Southern Delta Water Quality Objectives

SUMMARY OF PRESENTATIONS BY
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CORN STUDIES AFTER D-1485

"At the soil water salinity threshold for corn grain (3.7 dS/m), the average ratio is 1.7 which results in a maximum value of 2.2 dS/m for ECi without yield loss under normal conditions. With subirrigation and below normal rainfall, as in 1981, the maximum value of ECi would be 0.8 dS/m"

- Pritchard, et al, (1983)

CORN STUDIES AFTER D-1485

"Corn production on the organic soils of the Sacramento-San Joaquin Delta of California was affected by the salinity of the irrigation water and the adequacy of salt leaching. Full production was achieved on soils that were saline the previous year, provided the electrical conductivity of the irrigation water (ECi) applied by sprinkling was less than 2 dS/m and leaching was adequate from either winter rainfall or irrigation to reduce soil salinity (ECsw) below the salt tolerance threshold for corn (3.7 dS/m). For subirrigation, an ECi up to up 1.5 dS/m did not decrease yield for leaching had reduced ECsw below the threshold. If leaching was not adequate, even nonsaline water did not permit full production."

- Hoffman, et al. (1986)

CORN STUDIES AFTER D-1485

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RECENT BEAN RESEARCH

"When an ECw of 1.1 dS/m is considered over the 53-year rainfall series, the model predicts that the seasonal mean ECe is is 0.94 dS/m. In 80% fo the years, the mean seasonal ECe is less than 1.0 dS/m, the yield threshold for salt-sensitive bean. For 50 of the 53 years, the seasonal mean ECe for individual years is 1.05 or lower, which would result in a predicted yield reduction of 1% or less. However, this predicted reduction in yield potential is less than the error associated with the yield threshold value itself."

- Grattan, et al. (2004)

RECENT BEAN RESEARCH

"Over the entire 53-year period of record, yield reduction for beans is predicted to be noticeably reduced during only 3 years when applying irrigation water with an EC of 1.1 dS/m. All three years occurred during the period of drought in the 1970s. These three outliers translate into reductions in the potential yield of 2, 4 and 6%. Again, however, these predicted values are within the statistical uncertainty of the salinity threshold value itself. Moreover, such losses, if real, could be avoided by winter leaching."

- Grattan, et al. (2004)

RECENT BEAN RESEARCH

"Given these results, and taking into account all the other factors that potentially impact crop yield (e.g., weather, water stress and biotic stresses) and the conservative nature of all inputs into the model, the use of 1.1 dS/m as the threshold EC value for irrigation water is considered protective for beans, and thus all other agricultural uses of the water in the Davis area."

- Grattan, et al. (2004)

TABLE 1
Ayers & Westcot model with irrigation water salinity (ECw) of 0.7 dS/m

								EC_e predicted (dS/m) by quarters of the root				
Event	Effective rooting depth (in.)	Depth (in)	Total water (in.)	**EC_w weighted ave. (dS/m)**	Leaching (%)	Total irrigation water (in.)	Cumulative leaching (%)	1st	2nd	3rd	4th	**Ave.**
Irrigation water only		NA	22	**0.7**	15	22	15	1.1	1.7	3.0	4.7	**2.6**

TABLE 2

Ayers & Westcot model with a 22-inch water application, 12 inches of rain, and irrigation water salinity of 0.7 dS/m

								EC_e predicted (dS/m) by quarters of the root				
Event	Effective rooting depth (in.)	Depth (in.)	Total water (in.)	**EC_w weighted ave. (dS/m)**	Leaching (%)	Total irrigation water (in.)	Cumulative leaching (%)	1st	2nd	3rd	4th	**Ave.**
Rain	0	12	12	**0.09**	50	0	NA	0.1	0.1	0.1	0.1	**0.1**
Pre-irrigation	0	6	18	**0.29**	40	6	45	0.4	0.5	0.5	0.5	**0.5**
Crop irrigation 1	12	4	22	**0.37**	40	10	43	0.5	0.6	0.8	0.9	**0.7**
Crop irrigation 2	24	4	26	**0.42**	20	14	33	0.6	0.8	1.1	1.3	**0.9**
Crop irrigation 3	36	4	30	**0.46**	10	18	28	0.6	0.9	1.3	1.6	**1.1**
Crop irrigation 4	36	4	34	**0.48**	10	22	24	0.7	1.0	1.5	2.0	**1.3**

TABLE 3

Ayers & Westcot model with a 22-inch water application, 12 inches of rainfall, and irrigation water salinity (ECw) of 1.1 dS/m

								EC_e predicted (dS/m) by quarters of the root				
Event	Effective rooting depth (in.)	Depth (in.)	Total water (in.)	**EC_w weighted ave. (dS/m)**	Leaching (%)	Total irrigation water (in.)	Cumulative leaching (%)	1st	2nd	3rd	4th	**Ave.**
Rain	0	12	12	**0.09**	50	0	NA	0.1	0.1	0.1	0.1	**0.1**
Pre-irrigation	0	6	18	**0.43**	40	6	45	0.6	0.6	0.6	0.6	**0.6**
Crop irrigation 1	12	4	22	**0.55**	40	10	43	0.7	0.9	1.1	1.3	**1.0**
Crop irrigation 2	24	4	26	**0.63**	20	14	33	0.9	1.2	1.6	1.9	**1.4**
Crop irrigation 3	36	4	30	**0.70**	10	18	28	1.0	1.4	2.0	2.5	**1.7**
Crop irrigation 4	36	4	34	**0.74**	10	22	26	1.1	1.6	2.3	3.1	**2.0**

TABLE 4

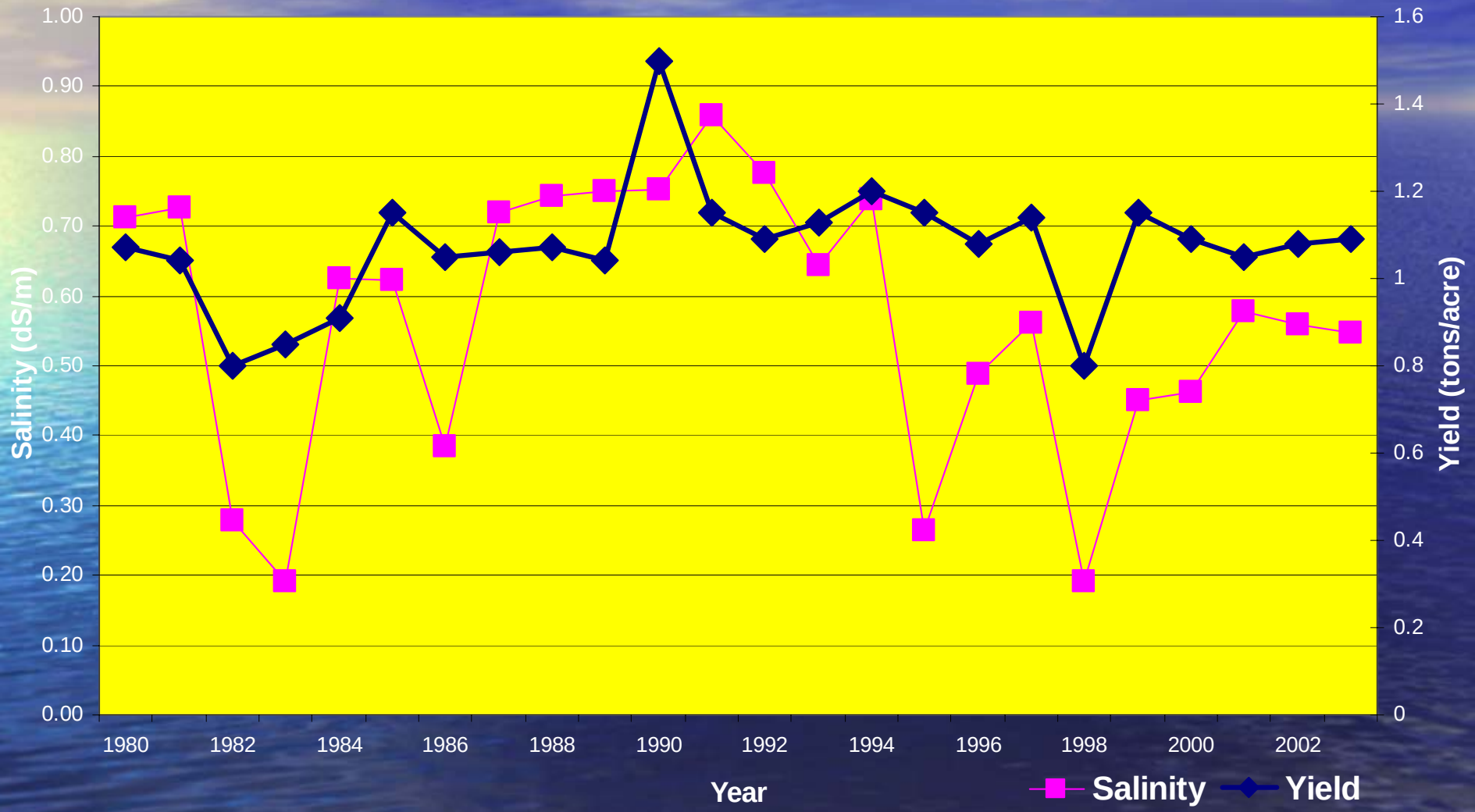
Ayers & Westcot model with a 22-inch water application, 12 inches of rainfall, and irrigation water salinity (ECw) of 1.5 dS/m

								EC_e predicted (dS/m) by quarters of the root				
Event	Effective rooting depth (in.)	Depth (in.)	Total water (in.)	**EC_w weighted ave. (dS/m)**	Leaching (%)	Total irrigation water (in.)	Cumulative leaching (%)	1st	2nd	3rd	4th	**Ave.**
Rain	0	12	12	**0.09**	50	0	NA	0.1	0.1	0.1	0.1	**0.1**
Pre-irrigation	0	6	18	**0.56**	40	6	45	0.7	0.7	0.7	0.7	**0.7**
Crop irrigation 1	12	4	22	**0.73**	40	10	43	0.9	1.2	1.5	1.7	**1.3**
Crop irrigation 2	24	4	26	0.85	20	14	33	1.2	1.6	2.1	2.6	**1.9**
Crop irrigation 3	36	4	30	**0.94**	10	18	28	1.3	1.9	2.7	3.4	**2.3**
Crop irrigation 4	36	4	34	**1.00**	10	22	26	1.4	2.0	2.9	3.7	**2.5**

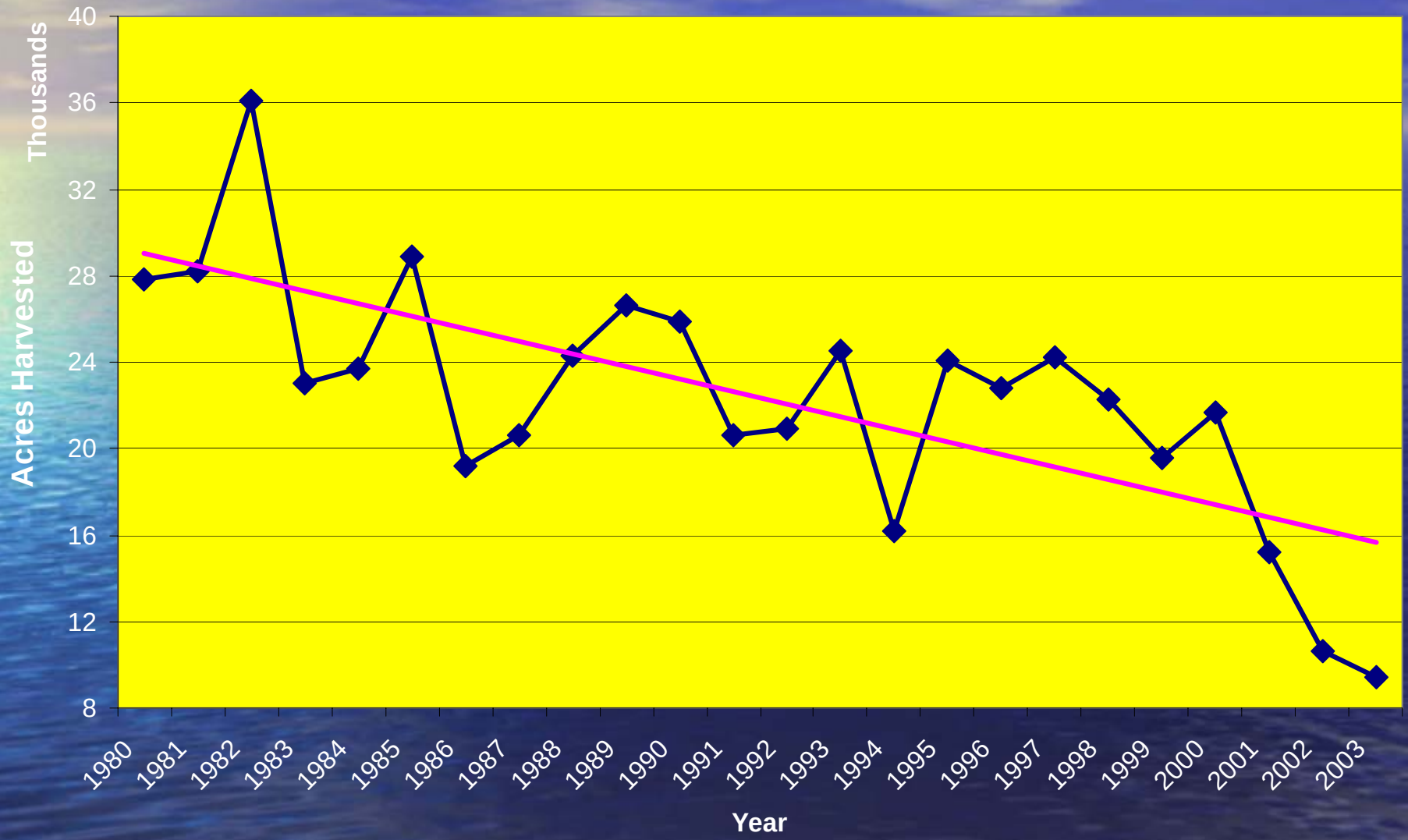
Ayers & Westcot model a 40-inch water application, no rainfall, and an irrigation water salinity (ECw) of 1.1 dS/m

								EC_e predicted (dS/m) by quarters of the root				
Event	Effective rooting depth (in.)	Depth (in)	Total water (in.)	**EC_w weighted ave. (dS/m)**	Leaching (%)	Total irrigation water (in.)	Cumulative leaching (%)	1st	2nd	3rd	4th	**Ave.**
Irrigation water only		NA	40	**1.1**	74	22	15	1.2	1.3	1.4	1.5	**1.4**

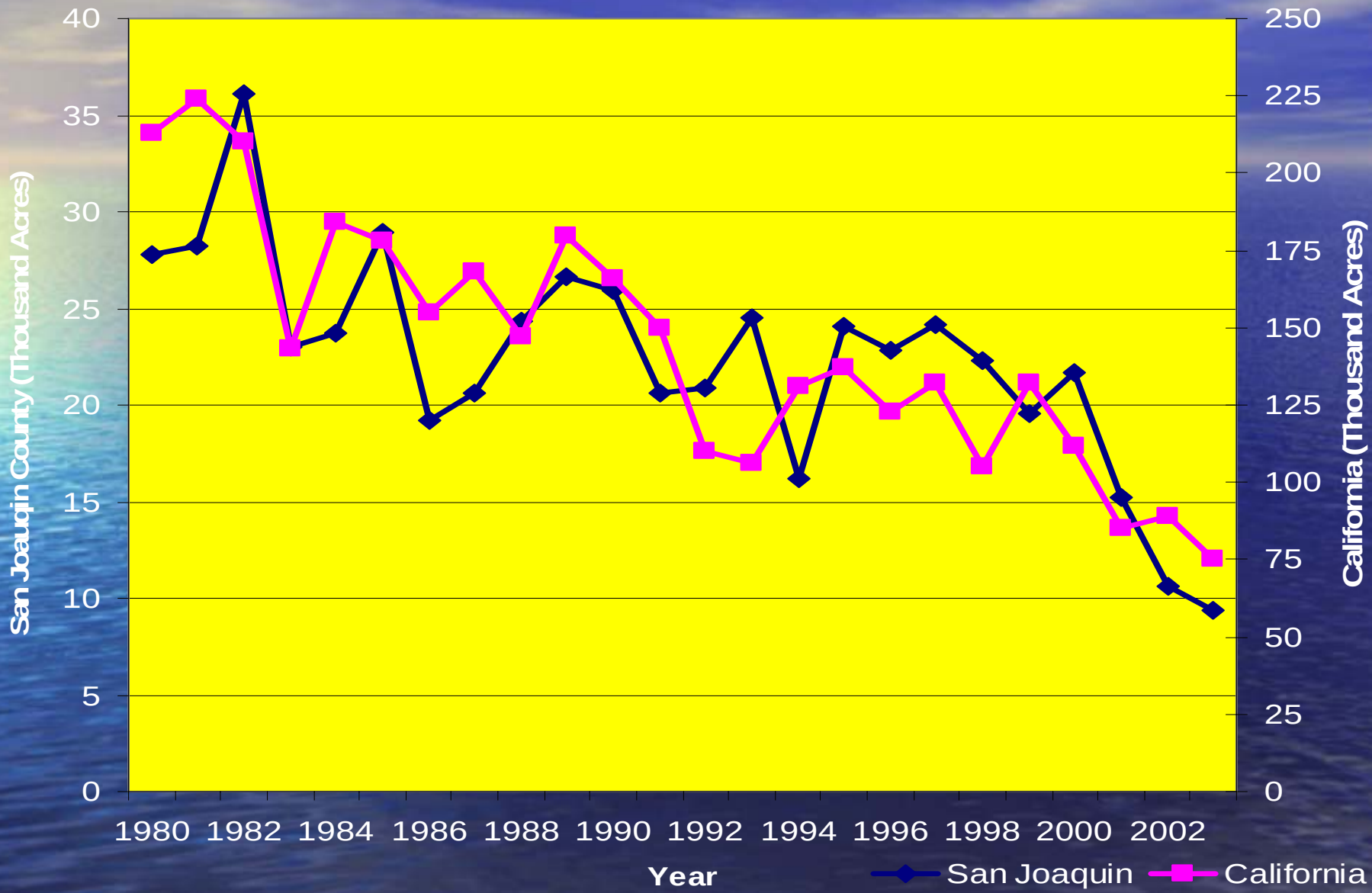
San Joaquin County annual dry bean yield and crop season average salinity at Vernalis



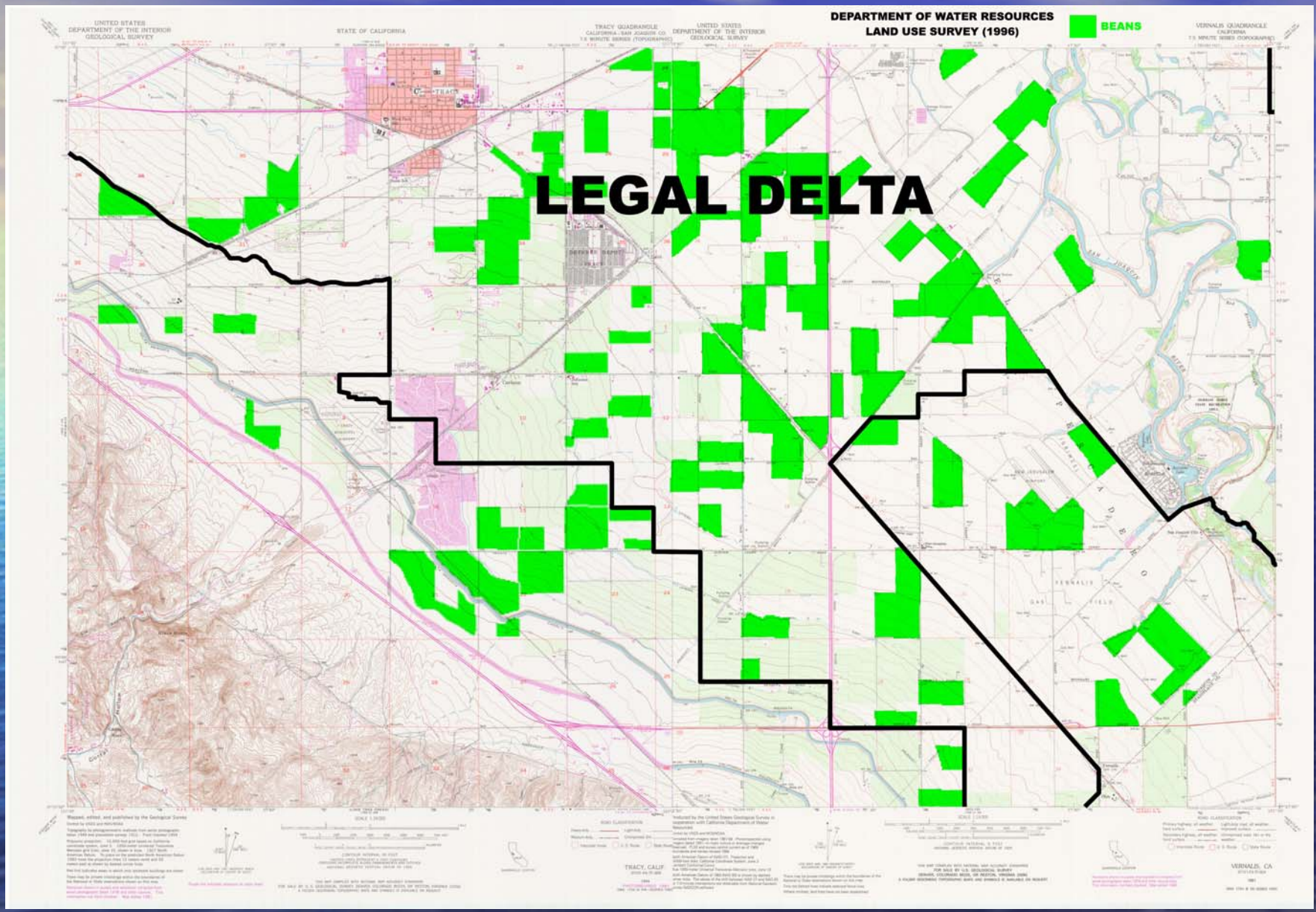
Acres of beans harvested in San Joaquin County, 1980-2003



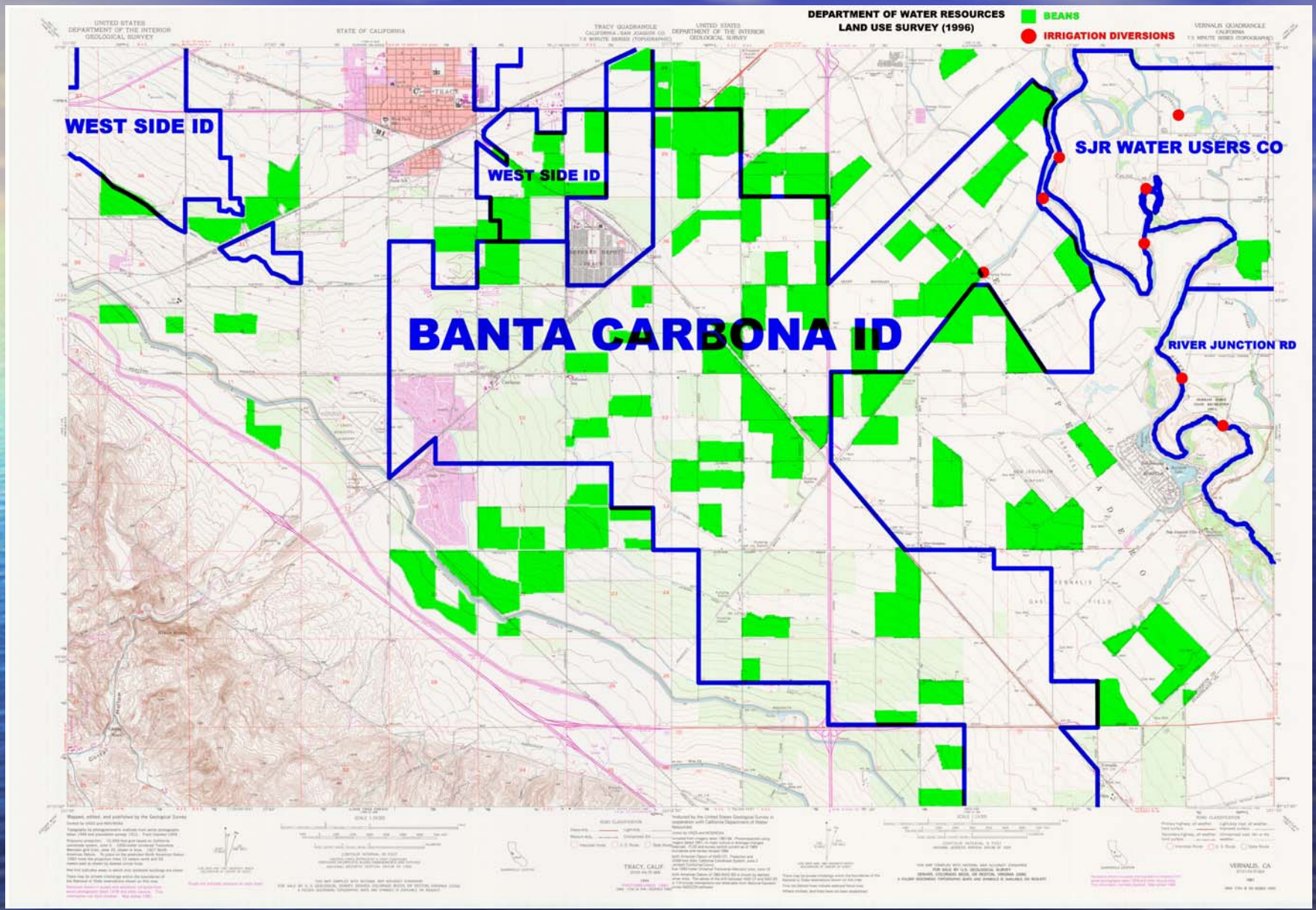
Dry beans harvested in San Joaquin County and California, 1980-2003



Combined Tracy-Vernalis Quadrangles



Combined Tracy-Vernalis Quadrangles



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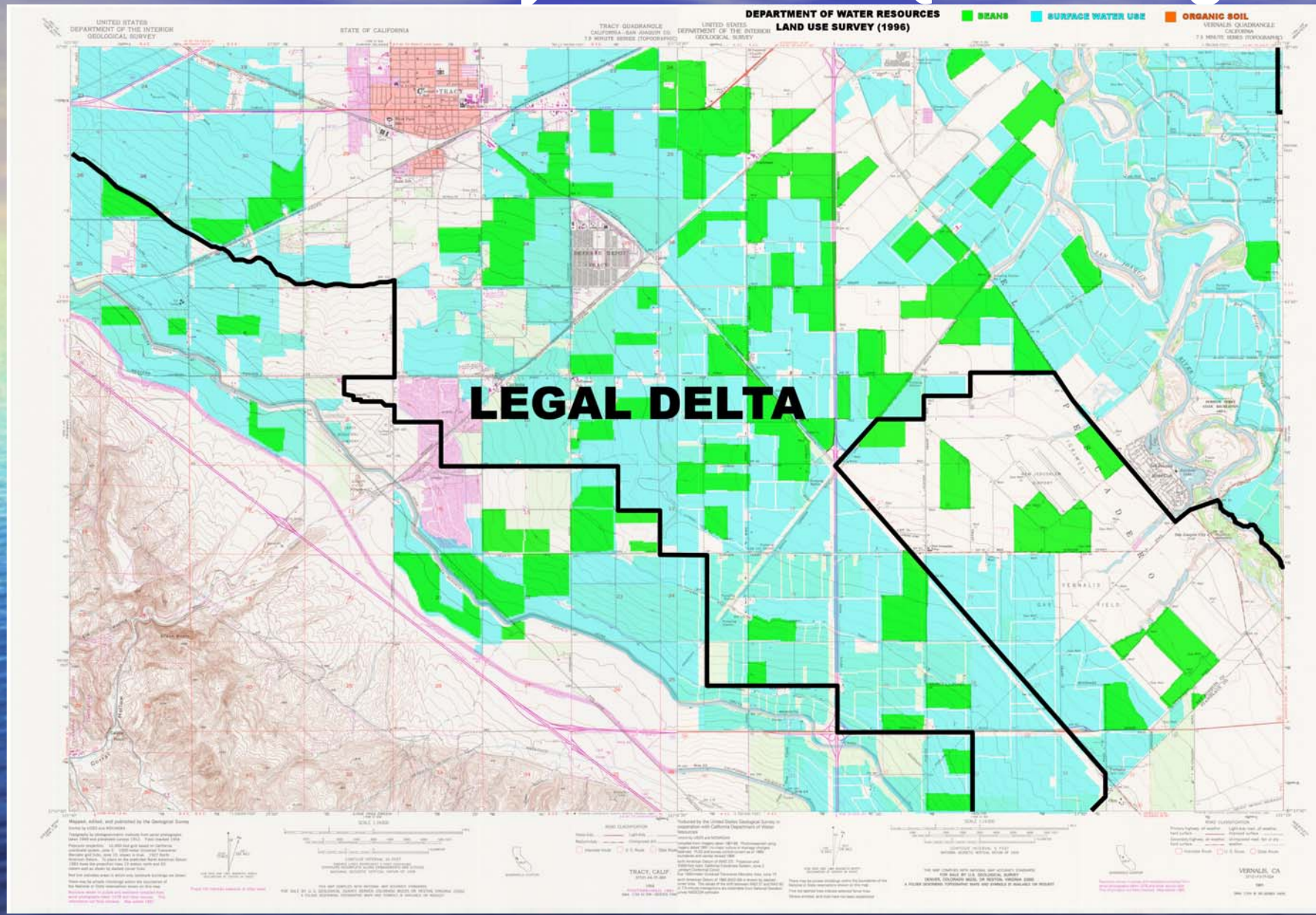
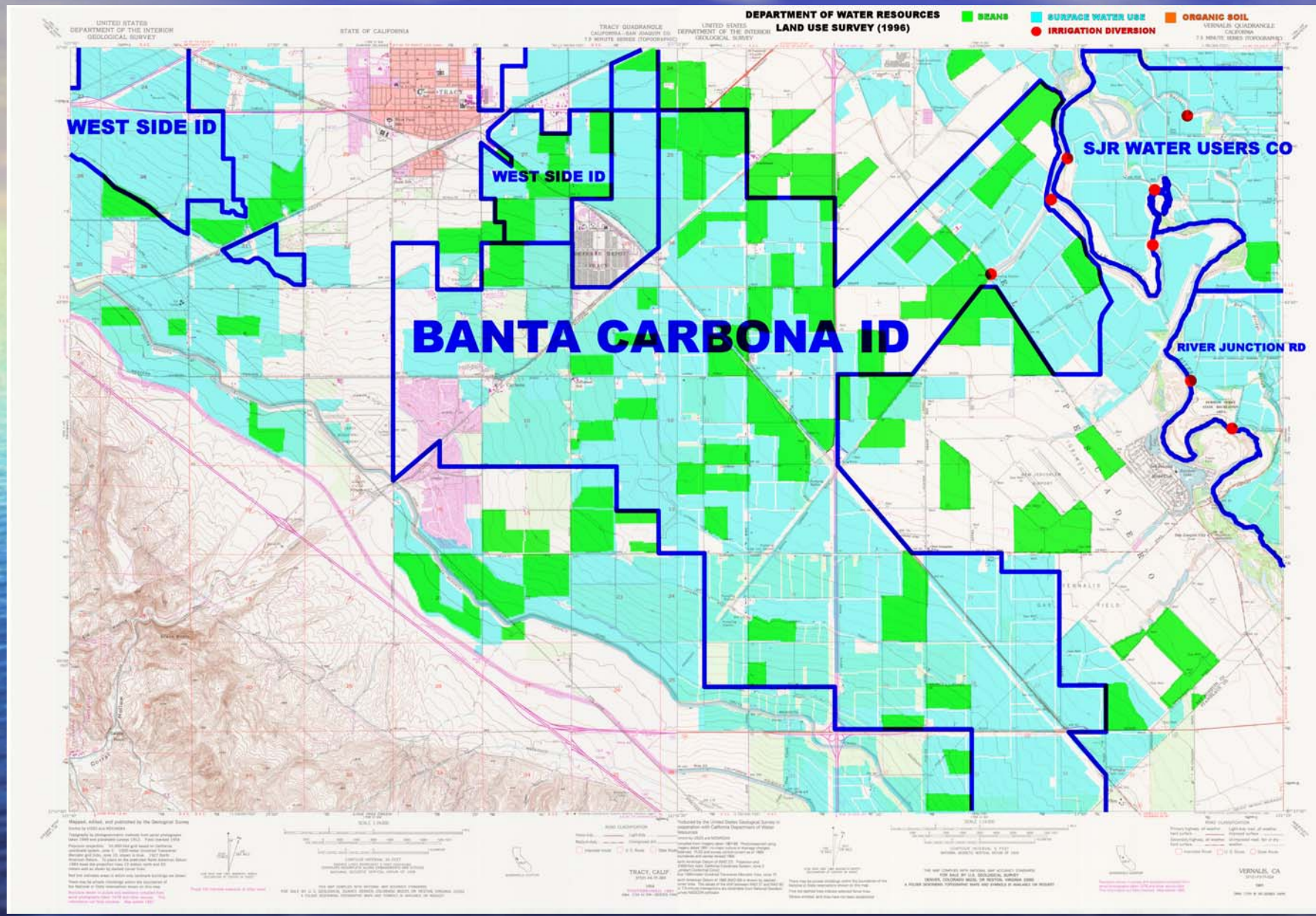
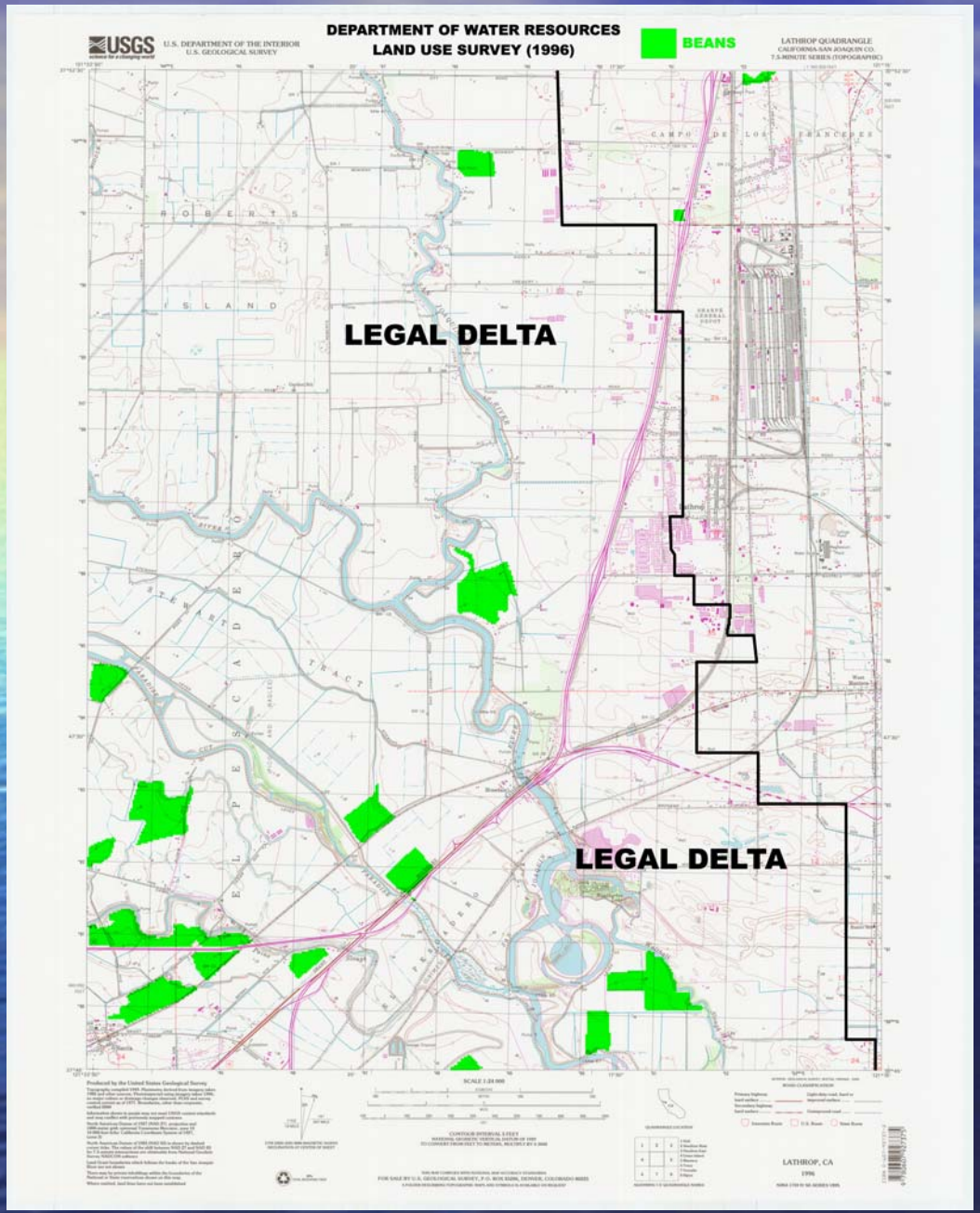


Combined Tracy-Vernalis Quadrangles

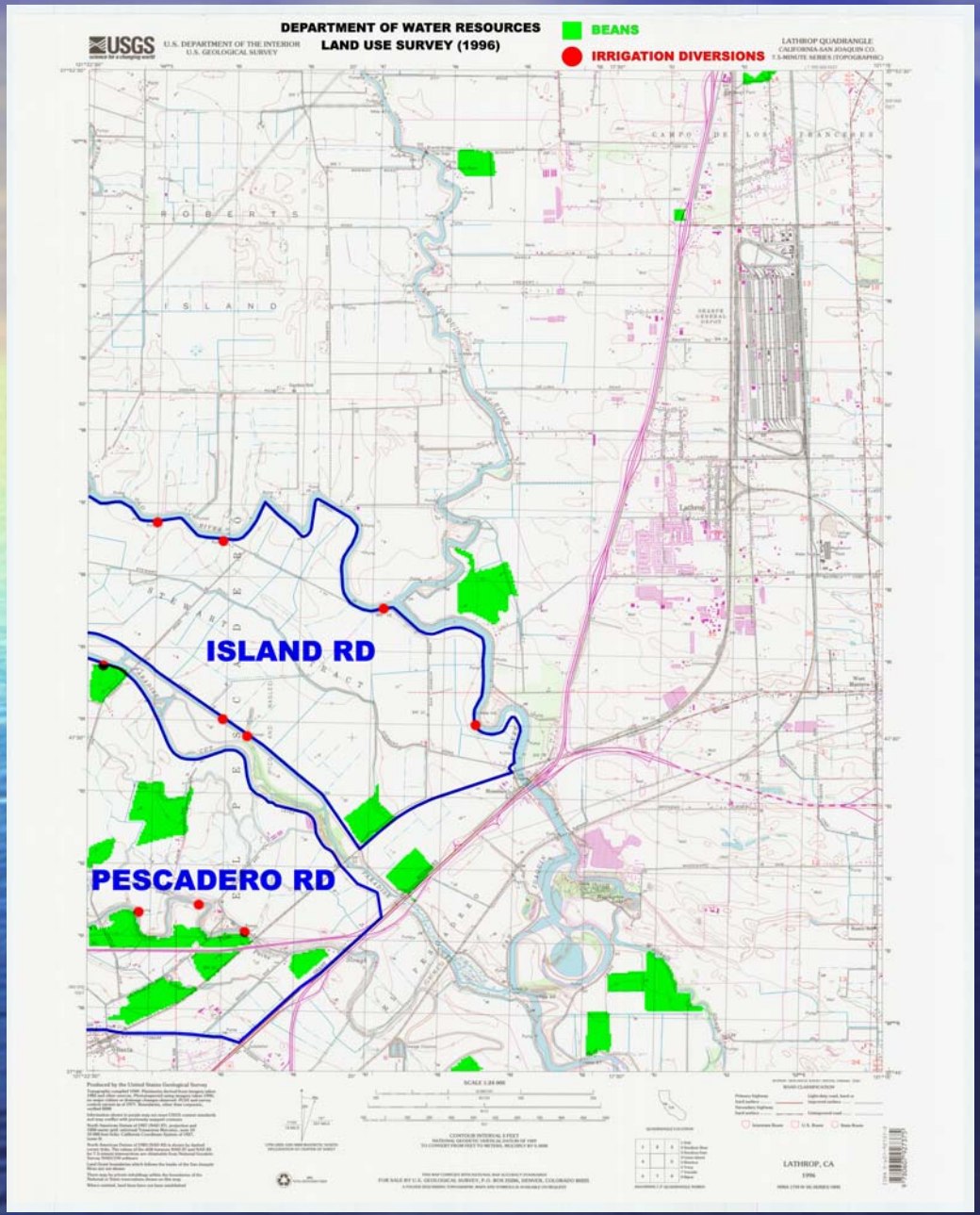




Lathrop Quadrangle

Department of Water Resources Land Use Survey 1996

Beans



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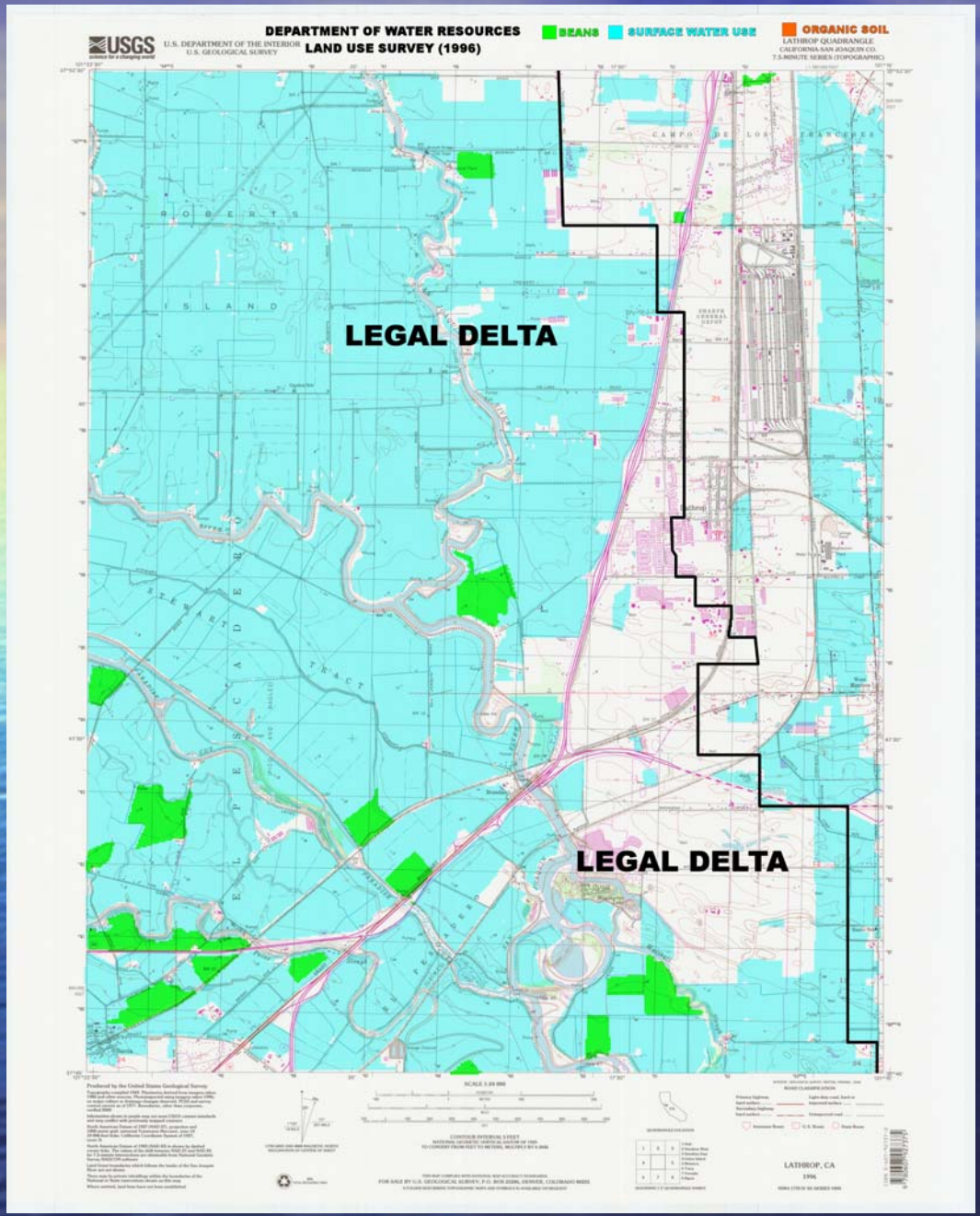

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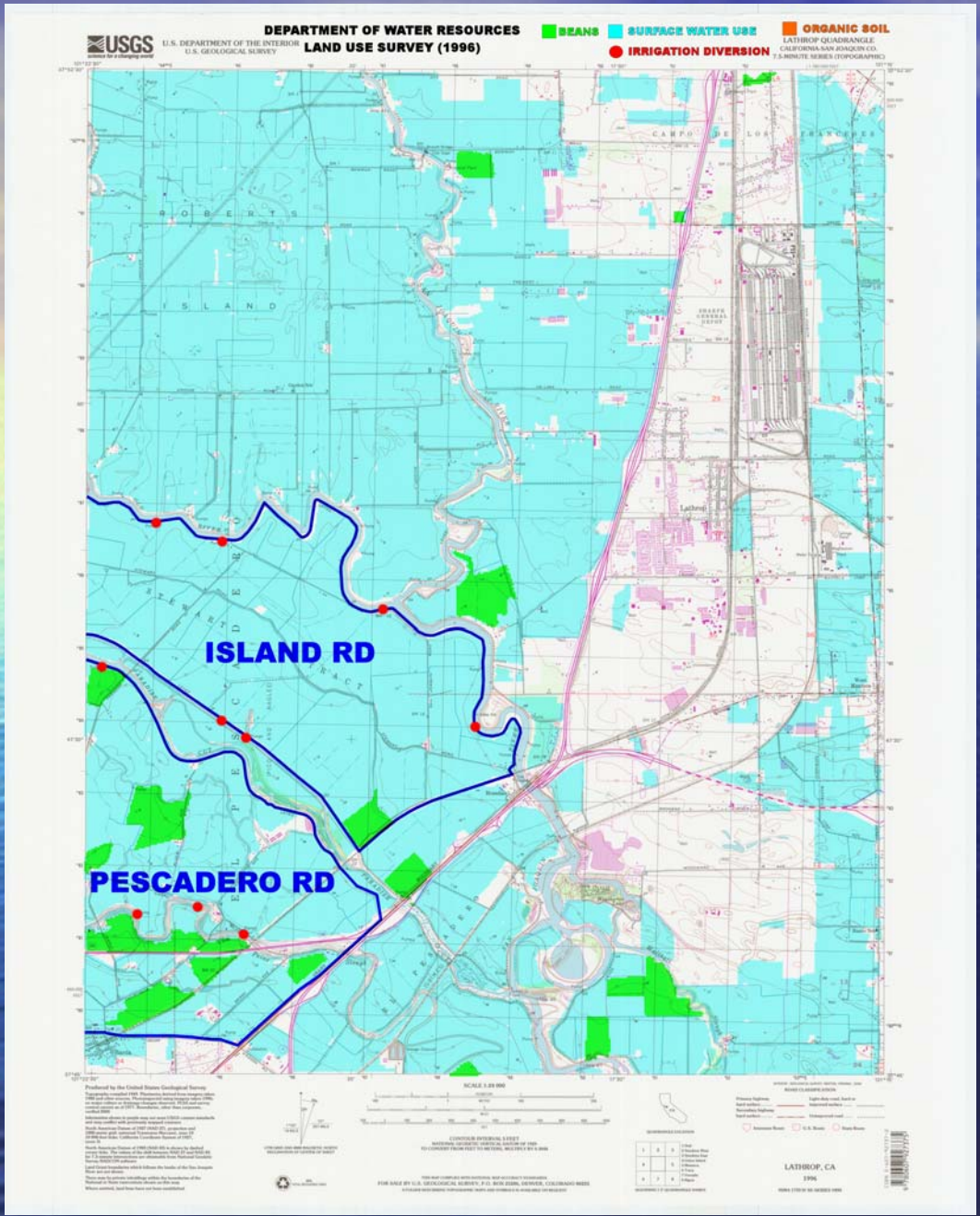
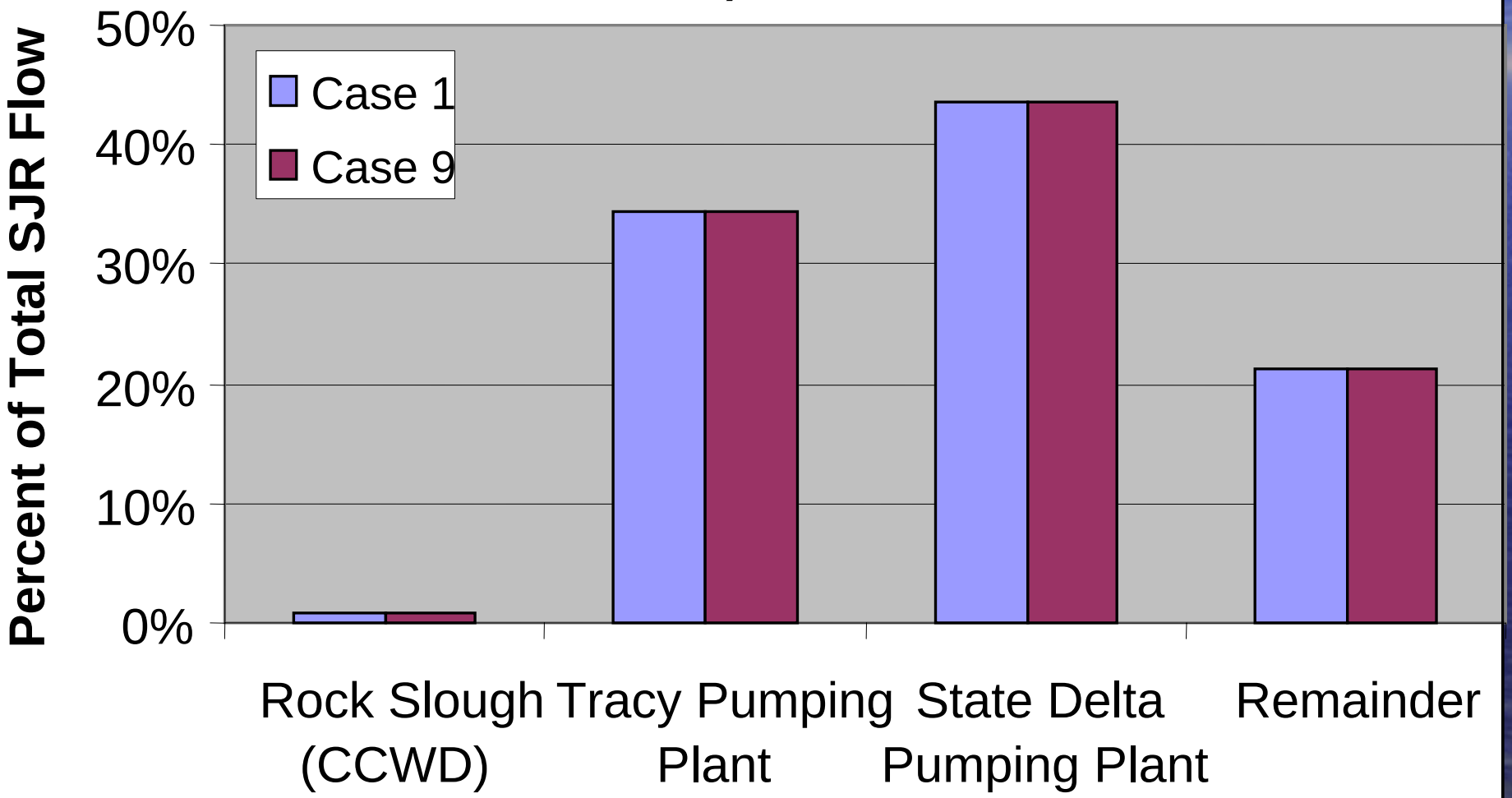


Lathrop Quadrangle

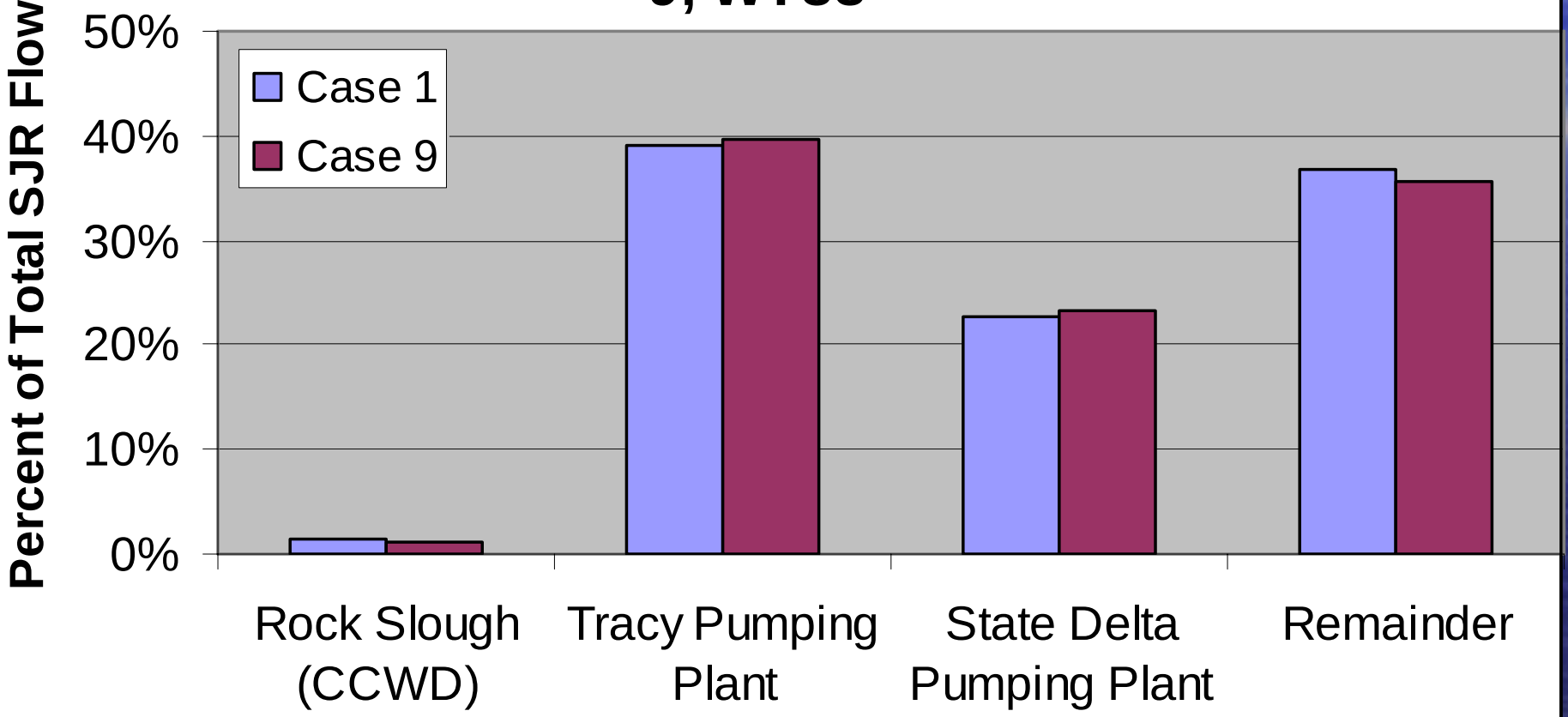
Department of Water Resources Land Use Survey 1996

Beans

Fate of San Joaquin River Water, Cases 1 and 9, WY64



Fate of San Joaquin River Water, Cases 1 and 9, WY88



Reduced Vernalis Flows and DO Exceedances at SDWSC

Wet

1996	June	July	Aug	Sept	Oct
Unimpaired	19,136	6,659	1,641	620	560
Actual	3,739	2,209	2,034	2,164	2,690
Percent/DO	8/4.8	63/3.4	94/2.0	89/2.5	15/3.7
Exports	9,382	10,472	10,557	10,093	9,662

Above Normal

2000	June	July	Aug	Sept	Oct
Unimpaired	15,692	3,436	1,491	844	914
Actual	2,772	1,898	2,171	2,330	2,806
Percent/DO	11/2.9	61/2.9	28/2.7	1/4.8	
Exports	7,260	10,159	10,513	10,769	9,194

Reduced Vernalis Flows and DO Exceedances at SDWSC

Dry

2001	June	July	Aug	Sept	Oct
Unimpaired	3,891	1,233	339	300	340
Actual	1,599	1,401	1,338	1,374	1,563
Percent/DO	69/2.5	75/2.53	73/3.0	61/2.9	
Exports	3,148	7,658	8,171	7,656	4,604

Critical

1990	June	July	Aug	Sept	Oct
Unimpaired	5,412	1,821	407	185	228
Actual	1,116	1,009	1,033	876	993
Percent/DO	11/4.5	<1/4.8	<1/4.9		
Exports	3,295	6,091	6,420	5,670	3,364