ATTACHMENT TO ACCOMPANY
APPLICATION FOR APPROPRIATION OF WATER
BY
BRIAN LOWELL

ATTACHMENT NO. 2

WATER AVAILABILITY ANALYSIS

Included herewith is a determination of water available at the point of diversion (POD) on the unnamed stream as identified in the Water Right Application (see attached map). The calculation of water available is based on the rainfall-runoff method using data recorded at the Red Bluff FSS Precipitation Station (Table 1).

The applicant requests authority to divert water to storage in an existing 64.5 acre-foot reservoir. The amount diverted on an annual basis required to offset seepage and evaporation losses is estimated to be about 24 acre-feet per annum (4 acre-feet evaporation loss over a reservoir surface area of approximately 6 acres).

The analyses attached in Tables 2 and 3 show that water is available in excess of 24 acre-feet during average and below average years. A complete water availability analysis with cumulative flow impairments will be prepared during the environmental review period, however a preliminary review of the Board's eWRIMS database shows that there are no water rights within the watershed tributary to the point of diversion for this project.

We undertook an additional analysis to determine whether the project would result in direct and cumulative adverse impacts to Cottonwood Creek instream flow. Using the rainfall-runoff method, we determined that average annual flow in Cottonwood Creek immediately below its confluence with the Unnamed Stream is approximately 75,200 acre-feet (see Tables 4 and 5). Accordingly, the anticipated annual diversion of 24 acre-feet from the Unnamed Stream constitutes about 0.03% of the average annual flow in Cottonwood Creek immediately below its confluence with the Unnamed Stream.

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We trust the analyses described above demonstrate both a reasonable likelihood that unappropriated water is available for the proposed appropriation as required by Water Code section 1260(k) and that maintaining the reservoir as it has been operated for the last ten years and as described in the attached Application does not impact the flow in Cottonwood Creek.

Table 1

Recorded Rainfall at Red Bluff FSS Precipitation Station
(all values in inches)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Total Annual
1933-34	--	0	8.33	0.88	2.97	1.13	--	--	--	--	0	0.03	--
1934-35	1.9	4.77	2.22	6.37	4.02	3.85	4.24	0.25	0	0	0	0.36	27.98
1935-36	3.26	0.61	3.54	5.09	4.1	1.63	2.33	0.92	1.64	0.1	0	0.55	23.77
1936-37	0.11	0	3.25	3.72	6.76	4.87	1.79	0.04	1.2	0.06	0	0	21.8
1937-38	3.1	6.4	4.67	3.6	5.16	6.33	1.35	0.15	0	0	0	1.02	31.78
1938-39	2.45	0.79	1.73	1.1	0.92	1.2	0.88	1.48	0	0	0	1.84	12.39
1939-40	1.33	0.21	3.7	7.66	8.98	3.44	0.66	1.67	0.12	0	0	0.14	27.91
1940-41	2.4	1.27	10.8	9.81	9.93	5.2	3.22	2.17	0.05	0.01	0	0.2	45.03
1941-42	1.41	3.89	7.3	5.55	4.45	1.67	5.4	2.26	0.12	0	0	0.13	32.18
1942-43	0.71	2.92	3.88	7.95	3.6	3.85	2.72	0.03	0.29	0	0	0	25.95
1943-44	0.42	1.75	2.24	3.29	3.23	0.49	2.17	1.15	0.58	0	0	0	15.32
1944-45	0.81	6.52	4.09	1.54	2.56	4.55	0.21	2.22	1.55	0	0	0.17	24.22
1945-46	2.84	3.51	8.35	2.1	1.09	1.36	0.61	0.23	0.02	0.24	0	0.09	20.44
1946-47	0.25	2.51	3.41	0.66	2.4	2.93	2.36	0.62	1.14	0	0.02	0.02	16.32
1947-48	4.77	1.15	1.97	2.06	0.98	4.47	6.51	2.68	--	0.22	0.19	0.7	25.7
1948-49	0.51	1.01	4.58	0.39	1.77	8.33	0.1	1.74	0	0	0	0	18.43
1949-50	0	0.94	0.74	5.48	4.33	2.05	0.33	0.6	0.21	0	0.05	0.17	14.9
1950-51	3.53	2.2	4.56	5.1	2.46	0.12	0.82	1.51	0.1	0	0.04	0.33	20.77
1951-52	1.98	4.21	4.54	6.32	1.6	4.31	0.74	0.49	0.95	0.2	0	0.03	25.37
1952-53	0.1	2.21	10.1	3.56	0.26	0.55	2.59	1.29	1.13	0	0.1	0	21.88
1953-54	0.58	3.11	0.46	3.55	3	4.07	1.24	0.01	0.83	0	1.23	0.15	18.23
1954-55	0.4	6.82	5.26	2.96	0.09	0.5	1.68	0.18	0.26	0.08	0	1.11	19.34
1955-56	0.38	3.63	7.71	8.63	1.09	0.01	1.27	4.04	0.58	0	0	0.29	27.63
1956-57	0.5	0.08	0	3.56	1.92	2.61	1.61	1.67	0.01	0	0	2.47	14.43
1957-58	4.3	1.2	2.59	5.5	11.4	5.57	2.47	1.49	1.06	0.42	0.07	0.21	36.26
1958-59	0.46	0.13	1.1	5.86	4.08	0.41	0.39	0.28	0.05	0	0.03	1.03	13.82
1959-60	0.04	0	1.06	4.63	4.27	2.45	2.36	0.48	0	0	0	0.05	15.34
1960-61	0.75	6.16	4.48	2.62	2.91	3.05	0.65	1.03	0.27	0	0.07	0.96	22.95
1961-62	0.07	2.71	4.61	1.25	6.96	2.19	0.14	0.98	1.1	0	0.15	0.25	20.41
1962-63	3.56	0.9	3.63	3.49	2.28	2.7	4.91	1.3	0.15	0	0	0	22.92
1963-64	2.21	4.96	0.46	2.3	0.02	1.67	0.05	0.43	0.59	0	0.67	0.85	14.21
1964-65	1.19	4.82	4.49	4.09	1.14	1.95	3.94	0	0	0	1.56	0	23.18

Table 1

Recorded Rainfall at Red Bluff FSS Precipitation Station
(all values in inches)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Total Annual
1965-66	0.01	5.33	1.65	3.58	4.3	0.71	0.68	0.06	0	0	0.11	0.1	16.53
1966-67	0	7.42	3.08	7.63	0.44	2.69	2.6	0.35	0.87	0.01	0	0.03	25.12
1967-68	0.08	1.9	2.51	5.82	3.65	1.27	0.29	0.56	0.48	0	1.18	0.01	17.75
1968-69	1.31	2.36	7.17	7.02	8.63	1.39	1.04	0	0.33	0.05	0	0	29.3
1969-70	1.25	0.62	6.6	8.4	1.53	2.32	0.07	0.08	1.25	0	0	0.01	22.13
1970-71	1.12	8.42	6.09	2.9	0.13	2.2	0.42	1.22	0.58	0	0	0.54	23.62
1971-72	0.08	1.77	3.26	1.44	0.93	0.58	0.58	0.9	0.26	0	0.01	1.54	11.35
1972-73	2.75	5.17	3.07	7.66	6.55	3.46	0.1	0.26	0	0	0	0.15	29.17
1973-74	2.37	7.37	3.75	4.27	1.53	4.51	1.49	0.04	0.13	0.69	0.01	0	26.16
1974-75	2.16	0.91	4.88	1.8	5.69	4.72	1.39	0	0.24	0.33	0.53	0	22.65
1975-76	3.43	0.48	1.04	0.22	0.95	1.47	1.69	0	0.03	0	0.54	1.04	10.89
1976-77	0.06	0.54	0.66	2.7	1.35	1.37	0.98	3.29	0.45	0	0	1.26	12.66
1977-78	0.13	3.13	4.63	10.2	5.41	8.4	4.35	0.01	0.05	0	0.06	0.58	36.92
1978-79	0	2.58	0.11	5.2	6.94	2.44	1.26	0.27	0	0	0.01	0.62	19.43
1979-80	2.81	3.69	5.99	2.84	7.77	2.09	1.76	0.9	1.21	0	0	0.1	29.16
1980-81	0.72	0.42	2.62	5.48	1.87	4.87	1.71	2.25	0	0	0	0.92	20.86
1981-82	3.74	6.15	4	3.55	2.39	3.56	1.45	0.01	1.63	0.25	0	1.48	28.21
1982-83	2.76	4.81	3.83	7.65	7.95	9.21	3.69	0.6	0.42	0	0.82	1.07	42.81
1983-84	0.35	6.93	10.3	0.4	1.9	1.41	0.54	0.04	0.17	0	0.48	0.2	22.71
1984-85	1.83	6.69	1.95	0.63	0.9	3.05	0.05	0.18	0.03	0.35	0.19	1.16	17.01
1985-86	1.21	3.84	2.41	5.18	8.3	4.97	0.97	2.6	0	0	0	3.53	33.01
1986-87	0.2	--	2.1	3.29	3.76	5.43	0	0.48	0	0	0	0	--
1987-88	0.33	2.67	6.31	6.19	0.19	0.84	1.26	2.06	1.44	0	0.02	0	21.31
1988-89	0.03	4.6	2.67	1.51	0.52	5.73	1.25	0.7	0.48	0	0.04	4.95	22.48
1978-90	5.17	0.85	0	4.59	1.26	1.73	0.08	2.99	0	0.41	0.47	0.08	17.63
1990-91	0.38	0.7	0	0.5	--	--	--	0.92	0.12	0.13	0	0	--
1991-92	0.26	0.67	3.86	2.77	7.76	3.36	1.2	0.26	1.21	0	0	0	21.35
1992-93	1.91	0.37	7.51	8.86	6.63	2.8	2.51	2.51	1.13	0	0.3	0	34.53
1993-94	1.02	1.5	2.32	3.08	5.83	0.58	1.83	2.32	0.06	0	0	0.04	18.58
1994-95	0.23	4.95	4.16	21.5	0.9	10.2	2.1	1.19	0.67	0	0	0	45.9
1995-96	--	--	0	--	--	--	--	--	--	0	0	0.59	--
1996-97	2.13	1.65	5.56	4.85	0.39	1.76	0.61	0.82	0.55	0	0.49	0.78	19.59
1997-98	1.42	6.55	2.82	9.69	13.4	4.26	1.9	6.53	1.47	0	0	0	47.99
1998-99	2.25	5.64	1.39	1.06	4.64	2.46	0.95	0.02	0.61	0	0.25	0	19.27
1999-00	0.31	3.44	0.3	4.87	6.93	2.42	2.43	0.9	0.55	0.7	0.04	0.43	23.32

Table 1

Recorded Rainfall at Red Bluff FSS Precipitation Station
(all values in inches)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Total Annual
2000-01	3.7	0.59	0.42	5.39	4.74	2.7	1.73	0	0.43	0	0	0.43	20.13
2001-02	0.8	5.14	6.13	2.11	0.95	1.49	0.81	0.82	0	0	0	0	18.25
2002-03	0	2.66	9.68	4.8	1.46	2.72	4.02	1.72	0	0.07	0.26	0.01	27.4
2003-04	0.03	3.32	7.97	2.68	7.61	0.85	0.23	0.97	0	0	0	0.1	23.76
2004-05	2.37	2.06	7.19	5.13	2.63	2.11	1.29	3.63	0.86	0	0	0.01	27.28
2005-06	0.33	5.07	7.68	4.26	2.44	5.11	4.4	0.62	0.34	0	0.01	0	30.26
2006-07	0.1	1.88	3.92	0	4.47	0.54	1.18	0.49	0.15	0.86	0	0.36	13.95
2007-08	1.11	0.35	2.77	7.04	2.12	0.07	0.11	0.26	0	0	0	0	13.83
Average	**1.35**	**2.97**	**3.92**	**4.45**	**3.68**	**2.92**	**1.62**	**1.06**	**0.45**	**0.07**	**0.13**	**0.47**	**23.45**

Table 2

Demonstration of Water Available

Application to Appropriate Water by Brian Lowell
"Average" Water Year

		POD
Tributary Drainage Area, 'A' (acres)[1]		40
Approximate mean annual precipitation for area tributary to POD (inches)[2]		23.5
Approximate mean annual precipitation at Red Bluff gage = 23.5 inches[3]		
Monthly precipitation at Red Bluff gage during diversion season 'I' (inches)[3]		
	November	2.97
	December	3.92
	January	4.45
	February	3.68
	March	2.92
	April	1.62
Runoff Coefficient, 'C'		0.55
Total discharge at POD, 'Q' (acre-feet) (Q = C x I x A)		
	November	5.4
	December	7.2
	January	8.2
	February	6.7
	March	5.4
	April	3.0
	Total	35.9
Total discharge tributary to POD (acre-feet)		36
Total diversion for project (acre-feet)[4]		24
Project diversion as percentage of total discharge		66.92%

NOTES:

1. The watershed tributary to the POD was delineated on digital USGS 7.5 minute quad maps, with watershed areas determined using AutoCad.
2. The mean annual precipitation of the watershed is estimated based on the isohyetal contours obtained from the map titled "Mean Annual Precipitation in the California Region" compiled by S.E. Rantz, dated 1969 and reprinted in 1972.
3. See Table 1 for calculation of mean monthly and annual precipitation at the Red Bluff gage.
4. Assumes evaporation and domestic use of 24 acre-feet per year.

Table 3

Demonstration of Water Available

Application to Appropriate Water by Brian Lowell
Below Average Water Year

		POD
Tributary Drainage Area, 'A' (acres)[1]		40
Approximate mean annual precipitation for area tributary to POD (inches)[2]		23.5
Approximate mean annual precipitation at Red Bluff gage = 23.5 inches[3]		
Monthly precipitation at Red Bluff gage during diversion season 'I' (inches)[3] (Below average water year assumed as 70% of average monthly precipitation)		
	November	2.08
	December	2.79
	January	3.12
	February	2.57
	March	2.05
	April	1.13
Runoff Coefficient, 'C'		0.55
Total discharge at POD, 'Q' (acre-feet) (Q = C x I x A)		
	November	3.8
	December	5.1
	January	5.7
	February	4.7
	March	3.8
	April	2.1
	Total	25.2
Total discharge tributary to POD (acre-feet)		25
Total diversion for project (acre-feet)[4]		24
Project diversion as percentage of total discharge		95.28%

NOTES:

1. The watershed tributary to the POD was delineated on digital USGS 7.5 minute quad maps, with watershed areas determined using AutoCad.
2. The mean annual precipitation of the watershed is calculated based on the isohyetal contours obtained from the map titled "Mean Annual Precipitation in the California Region" compiled by S.E. Rantz, dated 1969 and reprinted in 1972.
3. See Table 1 for calculation of mean monthly and annual precipitation at the Red Bluff gage.
4. Assumes evaporation and domestic use of 24 acre-feet per year.

Table 4

Calculation of Runoff Coefficient for

Watershed Tributary to

USGS Gaging Station No. 1137580 "South Fork Cottonwood Creek Near Cottonwood"

	Gage
Tributary Drainage Area, 'A' (acres)[1]	173,400
Approximate mean annual precipitation at Red Bluff gage = 2 feet[2]	2.0
Average Annual Unimpaired Flow as Measured at Gage 'Q' (acre-feet)[1]	160,100
Runoff Coefficient, 'C' (C = Q / A x P)	0.46

NOTES:

1. Based on information provided in Water Resources Data for California, Volume 4 published in 1979 by USGS.
2. See Table 1 for calculation of mean annual precipitation at the Red Bluff gage.

Table 5

Calculation of Estimated Flow in Cottonwood Creek

Immediately Below the Confluence of the Unnamed Stream and Cottonwood Creek

	POI
Tributary Drainage Area, 'A' (acres)[1]	83,200
Approximate mean annual precipitation at Red Bluff gage = 23.5 inches[2]	23.5
Runoff Coefficient, 'C' [3]	0.46
Total discharge at POI, 'Q' (acre-feet) (Q = C x I x A)	75,218

NOTES:

1. The watershed tributary to the POI was delineated on digital USGS 7.5 minute quad maps, with watershed areas determined using AutoCad.
2. See Table 1 for calculation of mean annual precipitation at the Red Bluff gage.
3. See Table 4 for calculation of runnoff coefficient. Gage data used to calculate coefficient is approximately 12 miles downstream from confluence of Cottonwood Creek and the Unnamed Stream. Watershed tributary to the Gage encompasses the watershed tributary to the point of interest.

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MAP REQUIREMENTS

See attached Engineer's Map