

Appendix A

Delphi Questionnaire

This appendix includes the Delphi questionnaire used in the second round of the Delphi process. The members individually responded to each of the questions by indicating whether they strongly agree, agree, disagree, or strongly disagree with the model components and scenarios. After the members finished the questionnaire, the responses were tallied and presented statistically to the group. The group then held a discussion about any opinions that fell outside the norm. These discussions were a modification to the traditional Delphi Process.

Butte County Agricultural Water Demand Forecast
Delphi Confidential Questionnaire
 July 14, 2003

Subject	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree	Comments
Crop Categories					
Input Data					
Scenario Descriptions					
Urbanization					
Implementation Method					
Applicable Regions					
Magnitude of Change					
Crop Idling					
Implementation Method					
Applicable Regions					
Magnitude of Change					
Crop Price					
Implementation Method					
Applicable Regions					
Magnitude of Change					
Groundwater Pumping					
Implementation Method					
Applicable Regions					
Magnitude of Change					
Conservation					
Implementation Method					
Applicable Regions					
Magnitude of Change					
Example Scenario Results					
Urbanization					
Crop Idling					
Crop Price					
Conservation					

Appendix B

Model Input Data

This appendix contains input data used in construction of the model. Data is separated by region. Each region includes data on crop costs and revenues, and irrigation requirements during normal and dry years. Section 3 of the report describes model input data.

B.1 East Butte Region

Crop Category	Proxy Crop	Price¹ (\$/ton)	Crop Yield² (ton/acre)	Total Revenue¹ (\$/acre)	Land Rent (\$)	Other Fixed Cost³ (\$)	Average Variable Cost⁴ (\$/acre)	Average Total Cost (\$/acre)
Field Crop	Beans	688	0.95	659.99	135.00	55.00	424.45	504.58
Forage	Alfalfa							
	Hay	114	6.00	680.69	21.00	84.00	298.85	408.94
Grain	Wheat	112	2.14	244.00	89.00	78.00	127.12	210.57
Rice	Rice	251	4.04	1,014.76	169.00	169.00	553.89	740.24
Safflower	Safflower	322	0.73	238.12	53.00	81.00	164.25	251.78
Orchards	Almonds	3,233	0.65	2,035.52	211.00	568.00	1,115.00	1,723.38

1 Price and total revenue are averages of 1992-2001 data adjusted to 2002 dollars.

2 Crop yield is average of 1992-2001 data.

3 Other Fixed Costs include office expenses, insurance, property taxes, building and equipment.

4 Variable costs include labor costs, fuel, lube and repairs, and material costs, excluding water costs.

Source: UCCE Crop Budgets, CAC data

Crop Category	Proxy Crop	Applied Water – Surface¹ (af/acre)	Applied Water-Groundwater¹ (af/acre)	ET of Applied Water¹ (af/acre)	Surface Water Cost (\$/acre)
Field Crop	Beans	3.03	2.92	2.00	21.84
Forage	Alfalfa				
	Hay	6.06	5.39	4.00	22.73
Grain	Wheat	1.11	1.10	0.80	26.00
Rice	Rice	5.60	5.40	3.40	25.53
Safflower	Safflower	0.09	0.20	0.10	19.32
Orchards	Almonds	4.06	3.59	2.70	23.46
Non-Crop Specific Data					
Groundwater Cost (\$/af)				13.43	
		<i>Surface</i>	<i>Groundwater</i>	<i>Total</i>	
Total Irrigated Acreage (acres)		97,070	23,630	120,700	
Ag Water Use (af)		525,640	103,920	629,560	

1 Applied Water Rates and ETAW are weighted averages of crop acreages in each category and associated applied water rates and ETAW.

Source: Butte County Applied Water Balance for 1997 Actual Year Scenario (acre-feet); Data from DWR, Northern District

Crop Category	Proxy Crop	Applied Water – Surface¹ (af/acre)	Applied Water- Groundwater¹ (af/acre)	ET of Applied Water¹ (af/acre)	Surface Water Cost (\$/acre)	Groundwater Cost (\$/af)
Forage	Alfalfa Hay	6.76	5.96	4.47	22.73	95.63
Grain	Wheat	1.11	1.89	1.70	1.30	30.40
Rice	Rice	5.90	5.70	3.60	25.53	91.45
Field Crop	Beans	3.09	3.30	2.20	21.84	52.92
Orchards	Almonds	4.89	4.34	3.26	23.46	69.61
Safflower	Safflower	0.55	0.60	0.50	19.32	9.63
Non-Crop Specific Data						
Groundwater Cost (\$/af)			Total Cost	Variable Cost	Capital Cost	
			16.04	8.81	7.23	
			Surface	Groundwater	Total	
Total Irrigated Acreage (acres)			9,050	30,230	120,730	
Ag Water Use (af)						

¹ Applied Water Rate and ETAW is a weighted average of crop acreages in each category and associated applied water rates and ETAW.

Source: DWR, Northern District Butte County Applied Water Balance for 1997 Drought Year Scenario

B.2 North Yuba Region

Crop Category	Proxy Crop	Price¹ (\$/ton)	Crop Yield² (ton/acre)	Total Revenue¹ (\$/acre)	Land Rent (\$)	Other Fixed Cost³ (\$)	Average Variable Cost⁴ (\$/acre)	Average Total Cost (\$/acre)
Field Crop	Beans	688	0.95	659.99	135.00	55.00	424.45	504.58
Forage	Alfalfa Hay	114	6.00	680.69	21.00	84.00	298.85	408.94
Grain	Wheat	112	2.14	244.00	89.00	78.00	127.12	210.57
Rice	Rice	251	4.04	1,014.76	169.00	169.00	553.89	740.24
Safflower	Safflower	--	--	--	--	--	--	--
Orchards	Almonds	3,233	0.65	2,035.52	211.00	568.00	1,115.00	1,723.38

See footnote text in Table 1 for the East Butte Region

Crop Category	Proxy Crop	Applied Water – Surface¹ (af/acre)	Applied Water-Groundwater¹ (af/acre)	ET of Applied Water¹ (af/acre)	Surface Water Cost (\$/acre)
Field Crop	Beans	--	2.42	1.70	--
Forage	Alfalfa				
	Hay	4.50	5.09	3.80	20.00
Grain	Wheat	1.00	0.90	0.70	20.00
Rice	Rice	--	5.40	3.40	
Safflower	Safflower	--	--	--	--
Orchards	Almonds	3.27	3.27	2.40	20.00
Non-Crop Specific Data					
Groundwater Cost (\$/af)					
				18.63	
			<i>Surface</i>	<i>Groundwater</i>	<i>Total</i>
Total Irrigated Acreage (acres)			2,230	12,030	14,260
Ag Water Use (af)			6,860	47,100	53,960

See footnote text in Table 1 for the East Butte Region

Crop Category	Proxy Crop	Applied Water – Surface¹ (af/acre)	Applied Water-Groundwater¹ (af/acre)	ET of Applied Water¹ (af/acre)	Surface Water Cost (\$/ac)	Groundwater Cost (\$/af)
Forage	Alfalfa					
	Hay	5.20	6.00	4.50	20.00	130.16
Grain	Wheat	1.92	1.70	1.30	20.00	36.88
Rice	Rice	3.00	5.70	3.60	20.00	123.65
Field Crop	Beans	3.00	3.00	2.10	20.00	65.08
Orchards	Almonds	4.45	4.48	3.21	20.00	97.20
Safflower	Safflower	--	--	--	--	--
Non-Crop Specific Data						
Groundwater Cost (\$/af)						
			Total Cost	Variable Cost	Capital Cost	
			21.69	14.46	7.23	
			Surface	Groundwater	Total	
Total Irrigated Acreage (acres)			1,820	12,440	14,260	
Ag Water Use (af)						

See footnote text in Table 1 for the East Butte Region

B.3 Vina Region

Crop Category	Proxy Crop	Price¹ (\$/ton)	Crop Yield² (ton/acre)	Total Revenue¹ (\$/acre)	Land Rent (\$)	Other Fixed Cost³ (\$)	Average Variable Cost⁴ (\$/acre)	Average Total Cost (\$/acre)
Field Crop	Beans	688	0.95	659.99	135.00	55.00	424.45	504.58
Forage	Alfalfa Hay	114	6.00	680.69	21.00	84.00	298.85	408.94
Grain	Wheat	112	2.14	244.00	89.00	78.00	127.12	210.57
Rice	Rice	--	--	--	--	--	--	--
Safflower	Safflower	322	0.73	238.12	53.00	81.00	164.25	251.78
Orchards	Almonds	3,233	0.65	2,035.52	211.00	568.00	1,115.00	1,723.38

See footnote text in Table 1 for the East Butte Region

Crop Category	Proxy Crop	Applied Water – Surface¹ (af/acre)	Applied Water-Groundwater¹ (af/acre)	ET of Applied Water¹ (af/acre)	Surface Water Cost (\$/acre)
Field Crop	Beans	2.90	2.82	2.10	--
Forage	Alfalfa Hay	--	5.10	3.80	--
Grain	Wheat	--	0.90	0.70	--
Rice	Rice	--	--	--	--
Safflower	Safflower	--	0.10	0.10	--
Orchards	Almonds	3.63	3.47	2.70	--
Non-Crop Specific Data					
Groundwater Cost (\$/af)				15.63	
		<i>Surface</i>	<i>Groundwater</i>	<i>Total</i>	
Total Irrigated Acreage (acres)		850	35,840	36,690	
Ag Water Use (af)		3,010	118,520	121,530	

See footnote text in Table 1 for the East Butte Region

Crop Category	Proxy Crop	Applied Water – Surface¹ (af/acre)	Applied Water-Groundwater¹ (af/acre)	ET of Applied Water¹ (af/acre)	Surface Water Cost (\$/ac)	Groundwater Cost (\$/af)
Forage	Alfalfa	5.70	5.70	4.30	55.21	106.28
Grain	Wheat	1.60	1.60	1.20	11.97	29.81
Rice	Rice	--	--	--	--	--
Field Crop	Beans	2.90	3.13	2.29	32.43	58.22
Orchards	Almonds	4.43	4.19	3.21	36.67	78.02
Safflower	Safflower	0.51	0.51	0.40	1.50	9.50
Non-Crop Specific Data						
Groundwater Cost (\$/af)			Total Cost	Variable Cost	Capital Cost	
			18.63	11.40	7.23	
			Surface	Groundwater	Total	
Total Irrigated Acreage (acres)			850	35,840	36,690	
Ag Water Use (af)						

See footnote text in Table 1 for the East Butte Region

B.4 West Butte Region

Crop Category	Proxy Crop	Price¹ (\$/ton)	Crop Yield² (ton/acre)	Total Revenue¹ (\$/acre)	Land Rent (\$)	Other Fixed Cost³ (\$)	Average Variable Cost⁴ (\$/acre)	Average Total Cost (\$/acre)
Field Crop	Beans	688	0.95	659.99	135.00	55.00	424.45	504.58
Forage	Alfalfa							
	Hay	114	6.00	680.69	21.00	84.00	298.85	408.94
Grain	Wheat	112	2.14	244.00	89.00	78.00	127.12	210.57
Rice	Rice	251	4.04	1,014.76	169.00	169.00	553.89	740.24
Safflower	Safflower	322	0.73	238.12	53.00	81.00	164.25	251.78
Orchards	Almonds	3,233	0.65	2,035.52	211.00	568.00	1,115.00	1,723.38

See footnote text in Table 1 for the East Butte Region

Table B-11 – Water Use and Water Cost Data for West Butte Region, Average Year						
Crop Category	Proxy Crop	Applied Water – Surface¹ (af/acre)	Applied Water-Groundwater¹ (af/acre)	ET of Applied Water¹ (af/acre)	Surface Water Cost (\$/acre)	
Field Crop	Beans	2.86	4.74	2.00	32.43	
Forage	Alfalfa					
	Hay	5.54	4.74	3.60	55.21	
Grain	Wheat	1.00	0.90	0.70	11.97	
Rice	Rice	5.40	5.19	3.30	33.63	
Safflower	Safflower	0.10	0.10	0.10	1.50	
Orchards	Almonds	3.50	3.26	2.50	36.67	
Non-Crop Specific Data						
Groundwater Cost (\$/af)				14.83		
				<i>Surface</i>	<i>Groundwater</i>	<i>Total</i>
Total Irrigated Acreage (acres)		22,710	34,510	57,220		
Ag Water Use (af)		94,160	106,840	201,000		

See footnote text in Table 1 for the East Butte Region

Table B-12 – Water Cost and Water Use Data for West Butte Region, Dry Year						
Crop Category	Proxy Crop	Applied Water – Surface¹ (af/acre)	Applied Water-Groundwater¹ (af/acre)	ET of Applied Water¹ (af/acre)	Surface Water Cost (\$/ac)	Groundwater Cost (\$/af)
Forage	Alfalfa					
	Hay	6.49	5.70	4.30	55.21	98.41
Grain	Wheat	1.70	1.60	1.20	11.97	27.67
Rice	Rice	5.90	5.70	3.60	33.63	98.50
Field Crop	Beans	3.16	3.07	2.24	32.43	53.05
Orchards	Almonds	4.38	4.13	3.25	36.67	71.29
Safflower	Safflower	0.51	0.51	0.40	1.50	8.76
Non-Crop Specific Data						
Groundwater Cost (\$/af)		Total Cost		Variable Cost	Capital Cost	
		17.27		10.04	7.23	
		Surface	Groundwater	Total		
Total Irrigated Acreage (acres)		22,180	35,070	57,250		
Ag Water Use (af)						

See footnote text in Table 1 for the East Butte Region

B.5 Mountain/Foothill Region

Table B-13 – Crop Cost and Revenue Data for Mountain/Foothill Region

Crop Category	Proxy Crop	Price¹ (\$/ton)	Crop Yield² (ton/acre)	Total Revenue¹ (\$/acre)	Land Rent (\$)	Other Fixed Cost³ (\$)	Average Variable Cost⁴ (\$/acre)	Average Total Cost (\$/acre)
Field Crop	Beans	--	--	--	--	--	--	--
Forage	Alfalfa Hay	114	6.00	680.69	21.00	84.00	298.85	408.94
Grain	Wheat	112	2.14	244.00	89.00	78.00	127.12	210.57
Rice	Rice	--	--	--	--	--	--	--
Safflower	Safflower	--	--	--	--	--	--	--
Orchards	Almonds	3,233	0.65	2,035.52	211.00	568.00	1,115.00	1,723.38

See footnote text in Table 1 for the East Butte Region

Table B-14 – Water Use and Water Cost Data for Mountain/Foothill Region, Average Year

Crop Category	Proxy Crop	Applied Water – Surface¹ (af/acre)	Applied Water-Groundwater¹ (af/acre)	ET of Applied Water¹ (af/acre)	Surface Water Cost (\$/acre)
Field Crop	Beans	--	--	--	--
Forage	Alfalfa Hay	4.06	3.57	3	202.00
Grain	Wheat	0.91	--	0.6	45.00
Rice	Rice	--	--	--	--
Safflower	Safflower	--	--	--	--
Orchards	Almonds	2.46	3.50	2.00	130.00
Non-Crop Specific Data					
Groundwater Cost (\$/af)					
		<i>Surface</i>	<i>Groundwater</i>	<i>Total</i>	
Total Irrigated Acreage (acres)		2,890	130	3,020	
Ag Water Use (af)		7,810	460	8,270	

See footnote text in Table 1 for the East Butte Region

Table B-15 – Water Cost and Water Use Data for Mountain/Foothill Region, Dry Year						
Crop Category	Proxy Crop	Applied Water – Surface¹ (af/acre)	Applied Water-Groundwater¹ (af/acre)	ET of Applied Water¹ (af/acre)	Surface Water Cost (\$/ac)	Groundwater Cost (\$/af)
Forage	Alfalfa Hay	4.19	3.43	3.1	202.00	68.57
Grain	Wheat	1.09	1.09	0.8	45.00	21.80
Rice	Rice	--	--	--	--	--
Field Crop	Beans	--	--	--	--	--
Orchards	Almonds	2.80	3.67	2.3	130.00	73.33
Safflower	Safflower	--	--	--	--	--
Non-Crop Specific Data						
Groundwater Cost (\$/af)		Total Cost		Variable Cost	Capital Cost	
		20.00		10.00	10.00	
		Surface		Groundwater	Total	
Total Irrigated Acreage (acres)		2,890		130	3,020	
Ag Water Use (af)						

See footnote text in Table 1 for the East Butte Region