,790	1,720,437
2000	66	61,535		27,837	2,703			18,251	110,326	102,937	1,500	8,613	1,803	23,083		137,936	(27,610)	1,692,827
2001	54	44,697		8,786	480	1,693		23,722	79,378	99,924	571	29,915	1,908	7,060	1,020	140,398	(61,020)	1,631,807
2002	46	58,203		13,451	1,511			12,715	85,880	93,321	1,264	33,073	1,302	5,035	771	134,766	(48,886)	1,582,921
2003	70	88,191		22,284	655			16,109	127,239	97,971	1,372	42,187	1,343	9,913	825	153,611	(26,373)	1,556,548
2004	48	78,550		10,987	3,341			17,497	110,375	102,224	1,328	28,005	1,415	9,098	310	142,380	(32,005)	1,524,544
2005	168	222,670	1,811	22,341	36,398			21,432	304,652	99,375	1,303	14,458	2,452	7,864	9,783	135,235	169,417	1,693,960
2006	169	177,597	20,714	16,848	32,792			20,262	270,213	102,145	1,569	1,966	2,343	12,591	6,314	126,928	143,285	1,837,245
2007	26	67,254	36,999	13,840	12,467			9,429	139,989	98,519	2,209	68,779	1,460	7,867	3,676	182,510	(42,521)	1,794,724
2008	71	92,876	239	10,291	-			9,786	113,194	91,705	1,864	42,537	1,586	4,093	413	142,198	(29,004)	1,765,721
2009	64	80,664	6,137	13,880	-			15,375	116,056	93,951	1,422	25,313	1,366	2,627	413	125,092	(9,035)	1,756,686
1970-09	99.4	123,825	6,842	19,811	3,796			20,430	174,746	106,179			1,963	11,977		130,829	43,917	

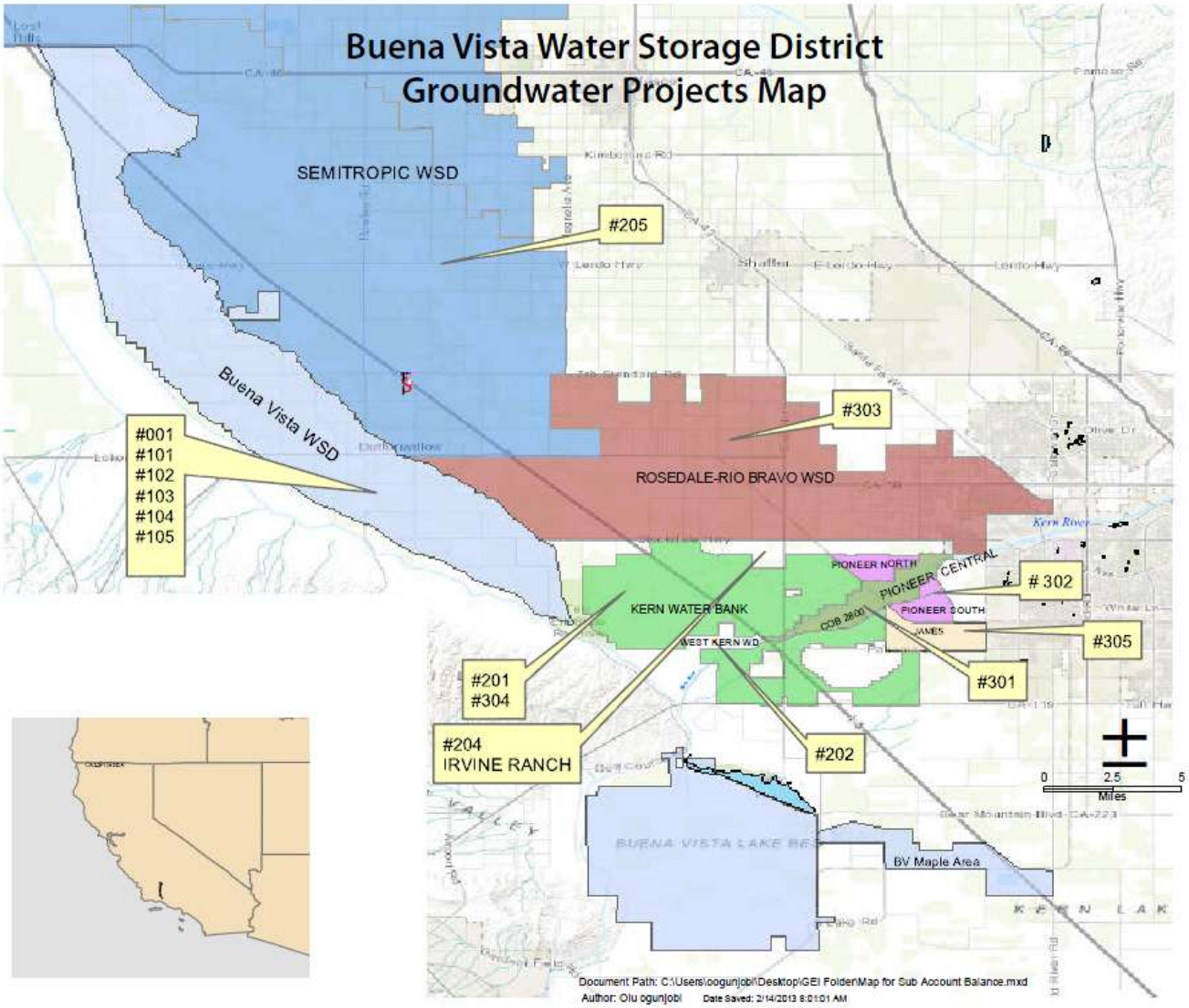
NOTES:

[1] April-July Runoff of the Kern River in % of average (1894-2005 = 464,430 AF)
[2] BV KR Supply (Surface deliveries to KR Intertie and surface sales to other in county jurisdictions downstream of 2nd Point taken out)
[3] FK supplies (NO BANKING FOR 3RD PARTY)
[4] SWP + pool purchases (NO BANKING FOR 3RD PARTY)
[5] Art 21 purchases
[6] Other purchased supplies

[8] Proportionate share of unappropriated minor local streams (#'s in discussion so left out for now)
[9] Gross Precip estimated at Meadows Field x cropped acreage + effective precip on other surfaces.
[10] = Sum of [2] through [9].

[11] Estimated crop water use (transpiration and soil evap) per CSPU.
[12] Industrial recovery contracts from BVWSD to westside oilfields

[14] Special project deliveries and Kern Fan pumping
[15] Water surface evaporation losses.
[16] Flows north of Hwy 46 (not including wheeling but including sales)
[17] MOU agreed to project losses start in 1995
[18] Sum of [11] through [17].


Buena Vista Water Storage District
Groundwater Projects Map
SEMITROPIC WSD
#205
Buena Vista WSD
#001
#101
#102
#103
#104
#105
#303
ROSEDALE-RIO BRAVO WSD
PIONEER NORTH
PIONEER CENTRAL
302
PIONEER SOUTH
#305
KERN WATER BANK
WEST KERN WD
#301
#201
#304
#204
IRVINE RANCH
#202
0
2.5
5
Miles
BV Maple Area
Document Path: C:\Users\oogunjobi\Desktop\GEI Folder\Map for Sub Account Balance.mxd
Author: Olu ogunjobi
Date Saved: 2/14/2013 8:01:01 AM

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT
COMMISSION OF THE STATE OF CALIFORNIA
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1-800-822-6228 – WWW.ENERGY.CA.GOV

AMENDED APPLICATION FOR CERTIFICATION FOR THE HYDROGEN ENERGY CALIFORNIA PROJECT

Docket No. 08-AFC-08A
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(Revised 2/11/13)

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Hearing Adviser

Galen Lemei
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Adviser for Facility Siting

DECLARATION OF SERVICE

I, Dale Shileikis, declare that on February 22, 2013, I served and filed copies of the attached Slides presented at the HECA Water Workshop, dated February 20, 2013. This document is accompanied by the most recent Proof of Service, which I copied from the web page for this project at: http://www.energy.ca.gov/sitingcases/hydrogen_energy/.

The document has been sent to the other persons on the Service List above in the following manner:

(*Check one*)

For service to all other parties and filing with the Docket Unit at the Energy Commission:

_X_ I e-mailed the document to all e-mail addresses on the Service List above and personally delivered it or deposited it in the US mail with first class postage to those persons noted above as "hard copy required"; OR

____ Instead of e-mailing the document, I personally delivered it or deposited it in the US mail with first class postage to all of the persons on the Service List for whom a mailing address is given.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, and that I am over the age of 18 years.

Dated: February 22, 2013