United States Department of the Interior
FISH AND WILDLIFE SERVICE

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

IN REPLY REFER TO:

WR-BNL-PMG

JAN 14 1985

MEMORANDUM

To: Project Leader, Benton Lake NWR

From: Refuge Supervisor, MT & WY

Subject: Water Management Plan for 1985

I've just read your Water Use/Management Plan. Very good job. Engineering should be responding to your water rights questions/issues.

Your plan for 1985 looks good. If you do not already have a plan for monitoring salinity levels, you should prepare one by spring. Such an evaluation scheme should be based on your discussions with staff at NPWRC.

Daniel W. Schranck

United States Department of the Interior
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IN REPLY REFER TO:

FR/EN
WR MT
MAIL STOP 60190

APR 16 1986

MEMORANDUM

To: ARD-Wildlife Resources, (60130)
Attn: Schranck

From: Regional Hydrologist, Engineering, Region 6

Subject: Annual Water Use Report
Benton Lake NWR & WMD

In response to our request of April 7, 1986, the subject 1985 water use reports have been reviewed and found to be in order. No further information will be required for the Wetland Management District.

Please extend our thanks to refuge personnel for their cooperation in this matter, and thank you for all your assistance.

1985 WATER USE REPORT

BENTON LAKE NATIONAL WILDLIFE REFUGE

Great Falls, Montana

I. Water Rights and Water Use

Table I is a compiled summary of water rights and use for the Benton Lake Refuge.

Table II is a compilation summary of water rights and use for the Wetland Management District.

Table III is a compiled record of water level gauge readings on the six marsh impoundments at Benton Lake.

II. Narrative Discussion

A. Benton Lake

B. Wetland Management District

TABLE 1. WATER RIGHTS AND USE AT BENTON LAKE NWR

REFUGE WATER RIGHTS						1985 WATER USE			
Source	Point of Diversion Map	Means of Diversion	Flow Rate	Claimed Volume	Use	Type	Place	Amount	Period
Headquarters well	J	Pump	45 gpm	2 AF	Domestic	Fire Protection	Headquarters	None	Annual
Diffuse runoff	A	Dam	Natural	135 AF	F & W	Marsh	Unit III	+	Annual
Lake Creek runoff	B	Dam	500 cfs	14,000 AF	F & W	Marsh	Units I-VI	1067	Annual
Diffuse runoff	C	Dam	Natural	392 AF	F & W	Marsh	Unit IVa	58	Annual
Diffuse runoff	D	Dam	Natural	23 AF	F & W	Marsh	Unit IVa	+	Annual
Other diffuse runoff	E,F,G	Dam	Natural	176 AF	F & W	Marsh	Unit IV	27	Annual
Other diffuse runoff	H,I	Dam	Natural	303 AF	F & W	Marsh	Unit VI	5	Annual
Muddy Creek (Irrigation flows)	K	Pump - 3x 16.6 cfs	50 cfs	14,600 AF	F & W	Marsh	Units I - VI	6380	Annual
TOTAL				29,641 AF				7537 AF	

+ runoff received but not measured

TABLE 11: WATER RIGHTS AND USE BY BENTON - WETLAND MANAGEMENT DISTRICT

Source	WATER RIGHTS: Point of Diversion Map	Means of Diversion	Flow Rate	Claimed Volume	Use	WATER USE 1985: Type	Place	Amount Acre Ft.	Period
Furnell WPA									
Trail Creek (s)	SE¼NE¼SW¼ Sec. 22	Headgate	2 cfs	480 AF	F & W	Wetlands Grasslands	Furnell WPA	NC	Annual
Kingsbury Lake WPA									
Stock Dam #1 (s)		Dam	Natural flow	1 AF	F & W	Pond	NE¼NW¼NW¼, Sec. 21	.5	Annual
Stock Dam #2 (s)		Dam	Natural flow	2.5 AF	F & W	Pond	SE¼SW¼SE¼, Sec. 16	.5	Annual
Stock Dam #3 (s)		Dam	Natural flow	2.5 AF	F & W	Pond	NE¼NW¼SW¼ Sec. 21	0	Annual
Unnamed coulee or dry runs (s)	011806	Dam	18 cfs	6.4 AF	F & W	Pond	SW¼NE¼NW¼ Sec. 28	.5	Annual
" (s)	011807	Dam	12 cfs	6.4 AF	F & W	Pond	SE¼SE¼SW¼ Sec. 8	.25	Annual
" (s)	011808	Dam	6 cfs	6.4 AF	F & W	Pond	W½NE¼. Sec. 17	3	Annual
" (s)	011809	Dam	24 cfs	6.4 AF	F & W	Pond	SW¼NW¼NW¼ Sec. 21	2	Annual
" (s)	011811	Dam	3 cfs	6.4 AF	F & W	Pond	SW¼SW¼NW¼, Sec. 20	.25	Annual
Alder Creek (s)	011810	Direct use	12 cfs.	3.25 AF	F & W	Lake	Sec. 19., T 21 N., R. 11 E.	450	Annual
Well, 5" casing	011812	Windmill & tank - non-functional	.50 gpm	3.5 AF	F & W	Tank	NE¼NW¼NW¼, Sec. 21	0	Annual

TABLE III: RECORDED MARSH UNIT ELEVATIONS FOR 1985

BENTON LAKE NATIONAL WILDLIFE REFUGE

Date	Flooding	UNIT I		UNIT II		UNIT III		UNIT IV		UNIT V		UNIT VI	
		Elev. 3621.0	Sal.*	Elev. 3615.0	Sal.*	Elev. 3613.0	Sal.*	Elev. 3613.0	Sal.*	Elev. 3613.0	Sal.*	Elev. 3613.0	Sal.*
11/15/84		3624.6		3621.1		3616.3		3614.95		3614.55		3615.9	
01/01/85		3624.6		3621.1		3616.3		3615.00		3614.55		3615.9	
01/15/85		3624.6		3621.1		3616.3		3615.00		3614.55		3615.9	
02/01/85		3624.6		3621.1		3616.3		3615.00		3614.55		3615.9	
02/15/85		3624.6		3621.1		3616.3		3615.00		3614.55		3615.9	
03/01/85		3624.6		3621.1		3616.3		3615.00		3614.55		3615.9	
03/15/85		3624.65		3621.1		3616.57		3615.17		3614.55		3616.1	2500
04/01/85	04/04/85	3625.6		3621.8		3616.3		3615.0		3614.5		3616.1	
04/15/85		3625.5		3621.3		3615.7		3614.8		3615.5		3616.0	
05/01/85		3625.1		3621.0		3615.0		3615.0		3615.4		3615.7	
05/15/85		3624.8	1400	3620.6		3615.1	2100	3614.7	5300	3615.1	2800	3615.5	4600
06/01/85		3625.4		3620.5		3615.2		3614.7		3615.2		3615.5	
06/15/85		3625.3	1250	3620.8	1200	3615.1	2200	3615.1	4000	3615.4		3616.0	
07/01/85		3625.4		3620.8		3615.0		3614.6		3615.2		3615.7	
07/15/85		3625.4		3621.0		3614.9		3614.4		3615.2		3615.5	
08/01/85		3625.7	650	3620.0	1200	3614.95	900	3614.75	1800	3615.0		3615.75	
08/15/85		3625.65		3620.35		3615.5		3614.2		3614.95		3616.7	
09/01/85		3625.6		3621.5		3615.0		3614.2		3615.35		3617.9	
09/15/85	Free	3625.8		3621.8		3615.25		3614.3		3616.8	1100	3617.9	
10/01/85		3625.9	1400	3621.6	850	3615.15	5200	3614.35		3617.0		3617.85	1400
10/15/85		3626.0		3621.6		3615.15		3614.35		3617.0		3617.8	
11/01/85	11/09/85	3626.0		3621.6		3615.15		3614.35		3617.0		3617.7	
11/15/85		3626.0		3621.6		3615.15		3614.35		3617.0		3617.65	
12/01/85		3626.0		3621.6		3615.15		3614.45		3617.0		3617.6	
12/15/85		3626.0		3621.6		3615.25		3614.55		3617.0		3617.6	
12/31/85		3626.0		3621.65		3625.35		3614.65		3617.05		3617.65	
Maximum Elevation		3627.0		3622.0		3618.0		3618.0		3618.0		3618.0	
General Pool Bottom		3623.0		3619.0		3615.0		3615.0		3615.0		3615.0	

Salinity is measured in micromhos/centimeter

II. Narrative Discussion

Weather conditions in early 1985 are characterized as being cold and dry with little snow cover. Spring thaw began with ice going out of the Missouri River on March 14 - 15. The meager snow melt and runoff were over with by March 25. Strong chinook winds took the remaining ice off lakes and marshes by April 4. The usual rainy season in May and June didn't occur until August and September. Soil moisture then built up and some local runoff occurred in September and October. A cold, moist early fall proceeded with marsh units briefly freezing over on October 6th. Below-zero temperatures the first week of November sealed all the marshes and most of the local rivers soon froze over, sending most migratory birds south earlier than usual.

A. Benton Lake Refuge

The 1985 runoff did little to relieve water shortages at the refuge. The amounts received by unit and month are recorded on Table IV. Runoff in the fall is unusual for Benton Lake, but hopefully the drought is over. Saturated soils and an early freezing of soils should promote more runoff next spring.

Measurements of water rights and use at Benton Lake are dependent on individual marsh unit water level gauge readings and associated field observations as no other recording instruments are in place. The accuracy of these projections is somewhat limited. Volume of water pumped from the Muddy Creek pumping station is calculated by multiplying pump hours by the rated capacity of the pumps. Runoff events occurring over long time periods or during periods of high evaporation complicate evaluation of such measurements. Runoff occurring during periods of pumping also becomes difficult to separate or measure.

Table V provides a projection of water consumed by evaporation at Benton Lake in 1985 (~~1607~~ 6407 acre feet). This is based on long term average evaporation rate for this area of 2.5 feet for the April to October period, and the average surface acres flooded in the various units by month.

TABLE IV; RUNOFF WATER RECEIVED 1985

Time	UNITS I	II	III	IVa	IV	V	VI	TOTALS
Carry over	+ 14	0	0	0	0	0	0	14
January	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0
March 14-26	+ 297	+ 335	+	+	+ 27	0	+	659
April	+	0	0	0	0	0	0	+
May	+	0	0	58	0	0	5	63
June	0	0	0	+	0	0	0	+
Sept. 18-21	48	188	+	+	0	0	0	236
Oct. 10-14	185	+	+	+	0	0	0	185
Totals	544	523	+	58	27	0	5	1157

cumulation during freeze-up winter period 11/15-85 - 02/11/85

...dicates observed runoff but too small to register on unit level gauges

WATER RIGHTS:

A.	Unit III basin (runoff from north)	+
B.	Lake Creek runoff (Units I, II, plus	1067
C.	Unit IVa (main watershed)	58
D.	Unit IVa (south watershed)	t
EFG.	Unit IV (basin runoff)	27
HI.	Unit VI (basin runoff)	5
Sub-total		1157
...t V (...)		0
Total		1157 Acre Feet

TABLE V: AVERAGE SURFACE ACRES - 1985

	I	II	III	IVa	IV	V	VI	TOTAL
April	343	439	640	299	530	376	604	3231
May	310	284	378	136	391	187	481	2167
June	345	329	343	54	346	358	534	2309
July	345	304	233	6	219	214	544	1865
Aug.	352	314	335	11	120	247	755	2134
Sept	353	521	431	28	121	773	804	3036
Oct.	375	505	427	115	143	833	804	3202
Total	2428	2696	2787	649	1870	2988	4526	17944
Ave. SA	347	385	398	93	267	427	646	2563
Evap. (2.5)	867	963	995	232	668	1067	1615	6407

Delivery of water from the Muddy Creek pumping station was delayed first by our contractor who was behind schedule on structure replacement in Lake Creek. Pumping began on May 27th but then inadequate supplies in Muddy Creek shut down one of our pumps until early July. Repairs on the new structure (#29) in Lake Creek, pipeline gate valve and pumphouse roof repairs also shut down pumping operations for a few days in June and July. The No. 3 pump had to be sent back to Salt Lake City for a redo on the 1984 overhaul job.

Finally in August there was adequate water supply and we were able to operate all three pumps, bringing water back up to target levels in the units. Table VI shows the distribution made of this 6380 acre feet of pumped supply. Table VII shows the redistribution of some 1717 acre feet of water among the units, primarily done to dewater Unit III and reflood Unit V. A considerable amount of this water was taken up by the dry soils in V. Table VIII shows the operational data summary for the Muddy Creek pumping station. Table IX shows water balances for each unit for the year. The refuge marsh units had a net gain of 2094 acre feet of water and will go into 1986 with considerably improved water habitat conditions.

The inter-unit pumping system was not operated this year.

TABLE VI: PUMPED WATER DISTRIBTION "P" (Acre Feet)

	total	UNITS I	II	III	IVa	IVc	V	VI	Comments
pril	0	0	0	0	0	0	0	0	
ay	233	208	25	0	0	0	0	0	Refill canal system
une	1260	76	163	0	0	290	320	411	Evaporative losses
uly	1020	153	147	0	20	200	250	250	Evaporative losses
ug.	2432	173	468	0	0	74	140	1577	Evaporative losses reduced by rainfall
ept.	1435	65	110	0	5	0	1255	0	Evaporation offset by rain/runoff
OTAL	6380	675	913	0	25	564	1965	2238	

TABLE VII: WATER TRANSFER BETWEEN UNITS "T" ± (Acre Feet)

onth	UNITS I	II	CANAL	III	IV	V	VI	Comments
ar.								
03/26			- 30				+ 30	Lowered canal to dewater Unit III
03/29-04/01				- 48			+ 48	Dewater III
il.								
04/01-09				-717		+717		Soils absorbed all but 81 AF - Dewater III
04/09-16		-359				+359		Remove excess from II, recharge V
04/16-22	-46	+ 46						Remove excess from I, recharge II
04/17-26				-128	+128			Dewater III by gravity
ay								
05/01-10		-103	+103					Refill canal
ne								
ly								
06/16-22		-286					+286	Drop levels in II due to botulism in backwaters
)	46	748	30	893				1717
TALS)		46	103		128	1076	364	1717

TABLE VIII: ANNUAL WATER PUMPING REPORT - 1985

A. PUMPING DATA	MAY	Jun	Jul	Aug	Sept.	
1. Hours Operated						
Pump No. 1	95	593	570	686	304	2248.8
Pump No. 2	72	321	170	686	360	1609.9
Pump No. 3	2	0	0	390	376.1	767.6
Total	169	914	740	1763	1040	4626.3
A.F.	233	1260	1020	2432	1435	

2. Acre feet pumped (hr. x 1.379 AF)	6380 AF
3. Kilowatt hours used	1,304,640
4. Costs	$38,260.36

B. WATER QUANTITY DATA

1. Acre feet on hand (beginning)	2844 AF
2. Acre feet received	7537 AF
3. Acre feet account	10421 AF
4. Acre feet on hand (close)	4978 AF
5. Acre feet consumed (check)	5443 AF
6. Acre feet consumed (actual)	6407
7. Acre feet difference	964
8. Cost/acre foot	$5.99/AF

TABLE IX: 1985 WATER BALANCES

WATER MANAGEMENT WORKSHEET — ALL UNITS — CALENDAR YEAR 1985

Unit	Elevations		Surface Acres		Acre Feet Contained		Acre Feet Received	Acre Feet Discharged	Acre Feet Consumed
	Begin	End	Beginning	End	Beginning	End			
	11/15/85	12/03/85							
I	3624.6	3626,0	280	[illegible]	442	898	1219		763
II	3621.1	3621.65	402	506	583	782	1436		1237
III	3616.3	3615.35	973	566	1005	212	+		793
IVa	3616.8	3616.0	282	15	191	29	83		245
IVb	-	-	-	-	-	-	-		-
IVc	3614.95	3614.65	543	281	234	109	591		716
V	3614.55	3617.05	-	835	-	1271	1965		694
VI	3615.9	3617.65	597	891	429	1677	2243		995
Totals			3077	3567	2884	4978	7537		5443
				+ 490 Surface Acres		+ 2094 Acre Feet			

B. Wetland Management District

This, the third drought year in a row, water conditions were poor throughout the district. A majority of the WPA's were dry most of the year. No water rights were exercised on Furnell WPA due to lack of runoff. The Kingsbury Lake (WPA) was all but dry. Most of the perimeter stock ponds did receive spring runoff and were full or nearly so in May when the duck nest drag crew searched the area for nests. The telemetry study on this WPA had to be re-programmed to a new study on Benton Lake due to lack of nesting birds, thought to be directly related to lack of permanent water. Alder Creek was flowing about 4 cfs on May 6, 1985.

Two additional stock ponds on the southwest side of Kingsbury Lake were filed on for water rights by regional engineering personnel.