October 14, 2015

Thomas Howard, Executive Director
Members of the Board
State Water Resources Control Board
Clerk to the Board, (916) 341-5600
1001 I Street Sacramento, CA 95814
Sent via email to Rich.Satkowski@waterboards.ca.gov

RE: Five Counties, Five Numbers: Livestock Feed Crop Production in the S. San Joaquin Valley, 2014

Thank you for the opportunity to comment on the important issue of livestock feed crop-related agricultural water use in the southern San Joaquin Valley.

To start, we wish to formally incorporate into this comment by reference the 6 July 2015 comment to the SWRCB titled "June 8, 2015 Temporary Urgency Change Petition Concerning SWP/CVP and Water Deliveries, in relation to the April 6, 2015 TUCO," submitted by Ara Marderosian (Sequoia ForestKeeper), Guy Saperstein, Alexandra Paul, Jon Marvel, Connie Hanson, Mike Hudak, Lorelei Plotczyk, Lorin Lindner, Marcia Hanscom, Robert Roy van de Hoek, and Todd M. Shuman (Wasteful UnReasonable Use), as well as the Objection/Protest respectfully submitted to the SWRCB by Sequoia ForestKeeper (SFK) and Wasteful UnReasonable Use (WURU) regarding the 8 June 2015 Notice of Request Filed by the California Department of Water Resources and the United States Bureau of Reclamation to modify and renew a Temporary Urgency Change Order regarding permits and license of the State Water Project and the Central Valley Project (filed initially on May 21, 2015).

We also wish to formally incorporate into this comment by reference the August 16, 2015 comment to the SWRCB titled "Unreasonable and Wasteful Water Use: Rice Cultivation, Livestock Feed Crop Production, the Sacramento River Settlement Contractors, and the July 3, 2015 TUCO", submitted by Ara Marderosian (Sequoia ForestKeeper), Todd M. Shuman (Wasteful UnReasonable Use), Mike Hudak (Ph.D, author), and Megan E. Gallagher, Esq. (Attorney at Law, Adjunct Professor).

The use of water drawn from surface flows and extracted from increasingly-depleted groundwater aquifers in the San Joaquin Valley to irrigate livestock feed crops is unreasonable and wasteful during this time of drought in California for a number of reasons, including the fact that climate change and the drought are exacerbated by the methane that is produced when the livestock feed crops are consumed by dairy and other cows. Use of groundwater extracted from increasingly depleted aquifers to irrigate livestock feed crops during this time of drought in California conflicts with the "waste or unreasonable use" section of the California Constitution. (See Article 10, Section 2, which declares that "the waste or unreasonable use … of water be prevented … The right to water or to the use or flow of water ... does not and shall not extend to the waste or unreasonable use … of water."1)

Moreover, the continued extraction of groundwater from increasingly-depleted San Joaquin Valley aquifers to enable livestock feed crop production appears inconsistent with legal requirements that have been incorporated into The Sustainable Groundwater Management Act of 2014. In Section10720.1, it is stated that "it is the intent of the Legislature to do all of the following . . . (b) To enhance local management of groundwater consistent with . . . Section 2 of Article X of the California Constitution." In Section 10720.5, it is stated that "(a) Groundwater management pursuant to this part shall be consistent with Section 2 of Article X of the California Constitution."

Five Counties, Five Numbers

The counties of Kern, Tulare, Kings, Fresno, and Madera recently released 2014 Annual Crop reports. Based on

the information within these reports, in combination with other sources, we have compiled and calculated a set of numbers that constitutes the basis for a concise narrative concerning water, livestock feed crop production, and greenhouse gas emission in the southern San Joaquin Valley in 2014. In short, approximately **1.275 million acres** were devoted to livestock feed crop (LFC) production in these five counties in 2014. Approximately **4.55 million acre-feet (MAF)** of water was used to cultivate this LFC acreage in 2014. Approximately **14.257 million tons** of livestock feed crop forage were produced from the application of this amount of water to the acreage cultivated in 2014. Assuming that such forage was fed to milking dairy cows, we have estimated that this amount of forage would have fed approximately **1.56 million lactating cows** in 2014. As we noted in earlier comments to the SWRCB, livestock feed crops consumed by cows are partially converted by cows into significant atmospheric methane emissions. Using the best available scientific information, we have estimated that those 1.56 million lactating cows would have collectively emitted (through the process of enteric fermentation) a quantity of methane that is equivalent to approximately **32.22 billion pounds of carbon dioxide** trapping heat in the atmosphere over the next 20 years. (See Appendix A and Appendix B)

Unreasonable Use: Atmospheric Carbon Emissions

Such livestock-associated carbon emissions should not be considered insignificant. (32 billion lbs. of heat-trapping CO2 is just under the amount of CO2 that would be emitted by four *yr*2010 coal-fired electricity-generation plants [33.6 billion lbs.]). Moreover, it is likely that these emissions have already contributed (and are currently contributing) to the further warming of our planet and the associated severe drought that has afflicted California. We note for the record that this claim is consistent with yet another recently published scientific study concerning this matter: Williams et al. (2015) concluded that "anthropogenic warming is estimated to have accounted for 8–27% of the observed drought anomaly [in California] in 2012–2014 and 5–18% in 2014. . . . anthropogenic warming has substantially increased the overall likelihood of extreme California droughts." [Williams, A. P., R. Seager, J. T. Abatzoglou, B. I. Cook, J. E. Smerdon, and E. R. Cook (2015), Contribution of anthropogenic warming to California drought during 2012–2014, Geophys. Res. Lett., 42, 6819–6828, doi:10.1002/2015GL064924.]
http://onlinelibrary.wiley.com/doi/10.1002/2015GL064924/full

The prominent Stanford University scientist and professor Noah Diffenbaugh has also noted recently that "We have a very high statistical confidence that the warming of California would not happen without human influence, and the amount of years that are warm and dry would not have happened without humans. . . . Continued human emissions are likely to lead to the continued warming of California, increased co-occurrence of dry years and warm conditions and the increased occurrence of extremely low precipitation seasons."
[http://www.appeal-democrat.com/news/scientists-blame-human-activity-for-climate-change/article_c26d333e-4b8b-11e5-ab6d-ab7bd68872bc.html]

Diffenbaugh was quoted in another article stating that "High temperatures plus low precipitation are more likely to produce a drought, and this will increase with climate change. . . .Global warming has at least tripled the probability of the atmospheric condition that brought the resilient high-pressure ridge" – the phenomenon that has been the primary cause of the California drought.
[http://www.dailybreeze.com/environment-and-nature/20150825/california-climate-researchers-sound-the-alarm-at-symposium-theres-no-way-out

Thus, the best available science continues to assert that continued greenhouse gas emissions in the present and near future are likely to further accelerate the warming of the planet generally and increase the probability that California will be adversely impacted by more frequent high-temperature droughts in the future.

We must, therefore, re-assert our previous claim: it is profoundly unreasonable—indeed, intensely irrational—for the SWRCB to continue to allow California water to be used during this time of drought for activities that are likely to generate even more water scarcity in California.

Allowing southern San Joaquin Valley farmers to use a large amount of water for livestock feed crop cultivation, when such LFC cultivation ultimately results in a significant new emission of potent, heat-trapping

greenhouse gas into the atmosphere of our rapidly-warming planet, is undoubtedly one of those profoundly unreasonable activities.

Wasteful, Unreasonable Use: Groundwater Depletion

As we stated in our July 6, 2015 comment to the SWRCB, we also view the use of such water to grow LFCs as wasteful and unreasonable due to its association with the depletion of scarce groundwater in the southern San Joaquin Valley. Again, it is likely that much or most of the water used to grow these livestock feed crops in 2014 came from local groundwater sources, as the southern San Joaquin Valley received little precipitation and almost no surface water allocation from the Central Valley Project in 2014. Furthermore, very little State Water Project water was delivered to this area in 2014.

The use of pumped groundwater from already-depleted groundwater aquifers to produce livestock feed is a wasteful, unreasonable use of water. A small fraction of that water could have been used to grow drought-tolerant beans that humans could have directly consumed. It was not. Water was, instead, wasted on flood irrigation of crops (especially alfalfa and irrigated pasture) that will be partially converted into significant amounts of methane and then emitted by livestock into the atmosphere. Such emissions will likely contribute to a long-term reduction in precipitation that will limit groundwater aquifer recharge in the future.

Groundwater use for livestock feed production in Tulare County remains especially (and egregiously) unreasonable to us, due to the recently-established link between livestock-feed crop-related groundwater use and the large number of well failures in the nearby areas associated with East Porterville.

Sincerely,

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Appendix A:

1): 2014 Kern County Agricultural Crop Report, August 18, 2015
2014 Tulare County Annual Crop and Livestock Report, August 2015
2014 Annual Agricultural Crop Report for the County of Kings, June 16, 2015
2014 Fresno County Agricultural Crop and Livestock Report, August, 2015
2014 Madera County Agricultural Crop and Livestock Report, August, 2015

2): We present here our derived numbers concerning the amount of CO2 equivalents (at the 20 year interval) that would likely result from lactating dairy cows eating 14.256827 million tons of livestock feed produced in 2014 in Kern, Tulare, Kings, Fresno, and Madera counties. That amount would feed over 1.56 million milking cows (1.562392 million dairy cows) for a year (50 lbs. of forage/cow/day X 365 days/yr = 18,250 lbs., or 9.125 tons/cow/yr). That number of milking cows would produce and release annual atmospheric methane emissions equivalent to 32.222 billion pounds of CO2 equivalents that trap heat for 20 years. (Lactating cows produce 239.8 lbs. of CH4/yr. Multiply by 86 and the value becomes 20622.8 lbs./yr of CO2 equivalents (20 year interval) released per milking cow. Multiply 20622.8 lbs. of CO2e/yr/cow by 1.562392 million cows, and the value becomes approximately 32.22 billion lbs. of CO2e (20 yr interval) released into the atmosphere by those 1.562392 million milking cows. ***In short, just over 14 million tons of livestock feed crops can supply feed for just over 1.5 million milking cows for a year, over which time that number of milking cows would likely emit an amount of methane that is equivalent to just over 32 billion lbs. of CO2 that traps heat in the upper atmosphere for 20 years. 32 billion lbs. of heat-trapping CO2 is just under the amount of CO2 that is emitted by four yr2010 coal plants (33.6 billion lbs.).***

3): Source for estimate of 50 lbs./day as amount of feed consumed by a dairy cow each day: http://www.ansc.purdue.edu/faen/dairy%20facts.html

Appendix B

	Acres	Alm Meats	Alm Hulls	Alm Shells	Alm AcresBrg	AWC	Acre Feet	TAF		LFCUnitValue	Tonnage
Kern LFC											
Alm Hull Shr	87,560 [i]	201000 T	329000 T	214000 T	199000	4.54	397522.4	397.52		170/ton	329000
Alfalfa, Hay	109,000					5.08	553720	553.72		247/ton	922000
Hay, Grain	9210					1.86	17130.6	17.13		212/ton	47800
Hay, Other	7400					2.87	21238	21.23		192/ton	25200
Pasture, Irr	7000					4.61	32270	32.27		140/acre	14000 [ii]
Silage/Forage	85000					3.39 [iii]	288150	288.15		49.8/ton	1632000
Misc [iv]	16700					2.87	47929	47.92		178.9/ton	64640
Subtotal	321,870						1357960	1357.94			3034640
Tulare LFC											
Alm Hull Shr [v]	24453	48700 T	97500 T	n/a	46400	3.89	95122.17	95.12		152/ton	97500
Alfalfa, Hay	60000					5.13	307800	307.79		222/ton	612000
Alfalfa, Silage	0									64/ton	492000
Corn (Gr)	947					3.16	2992.52	2.99		276/ton	4920
Corn (Silage)	117000					3.16	369720	369.72		63.4/ton	2948000
Hay, Other	14400					2.81	40464	40.46		90/ton	39900
Pasture, Irr	93000					4.96	461280	461.28		193/acre	186000 [vi]
Silage Sm Gr	75100					1.86	139686	139.68		51/ton	1232000
Sudan Grass	168					2.81	472.08	0.47		173/ton	675
Subtotal	385068						1417536.77	1417.51			5612995
Kings LFC											
Alm Hull Shr	11098 [vii]	21558 T	43116 T	10779 T	19422	3.88	43060.24	43.06		150/ton	43116
Alfalfa, Hay	36597					4.95	181155.15	181.15		252/ton	298997
Alfalfa Silage	6432					4.95	31838.4	31.83		55.3/ton	16916
Alf Silage All Yr	1927					4.95	9538.65	9.53		54.2/ton	68197
Alf Stubble	9149					4.95	45287.55	45.28		25/ton	9160 [viii]

Corn Silage	51121					2.98	152340.58	152.34		65.2/ton	1309209
Oat Hay	1085					1.47	1594.95	1.59		188/ton	4058
Oat Silage	593					1.47	871.71	0.87		42.2/ton	8545
Sorghum Silage	13064					2.49	32529.36	32.52		49.4/ton	211637
Sudan Hay	274					2.49	682.26	0.68		162/ton	1474
Triticale Silage	3037					1.47	4464.39	4.46		49.5/ton	46861
Wheat Hay	549					1.47	807.03	0.79		216/ton	2212
Wheat Silage	44684					1.47	65685.48	65.68		51.3/ton	769905
Other [ix]	38391					2.49	95593.59	95.59		538.9/acre	76782
Subtotal	218001						665449.34	665.37			2867069
Fresno LFC											
Alm Hull Shr	89965 [x]	184000 T	326000 T	n/a	170711	3.52	316676.8	316.67		163/ton	326000
Alfalfa, Hay	52200					4.59	239598	239.59		238/ton	338000
Hay, Wheat	9190					1.26	11579.4	11.57		209/ton	37400
Hay, Other	10600					2.54	26924	26.92		169/ton	21300
Corn, Silage	28100					2.74	76994	76.99		62/ton	649000
Wheat, Silage	8960					1.26	11289.6	11.28		55/ton	163000
Other [xi]	33390					2.54	84810.6	84.81		527/acre	66780
Subtotal	232405						767872.4	767.83			1601480
Madera LFC											
Alm Hull Shr	55862 [xii]	99640 T	195294 T	n/a	106000	3.34	186579.08	186.57		145/ton	195294
Alfalfa, Hay	16,000					4.32	69120	69.12		231/ton	108800
Alfalfa, Silage	0					0	0	0		70/ton	20287
Corn, Grain	600					2.55	1530	1.53		230/ton	4530
Corn, Silage	18,300					2.55	46665	46.66		59/ton	473238
Oat, Hay	800					1.03	824	0.8		185/ton	2824
Pasture, Irr	1,500					4.21	6315	6.31		150/acre	3000 [xiii]
Wheat, Silage	18,200					1.03	18746	18.74		38/ton	270452
Winter Forage	3,300	[xiv]				1.03	3399	3.39		48/ton	57618
Misc [xv]	2,300					2.52	5796	5.79		1559/acre	4600
Subtotal	116,862						338974.08	338.91			1140643
Kern LFC	321870						1357960	1357.94			3034640
Tulare LFC	385068						1417536.77	1417.51			5612995
Kings LFC	218001						665449.34	665.37			2867069
Fresno LFC	232405						767872.4	767.83			1601480
Madera LFC	116862						338974.08	338.91			1140643
Total KTKFM	**1274206**						**4547792.59**	**4547.56**			**14256827**
LFC - 5 Cty	**1,274,206 acres**							**4.54756MAF**			**14,256,827 tons of LFC**
Approximately	**1.275 million acres**							**4.55 MAF**			**14.257 million tons of LFC**

LFC - Livestock Feed Crop									
AWC - Applied Water Constants taken from DWR spreadsheet (yr2010)									
TAF - Thousand Acre Feet									
MAF - Million Acre Feet									

Shuman ran the numbers on the amount of CO2 equivalents (at the 20 year interval) that would likely result from lactating dairy cows eating 14.256827 million tons of livestock feed produced in 2014 in Kern, Tulare, Kings, Fresno, and Madera counties. That amount would feed over 1.56 million milking cows (1.562392 million dairy cows) for a year (50 lbs of forage/cow/day X 365 days/ys = 18,250 lbs, or 9.125 tons/cow/yr). That number of milking cows would produce and release annual atmospheric methane emissions equivalent to 32.222 billion pounds of CO2 equivalents that trap heat for 20 years. (Lactating cows produce 239.8 lbs of CH4/yr. Multiply by 86 and you get 20622.8 lbs/yr of CO2 equivalents (20 year interval) released per milking cow. Multiply 20622.8 lbs of CO2e/yr/cow by 1.562392 million cows, and you get approximately 32.22 billion lbs of CO2e (20 yr interval) released into the atmosphere by those 1.562392 million milking cows. In short, just over 14 million tons of livestock feed crops can supply feed for just over 1.5 million milking cows for a year, over which time that number of milking cows would likely emit an amount of methane that is equivalent to just over 32 billion lbs of CO2 that traps heat in the upper atmosphere for 20 years. 32 billion lbs of heat-trapping CO2 is just under the amount of CO2 that is emitted by four yr2010 coal plants (33.6 billion lbs).

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Source for estimate of 50 lbs./day as amount of feed consumed by a dairy cow each day: http://www.ansc.purdue.edu/faen/dairy%20facts.html

[i] Value for cell B3 (acreage attributed to hull production) is 44% of cell F3, based on hull tonnage as a share of total almond product tonnage (meats+hulls+shells). 201K + 329K +214K =744K; 329K/744K = 44.22%

[ii] Value for cell L7 is based on the assumption that forage production is equivalent to 2 tons/acre. See UGA Cooperative Extension Bulletin #1392, Forage Systems for Stocker Cattle, page 3, Table 1, September 2011

[iii] Value for cell G8 is the Corn AWC

[iv] Crops included: rape, rye, sorghum-milo, safflower, straw, sugar cane, tritcale. Value for cell K9 derived by dividing total value by tonnage. 11564000/64640 = 178.898

[v] Value for cell B13 is 52.7% of total almond bearing acreage, based upon "Hull, shell, and kernel relationships in almond fresh fruits" Godini A., GREMPA, colloque 1983 Paris : CIHEAM, Options Méditerranéennes : Série Etudes; n. 1984-II 1984 pages 53-56

[vi] Value for cell L19 is based on the assumption that forage production is equivalent to 2 tons/acre. See UGA Cooperative Extension Bulletin #1392, Forage Systems for Stocker Cattle, page 3, Table 1, September 2011

[vii] Value for cell B25 value (acreage attributed to hull production) is 57.14% of cell 25F, based on hull tonnage as a share of total almond product tonnage (meats+hulls+shells). 21558+43116+10779 = 75453; 43116/75453 = 57.14%

[viii] Value for L29 is derived by total value divided by value per unit, which then equals number of units (tons). 229000/25 = 9160

[ix] Crops included: barley grain, barley hay, barley silage, beans-dry, corn-grain, forage, hay-other, pasture irrigated, ryegrass, safflower, sorghum-milo, sudan silage, sugar beets-silage, triticale grain, and wheat straw. Value for cell K38 is derived by dividing total value by acreage. 20689000/38391 = 538.9. Value for cell L38 is based on the assumption that forage production is equivalent to

2 tons/acre. See UGA Cooperative Extension Bulletin #1392, Forage Systems for Stocker Cattle, page 3, Table 1, September 2011

[x] Value for cell 42B is 52.7% of total almond bearing acreage, based upon "Hull, shell, and kernel relationships in almond fresh fruits" Godini A., GREMPA, colloque 1983 Paris : CIHEAM, Options Méditerranéennes : Série Etudes; n. 1984-II 1984 pages 53-56

[xi] Crops included: corn grain, cotton by-products, field stubble (includes acres not included in total field crop acreage), irrigated pasture, oat grain, rice (grain and bran), safflower, silage (alfalfa, barley, oat, sorghum, sudangrass, triticale, and winter forage), straw, triticale grain; ORGANIC:alfalfa hay, beans-dried, wheat grain and rice. Value for cell K48 is derived by dividing total value by acreage. 17600000/33390 = 527. Value for cell L48 is based on the assumption that forage production is equivalent to 2 tons/acre. See UGA Cooperative Extension Bulletin #1392, Forage Systems for Stocker Cattle, page 3, Table 1, September 2011

[xii] Value for cell B52 is 52.7% of total almond bearing acreage, based upon "Hull, shell, and kernel relationships in almond fresh fruits" Godini A., GREMPA, colloque 1983 Paris : CIHEAM, Options Méditerranéennes : Série Etudes; n. 1984-II 1984 pages 53-56

[xiii] Value for cell L58 is based on the assumption that forage production is equivalent to 2 tons/acre. See UGA Cooperative Extension Bulletin #1392, Forage Systems for Stocker Cattle, page 3, Table 1, September 2011

[xiv] Value for cell C60 is the Grain AWC

[xv] Crops included: ryegrass hay, seed crops, Sudangrass, wheat hay, field and stubble straw. Value for cell K61 is total value /acres. 3587000/2300 = 1559.56. Value for cell L61 is based on the assumption that forage production is equivalent to 2 tons/acre. See UGA Cooperative Extension Bulletin #1392, Forage Systems for Stocker Cattle, page 3, Table 1, September 2011