CO 20.00.10

BA/WTR

Mail Stop 60189

MAY 2 3 1996

Initial	Date
MEJ	5/23/96
Ca	5-23

Memorandum

To: Refuge Operations Specialist, Arapaho National Wildlife Refuge

From: Refuge Hydrologist, Division of Water Resources

Subject: Net Depletion Determination for Hankin Wetland Development Project

I utilized the SCS Technical Release 21 (TR 21), Irrigation Water Requirements to analyze the net depletion that would occur as a result of the proposed project. I also utilized temperature and precipitation data from the Steamboat Springs weather station, and evaporation data from Grand Lake (closest site at a similar elevation, with evaporation data for May through October). The analysis and the data used are attached.

Using this method, the consumptive use of the predevelopment subirrigated meadow, assuming water use would be similar to subirrigated alfalfa, is 2.78 acre-feet per year. The predicted consumptive use of the wetland, assuming 50% open water and 50% emergent wetland vegetation, will be 3.08 acre-feet per year. The difference will be 0.30 acre-feet per year.

If you have any questions, or require additional information, please call me at (303)236-5322, x232.

/s/ MEGAN ESTEP-JOHNSTON

Attachments

cc: Bill Noonan, FWS Ecological Services, Golden, CO

bcc: WR rf
RO rf

WTR:MEJohnston:ca:5/23/96

Table 1. **Predevelopment** Consumptive use analysis using SCS Blaney-Criddle Method
Source : SCS Technical Release No. 21

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12
	Steamboat Mean Temp (F) (t)	0.5 Latitud Daylight Hours % (p)	Cons use Factor (t*p/100) (f)	Climate Coeff Tab 4 (kt)	Growth Coeff Alfalfa Curve No. 2 (kc)	Cons use Coeff (kt*kc) (k)	Monthly Cons use inches (f*k=u) (u)	Recorded Precip inches	Computed Effective Prec (in) Fig 3. (Re)	Net Cons use (C7 -C9) or 0 inches	Pre-Development acres	Computed Con Use ac-ft
January	***14.68***	***6.72***	0.99	***0.30***	***0.00***	0.00	0.00	***2.42***	1.34	0.00	***2.30***	0.00
February	***18.87***	***6.70***	1.26	***0.30***	***0.00***	0.00	0.00	***2.26***	1.39	0.00	***2.30***	0.00
March	***27.59***	***8.32***	2.30	***0.30***	***0.00***	0.00	0.00	***2.20***	1.39	0.00	***2.30***	0.00
April	***38.67***	***8.95***	3.46	***0.35***	***0.00***	0.00	0.00	***2.27***	1.39	0.00	***2.30***	0.00
May	***53.22***	***10.04***	5.34	***0.60***	***1.08***	0.65	3.46	***2.06***	1.41	2.05	***2.30***	0.39
June	***55.37***	***10.13***	5.61	***0.65***	***1.13***	0.73	4.12	***1.49***	1.09	3.03	***2.30***	0.58
July	***61.53***	***10.26***	6.31	***0.75***	***1.11***	0.83	5.26	***1.57***	1.24	4.02	***2.30***	0.77
August	***62.38***	***9.57***	5.97	***0.77***	***1.06***	0.82	4.87	***1.59***	1.22	3.65	***2.30***	0.70
September	***55.09***	***8.39***	4.62	***0.64***	***0.99***	0.63	2.93	***1.68***	1.15	1.78	***2.30***	0.34
October	***42.04***	***7.74***	3.25	***0.41***	***0.91***	0.37	1.21	***1.92***	1.22	0.00	***2.30***	0.00
November	***28.55***	***6.71***	1.92	***0.30***	***0.78***	0.23	0.45	***1.94***	1.23	0.00	***2.30***	0.00
December	***16.89***	***6.51***	1.10	***0.30***	***0.00***	0.00	0.00	***2.46***	1.48	0.00	***2.30***	0.00
Means	39.57	8.34					1.86	1.99	1.30			
Total							22.30	23.86	15.55	14.53		2.78

'Predevelopment Consumptive Use = 2.78 Acre-Feet

'Postdevelopment Consumptive Use = 3.08 Acre-Feet

Difference 0.30 Acre-Feet

Data that is bold and italicized is data that should change for new sites, other data are results based on calculations using italicized data.

Table 2. **Postdevelopment** Consumptive use analysis using SCS Blaney-Criddle Method
Source : SCS Technical Release No. 21

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14	Column 15	Column 16	Column 17	Column 18
	Steamboat Mean Temp (F) (t)	0.5 Latitud Daylight Hours % (p)	Cons use Factor (t*p/100) (f)	Climate Coeff Tab 4 (kt)	Growth Coeff Alfalfa Curve No. 2 (kc)	Cons use Coeff (kt*kc) (k)	Monthly Cons use inches (f*k=u) (u)	Recorded Precip inches	Computed Effective Prec (in) Fig 3. (Re)	Net Cons use (C7 -C9) inches	Post-Development Vegetated acres	Computed Con Use ac-ft	Average Pan A Evap inches (Grand lake)	Average FWS Evap inches (C 13 x 0.7)	Average Precip inches	Net Evap inches (C 14 - C 15)	FWS Acerage acres	FWS Gross Cons Use ac-ft
January	***14.68***	***6.72***	0.99	***0.30***	***0.00***	0.00	0.00	***2.42***	1.34	0.00	***1.15***	0.00	***0***	0.00	***2.42***	0.00	***1.15***	0.00
February	***18.87***	***6.70***	1.26	***0.30***	***0.00***	0.00	0.00	***2.26***	1.39	0.00	***1.15***	0.00	***0***	0.00	***2.26***	0.00	***1.15***	0.00
March	***27.59***	***8.32***	2.30	***0.30***	***0.00***	0.00	0.00	***2.20***	1.39	0.00	***1.15***	0.00	***0***	0.00	***2.20***	0.00	***1.15***	0.00
April	***38.67***	***8.95***	3.46	***0.35***	***0.00***	0.00	0.00	***2.27***	1.39	0.00	***1.15***	0.00	***0***	0.00	***2.27***	0.00	***1.15***	0.00
May	***53.22***	***10.04***	5.34	***0.60***	***1.08***	0.65	3.46	***2.06***	1.41	2.05	***1.15***	0.20	***7***	4.90	***2.06***	2.84	***1.15***	0.27
June	***55.37***	***10.13***	5.61	***0.65***	***1.13***	0.73	4.12	***1.49***	1.09	3.03	***1.15***	0.29	***8.3***	5.81	***1.49***	4.32	***1.15***	0.41
July	***61.53***	***10.26***	6.31	***0.75***	***1.11***	0.83	5.26	***1.57***	1.24	4.02	***1.15***	0.38	***8.33***	5.83	***1.57***	4.26	***1.15***	0.41
August	***62.38***	***9.57***	5.97	***0.77***	***1.06***	0.82	4.87	***1.59***	1.22	3.65	***1.15***	0.35	***7***	4.90	***1.59***	3.31	***1.15***	0.32
September	***55.09***	***8.39***	4.62	***0.64***	***0.99***	0.63	2.93	***1.68***	1.15	1.78	***1.15***	0.17	***5.65***	3.96	***1.68***	2.28	***1.15***	0.22
October	***42.04***	***7.74***	3.25	***0.41***	***0.91***	0.37	1.21	***1.92***	1.22	0.00	***1.15***	0.00	***3.67***	2.57	***1.92***	0.65	***1.15***	0.06
November	***28.55***	***6.71***	1.92	***0.30***	***0.78***	0.23	0.45	***1.94***	1.23	0.00	***1.15***	0.00	***0***	0.00	***1.94***	0.00	***1.15***	0.00
December	***16.89***	***6.51***	1.10	***0.30***	***0.00***	0.00	0.00	***2.46***	1.48	0.00	***1.15***	0.00	***0***	0.00	***2.46***	0.00	***1.15***	0.00
Means	39.57	8.34					1.86	1.99	1.30						1.99			
Total							22.30	23.86	15.55	14.53		1.39	39.95	27.97	23.86	17.66		1.69

Data that is bold and italicized is data that should change for new sites, other data are results based on calculations using italicized data.

Total = 3.08 ac-ft

Station: **STEAMBOAT SPRINGS**
Parameter: Precipitation
Year: 1908-1994
State: COLORADO
County: ROUTT

ID: 7936
Statistic: (None)
Latitude: 40:29:00
Longitude: 106:50:00
Elevation: 6760.00

Monthly Statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
# Days	2593	2367	2622	2545	2616	2535	2623	2624	2565	2624	2466	2625
Avg Day	.079	.079	.071	.076	.067	.05	.051	.051	.056	.062	.066	.08
# Months	84	84	85	85	85	84	85	85	85	85	82	85
SDev Month	1.24	.949	.947	.981	1.02	1.03	.86	.879	1.2	1.1	.992	1.32
Min Month	.43	.3	.49	.6	.07	.00000007	.14	.17	.07	0	.14	.63
Max Month	5.8	5.13	5.93	5.13	5.42	4.31	4.98	5.36	8.15	5.97	5.59	7.26
Avg Month	2.42	2.26	2.2	2.27	2.06	1.49	1.57	1.59	1.68	1.92	1.94	2.46
Skew Month	.532	.789	.838	.545	.811	.703	.952	1.06	2.27	.746	1.13	1.35
Kurt Month	2.41	3.36	4.36	2.79	3.93	2.65	4.55	5.36	11.58	3.91	5.11	5.06
M Min Year	1919	1935	1910	1966	1948	1919	1971	1944	1953	1933	1914	1979
M Max Year	1980	1936	1929	1920	1981	1945	1912	1914	1961	1908	1985	1951
Exceedences	0	0	0	0	0	0	0	0	0	0	0	0
1%	.681	.81	.6	.77	.748	.7	.738	.648	.7	.818	.7	.72
5%	.37	.38	.38	.42	.382	.32	.32	.32	.34	.418	.397	.4
10%	.25	.27	.25	.28	.24	.16	.16	.18	.205	.22	.24	.26
20%	.14	.146	.12	.12	.1	.04	.05	.06	.06	.05	.1	.14
50%	0	0	0	0	0	0	0	0	0	0	0	0
80%	0	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	0	0	0	0	0	0	0	0	0	0
95%	0	0	0	0	0	0	0	0	0	0	0	0
99%	0	0	0	0	0	0	0	0	0	0	0	0

Station: **STEAMBOAT SPRINGS**
Parameter: Maximum Temperature
Year: 1908-1994
State: COLORADO
County: ROUTT

ID: 7936
Statistic: (None)
Latitude: 40:29:00
Longitude: 106:50:00
Elevation: 6760.00

Monthly Statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
# Days	2531	2336	2621	2541	2576	2500	2592	2553	2518	2628	2460	2593
Avg Day	28.76	34	41.89	53.23	65.01	75.23	82.02	80.04	72.31	60.18	43.12	30.66
# Months	82	83	85	85	84	83	84	83	83	85	82	84
SDev Month	3.76	4.07	4.03	4.97	3.53	3.44	2.46	2.75	3.57	4.47	5.35	4.74
Min Month	20.19	23.75	31.23	39.53	56.52	67.67	76.9	71.03	61.4	49.39	31.27	19.23
Max Month	42.77	44	52.71	62.9	74.52	82.53	88.06	84.97	77.87	69.26	55.47	45.74
Avg Month	28.77	33.91	41.89	53.24	65.01	75.22	82	80.05	72.24	60.17	43.14	30.66
Skew Month	.462	-.131	-.095	-.128	.097	.027	.13	-.708	-.714	-.413	.149	.399
Kurt Month	4.18	2.68	3.39	2.54	2.53	2.24	2.3	3.78	3.02	2.86	2.43	3.57
M Min Year	1979	1923	1923	1920	1917	1945	1912	1927	1961	1969	1929	1927
M Max Year	1981	1934	1910	1987	1934	1988	1934	1934	1979	1950	1939	1939
Exceedences	0	0	0	0	0	0	0	0	0	0	0	0
1%	47	52	60	74	81	89	93	91	87	78	65	53
5%	43	47	55	70	78	86	90	89	84	75	62	45
10%	40	45	52	67	76	85	88	87	82	73	58	42
20%	36	41	49	63	73	82	86	85	79	70	53	38
50%	30	35	42	54	67	77	82	80	74	62	43	31
80%	22	27	35	44	57	69	78	75	66	51	34	23
90%	17	23	31	40	52	64	75	72	60	44	29	19
95%	13	20	28	36	48	60	73	70	56	40	26	15
99%	5	10	20	32	41	52	68	64.53	45.18	34	18.6	6

Station: **STEAMBOAT SPRINGS**
Parameter: Minimum Temperature
Year: 1908-1994
State: COLORADO
County: ROUTT

ID: 7936
Statistic: (None)
Latitude: 40:29:00
Longitude: 106:50:00
Elevation: 6760.00

Monthly Statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
# Days	2595	2368	2655	2570	2610	2531	2624	2619	2564	2626	2430	2558
Avg Day	.583	3.87	13.3	24.1	31.28	35.53	41.07	39.79	32.31	23.92	13.92	3.12
# Months	84	84	86	86	85	84	85	85	85	85	81	83
SDev Month	5.4	5.13	4.84	2.7	2.18	2.13	1.99	2.65	2.55	2.53	4.18	5.07
Min Month	-12.93	-8.93	1.65	18.07	26.26	30.8	36.81	33.81	26.57	18.83	3.77	-10.13
Max Month	12.06	15.25	23.26	29.57	41.42	42.83	46.19	44.61	38	30.35	21.9	15.68
Avg Month	.584	3.83	13.29	24.1	31.28	35.52	41.07	39.78	32.3	23.92	13.96	3.11
Skew Month	-.031	-.045	-.339	-.07	1.23	.266	.084	-.284	.11	-.012	-.3	-.00225
Kurt Month	2.54	2.74	2.66	2.23	7.27	3.72	2.69	2.32	2.33	2.38	2.47	2.83
M Min Year	1930	1923	1917	1917	1916	1950	1924	1924	1912	1919	1956	1928
M Max Year	1981	1986	1992	1989	1914	1988	1989	1983	1939	1972	1913	1980
Exceedences	0	0	0	0	0	0	0	0	0	0	0	0
1%	30	30	33	38	46	50	54	54	50	42	34	31
5%	24	27	30	35	40	45	51	51	45	37	30	26
10%	20	23	27	33	38	43	49	48	42	33	27	21
20%	14	18	24	30	35	40	46	45	38	30	23	16
50%	1	5	15	25	31	35	41	40	32	24	15	3
80%	-13	-9	3	19	27	31	36	35	26	18	5	-9
90%	-19	-15	-3	14	25	29	34	32	23	15	-1	-16
95%	-24	-21	-9	11	22	27	32	30	21	13	-6	-21
99%	-34	-29	-20	3	18	24	30	26	17	6	-17	-28