SUGGESTED ALLOCATIONS
in
CENTRAL DIVISION

and

SUPPLEMENTAL UPSTREAM
STORAGE DATA

Report to

BEAR RIVER COMPACT COMMISSION

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Nov. 1, 1952

At the last Commission meeting held Oct. 15 and 16, the Logan Office of the U. S. Geological Survey was assigned certain studies to be made for presentation to the Commission on Nov. 6th. These studies and the order in which they have been arranged in this report may be summarized as follows:

Part 1. Make a comparative study of Compact deliveries in the Central Division with the following alternative proposals for division of divertible flow:

(a) 43% to Wyoming and 57% to Idaho.

(b) 35% to Wyoming and 65% to Idaho.

(c) Relative priority of rights as determined and listed in Report #16.

Part 2. Study the availability and downstream effect on power and irrigation of upstream storage in the amounts of 30,000 and 36,000 acre-feet. Such study would be limited by the following:

(a) An irrigation reserve in Bear Lake below elevation ~~5,814.50~~ 5,914.50 ft. (787,500 acre-feet).

(b) Storage period from Oct. 1 to Apr. 30.

Part 3. Study the possibility of storage exchange, in a reservoir at Woodruff Narrows, between the users on the Bear River and Francis-Lee Canals and the users in Wyoming above Woodruff Narrows.

Part 4. List the available supplies and requirements for a reservoir at Hilliard Flats in Wyoming.

Part 5. Study the availability and effect of a proposal to store 36,000 acre-feet above Bear Lake of which not to exceed 30,000 acre-feet would be storable from Oct. 1 to Apr. 30, and the balance would be storable after Apr. 30, when the flow of Bear River at Border exceeds 700 cfs.

This report is being divided into five parts to cover the above items.

PART 1

Tabular and graphical analysis of suggested compact deliveries are shown in tables 1 to 7 and Plates 1 to 7, respectively. This analysis is based on the water years 1944, 1946 and 1948, as being representative of the period in which diversion records are available (1944-48). If time had permitted, 1945 and 1947 water years would have been included.

Table 1 is a listing of relative water rights in the Central Division taken from Report #16. It should be noted that the rights have been reduced to a common duty of 1 cfs to each 50 acres.

Tables 2 - 7 show the total divertible flow in the Division, the diversions or divertible flow in each of the two sections, and the corresponding allocations to each section when computed on (1) 57% - 43% (2) 65% - 35% and (3) priority of right schedule. These computations begin the first day each year on which the total divertible flow falls below 810 cfs. and are continued to Sept. 30th. The average flow given at the end of the tables and summarized on the graphs has been computed for this regulation period of each year.

In arriving at the division on a relative priority of rights schedule, the total accumulated rights as given in Table 1 were considered to be essentially the same as the Total Divertible Flow. In this manner the relative rights could be ascertained each day for each section, the total of the sections equalling the Total Divertible Flow each day.

Plate 1 gives a graphical representation of each section's share under the three suggested plans of division.

Plates 2 - 7 give a hydrographic presentation by sections of the data from the foregoing tables. The pattern is fairly consistent for all three years in each section. In general, actual diversions in Lower Wyoming are greater than suggested compact allocations; while the reverse is evident in Upper Idaho.

TABLE 1
TABLE OF RELATIVE RIGHTS - CENTRAL DIVISION

Lower Wyoming rights include those from Bear River below mouth of Smiths Fork, Smiths Fork, Grade Creek, Pine Creek, Sublette Creek, Pine Creek Springs, and Spring Creek, involving a total of 17,830 acres of irrigated lands.

Upper Idaho rights include those from Bear River between Border and Stewart Dam, involving a total of 22,664 acres of irrigated lands as tabulated in "Analysis of Bear River Water Rights, Page 11." Rep 14) See Report #16 Page 8

A duty of water of 1 second foot for each 50 acres of irrigated lands has been used throughout the tabulation.

Year	Lower Wyoming Right	Lower Wyoming Accum. Rights	Revised Upper Idaho Right	Revised Upper Idaho Accum. Rights	Accumulative Rights in Central Division
1870		0	40.00	40	40
1871		0		40	40
1872		0		40	40
1873		0	4.64	45	45
1874		0	40.00	85	85
1875		0		85	85
1876		0		85	85
1877	2.10	2	100.68	185	187
1878	6.08	8	7.92	193	201
1879	.10	8	76.80	270	278
1880		8	6.00	276	284
1881	10.54	19		276	295
1882	13.52	32	18.60	295	327
1883	58.87	91	16.68	311	402
1884	13.38	105	30.74	342	447
1885	24.80	129		342	471
1886	12.34	142		342	484
1887	20.74	162	56.00	398	560
1888	9.38	172		398	570
1889	5.26	177		398	575
1890	1.30	178	3.20	401	579
1891		178	52.00	453	631
1892	4.12	183		453	636
1893	5.50	188		453	641
1894	6.40	194		453	647
1895		194		453	647
1896		194		453	647
1897	12.68	207		453	660
1898	2.38	209		453	662
1899		209		453	662

TABLE 1 (Cont'd.)

Year	Lower Wyoming Right	Lower Wyoming Accum. Rights	Revised Upper Idaho Right	Revised Upper Idaho Accum. Rights	Accumulative Rights in Central Division
1900	2.70	212		453	665
1901	2.80	215		453	668
1902	.68	216		453	669
1903	15.54	231		453	684
1904	8.26	239		453	692
1905	16.00	255		453	708
1906	9.08	265		453	718
1907	9.68	274		453	727
1908	4.06	278		453	731
1909	43.22	322		453	775
1910	5.70	327		453	780
1911	11.17	338		453	791
1912	1.96	340		453	793
1913	2.33	343		453	796
1914		343		453	796
1915	8.04	351		453	804
1916	.68	351		453	804
1917		351		453	804
1918		351		453	804
1919	2.30	354		453	807
1920		354		453	807
1921		354		453	807
1922		354		453	807
1923		354		453	807
1924		354		453	807
1925		354		453	807
1926		354		453	807
1927	1.99	356		453	809
1928		356		453	809
1929		356		453	809
1930		356		453	809
1931		356		453	809
1932		356		453	809
1933		356		453	809
1934		356		453	809
1935		356		453	809
1936		356		453	809
1937	1.64	357		453	810
1938		357		453	810
1939		357		453	810

From Rob' OK 11-23

TABLE 2
LOWER WYOMING - 1944
c.f.s.

Date	Total Divert. Flow	Wyo. Diver.	43% Divert. Flow	35% Divert. Flow	Priority Right
Jul.18	811	366	348	283	357
19	795	371	342	278	342
20	773	378	332	271	320
21	774	371	332	272	321
22	765	360	328	268	312
23	754	344	322	264	301
24	741	333	318	260	288
25	738	324	317	258	285
26	745	316	320	261	292
27	722 762	309 347	310	253	269
28	701	304	302	246	248
29	686	298	295	240	233
30	665	291	286	233	212
31	648	272	278	226	195
Aug. 1	589	247	253	206	178
2	597	241	256	209	178
3	563	233	242	197	165
4	547	226	235	191	162
5	521	218	224	183	160
6	517 603	216 255	222	181	158
7	505	211	217	177	152
8	489	205	210	171	144
9	483	199	207	169	142
10	474	192	204	166	132
11	466	192	200	163	124
12	456	188	196	160	116
13	450	187	193	157	108
14	451	191	194	158	109
15	445	189	191	156	104
16	440 466	192 195	189	154	105
17	418	188	180	146	99
18	410	183	176	143	95
19	405	181	174	142	92
20	403	184	173	141	92
21	400	191	172	140	90
22	409	201	176	143	94
23	406	200	175	142	93
24	394	199	169	138	87
25	388	199	167	136	84
26	380 401	195 192	163	133	69

Date	Total Divert. Flow	Wyo. Diver.	43% Divert. Flow	35% Divert. Flow	Priority Right
Aug.27	372	193	160	131	61
28	360	189	154	126	49
29	359	188	154	126	48
30	356	186	153	124	47
31	358	183	154	125	47
Sep. 1	364	191	156	127	53
2	365	197	157	128	54
3	360	197	154	126	49
4	361	202	151	120	50
5	358 361	201 193	154	120	47
6	351	198	151	123	44
7	343	192	147	120	40
8	333	186	143	116	35
9	339	185	146	119	38
10	333	182	143	116	35
11	326	178	140	114	32
12	324	173	139	113	31
13	327	167	140	114	32
14	326	163	140	114	32
15	323 332	161 178	139	113	30
16	324	161	139	113	31
17	319	160	137	112	29
18	302	142	130	106	22
19	310	136	133	108	26
20	308	145	132	108	25
21	316	151	136	111	29
22	310	147	133	108	26
23	311	146	133	109	27
24	311	145	133	109	27
25	314 312	147 148	135	110	28
26	313	144	134	109	28
27	311	142	133	109	27
28	311	139	133	109	27
29	299	141	128	105	21
30	315 310	142 142	135	110	29
Ave.	452	210	194	158	112

TABLE 3
LOWER WYOMING - 1946

c.f.s.

Date	Total Divert. Flow	Wyo. Diver.	43% Divert. Flow	35% Divert. Flow	Priority Right
Jul. 9	803	360	345	281	350
10	779	346	335	273	326
11	757	344	330	265	304
12	775	353	333	271	322
13	775	345	333	271	322
14	745	333	320	261	292
15	720	329	310	252	267
16	705	329	303	247	252
17	702	329	302	246	249
18	698 746	336 340	300	244	245
19	686	338	295	240	233
20	662	328	284	232	209
21	633	312	272	222	180
22	619	315	266	217	178
23	629	322	270	220	178
24	658	315	283	230	205
25	722	372	310	253	269
26	792	441	341	277	339
27	730	368	314	256	277
28	653 678	265 338	281	229	200
29	623	238	268	218	178
30	618	241	266	216	178
31	609	235	262	213	178
Aug. 1	582	224	250	204	178
2	568	219	244	199	170
3	552	212	237	193	158
4	531	206	228	186	148
5	522	196	224	183	143
6	504	186	216	176	152
7	495 560	182 214	212	173	147
8	478	179	206	167	136
9	492	175	212	172	146
10	468	168	201	164	126
11	460	174	198	161	118
12	456	178	196	160	114
13	458	177	197	160	116
14	454	177	195	159	112
15	441	169	190	154	102
16	424	163	182	148	102
17	407 454	158 172	175	142	93
18	402	160	173	141	91
19	399	164	171	140	89
20	394	162	169	138	87
21	390	163	168	136	85
22	405	172	174	142	93
23	420	185	180	147	100
24	496	206	192	156	105
25	440	203	189	154	102
26	443	203	190	155	103
27	471 436	198 182	202	165	129
28	417	173	179	146	98
29	385	160	166	135	82
30	379	158	163	133	79
31	377	156	162	132	78
Sep. 1	356	133	153	125	47
2	353	124	152	124	45
3	353	121	152	124	45
4	352	118	151	123	45
5	354	112	154	124	46
6	358 368	112 137	154	125	48
7	363	112	156	127	50
8	357	104	153	125	47
9	363	104	156	127	50
10	367	102	158	128	52
11	366	97	157	128	52
12	360	95	155	126	49
13	342	92	147	120	40
14	359	88	154	126	48
15	353	83	152	124	45
16	347 358	85 96	149	121	42
17	350	86	150	122	44
18	337	86	145	118	37
19	341	82	146	119	39
20	353	80	152	124	45
21	346	81	148	121	42
22	343	79	147	120	40
23	342	78	147	120	40
24	330	69	142	116	34
25	333	66	143	117	36
26	340 342	64 77	146	119	39
27	339	64	146	119	38
28	330	59	142	116	34
29	325	57	140	114	31
30	329 331	58 60	141	115	33
Ave.	483	188	208	169	126

TABLE 4
LOWER WYOMING - 1948
c.f.s.

Date	Total Divert. Flow	Wyo. Diver.	43% Divert. Flow	35% Divert. Flow	Priority Right
Jul. 15	786	389	348	275	333
16	775	380	333	271	322
17	760	368	327	266	307
18	746	360	321	261	293
19	716	344	308	251	263
20	745	338	320	261	292
21	736	310	316	258	283
22	679	286	296	238	226
23	681	298	292	238	228
24	669	290	288	234	216
25	655	279	282	229	202
26	609	270	262	213	178
27	609 685	264 304	262	213	178
28	585	259	251	205	178
29	600	269	258	210	178
30	610	280	262	214	178
31	604	275	259	211	178
Aug. 1	598	280	257	209	178
2	587	276	252	205	178
3	559	264	240	196	162
4	555	266	238	194	160
5	556	259	239	195	160
6	542 580	247 268	233	190	153
7	538	248	231	188	151
8	532	247	228	186	148
9	525	245	226	184	145
10	509	245	218	178	154
11	502	239	216	176	151
12	484	234	208	169	142
13	468	228	201	164	126
14	472	235	202	165	130
15	465	232	200	163	123
16	447 494	226 238	192	156	105
17	433	218	186	152	98
18	398	215	168	137	86
19	424	219	182	148	102
20	404	222	~~173~~ 174	141	92
21	405	218	174	142	92
22	403	214	173	141	92
23	408	222	175	143	94
Aug. 24	405	219	174	142	92
25	403	216	173	141	91
26	410 409	220 218	176	144	95
27	391	208	168	137	85
28	360	183	154	126	70
29	361	189	155	126	71
30	360	191	154	126	70
31	367	200	158	128	55
Sep. 1	382	214	164	134	81
2	371	214	159	130	75
3	365	210	157	128	70
4	364	211	156	127	69
5	385 371	213 203	165	135	82
6	379	209	163	133	79
7	368	207	158	129	73
8	356	194	157	125	47
9	339	182	146	119	38
10	364	196	156	127	69
11	347	189	149	121	42
12	349	179	150	122	43
13	352	176	151	123	45
14	349	173	150	122	43
15	347 355	170 188	149	121	42
16	346	168	148	121	42
17	340	167	146	119	39
18	345	160	148	121	45
19	379	165	163	133	79
20	389	166	167	136	84
21	381	160	164	133	80
22	385	164	165	135	82
23	374	152	160	131	77
24	377	161	162	132	78
25	403 372	166 163	173	141	91
26	387	164	166	135	83
27	366	151	157	128	71
28	~~375~~ 377	138	~~161~~ 162	131	77
29	364	135	156	127	69
30	357 370	127 143	153	125	62
Ave.	472	226	203	165	124

TABLE 5
UPPER IDAHO - 1944
c.f.s.

Date	Total Divert. Flow	Idaho Divert. Flow	57% Divert. Flow	65% Divert. Flow	Priority Right	Date	Total Divert. Flow	Idaho Divert. Flow	57% Divert. Flow	65% Divert. Flow	Priority Right
Jul. 19	795	424	453	517	453	Sept. 2	365	168	208	237	311
20	773	395	441	502	453	3	360	163	206	234	311
21	774	403	442	502	453	4	361	159	210	241	311
22	765	405	437	497	453	5	358	157	204	233	311
23	754	410	432	490	453	6	351	153	200	228	307
24	741	408	423	481	453	7	343	152	196	223	303
25	738	414	421	480	453	8	333	147	190	217	298
26	745	429	425	484	453	9	339	154	193	220	301
27	722	413	412	469	453	10	333	151	190	217	298
28	701	397	399	455	453	11	326	148	186	212	294
29	686	388	391	446	453	12	324	151	185	211	293
30	665	374	379	432	453	13	327	160	187	213	295
31	648	376	370	422	453	14	326	163	186	212	294
Aug. 1	589	342	336	383	411	15	323	162	184	210	293
2	597	356	341	388	419	16	324	163	185	211	293
3	563	330	321	366	398	17	319	159	182	207	290
4	547	321	312	356	385	18	302	160	172	196	280
5	521	303	297	338	361	19	310	174	177	202	284
6	517	301	295	336	357	20	308	163	176	200	283
7	505	294	288	328	353	21	316	165	180	205	287
8	489	284	279	318	345	22	310	163	177	202	284
9	483	284	276	314	341	23	311	165	178	202	284
10	474	282	270	308	342	24	311	166	178	202	284
11	466	274	266	303	342	25	314	167	179	204	286
12	456	268	260	296	340	26	313	169	179	204	285
13	450	263	257	293	342	27	311	169	178	202	284
14	451	260	257	293	342	28	311	172	178	202	284
15	445	256	255	289	341	29	299	158	171	194	278
16	440	248	251	286	335	30	315	173	180	205	286
17	418	230	238	272	319						
18	410	227	234	267	315	Average	447	239	256	291	339
19	405	224	231	263	313						
20	403	219	230	262	311						
21	400	209	228	260	310						
22	409	208	233	266	315						
23	406	206	231	264	313						
24	394	195	225	256	307						
25	388	189	221	252	304						
26	380	185	217	247	311						
27	372	179	212	241	311						
28	360	171	206	234	311						
29	359	171	205	233	311						
30	356	170	203	232	309						
31	358	175	204	233	311						
Sep. 1	364	173	208	237	311						

TABLE 6
UPPER IDAHO - 1946
c.f.s.

Date	Total Divert. Flow	Idaho Divert. Flow	57% Divert. Flow	65% Divert. Flow	Priority Right
July 9	803	443	458	522	453
10	779	433	~~464~~ 454	506	453
11	757	413	~~427~~ 431	492	453
12	775	422	442	504	453
13	775	430	442	504	453
14	745	412	425	484	453
15	720	391	410	468	453
16	705	376	402	458	453
17	702	373	400	456	453
18	698	362	398	454	453
19	686	348	~~395~~ 391	446	453
20	662	334	378	430	453
21	633	321	361	411	453
22	619	304	353	402	441
23	629	307	359	409	451
24	658	343	~~376~~ 375	428	453
25	722	350	411	469	453
26	792	351	451	515	453
27	730	362	416	474	453
28	653	388	372	424	453
29	623	385	355	405	445
30	618	377	352	402	440
31	609	374	347	396	431
Aug. 1	582	358	332	378	404
2	568	349	324	369	398
3	552	340	315	359	394
4	531	325	303	345	383
5	522	326	298	339	379
6	504	318	288	328	352
7	495	313	283	322	348
8	478	299	272	311	342
9	492	317	280	320	346
10	468	300	267	304	342
11	460	286	262	299	342
12	456	278	260	296	342
13	458	281	261	298	342
14	454	277	259	295	342
15	441	272	251	287	339
16	424	261	242	276	322
17	407	249	232	265	314
18	402	242	229	261	311
19	399	235	228	259	310
20	394	232	225	256	307
21	390	227	222	254	305
22	405	233	231	263	312
Aug. 23	420	235	240	273	320
24	446	240	254	290	341
25	440	237	251	286	338
26	443	240	253	288	340
27	471	273	269	306	342
28	417	244	238	271	319
29	385	225	219	250	303
30	379	221	216	246	300
31	377	221	215	245	299
Sept. 1	356	223	203	231	309
2	353	229	201	229	308
3	353	232	201	229	308
4	352	234	201	229	307
5	354	242	200	230	308
6	358	246	204	233	310
7	363	251	207	236	313
8	357	253	204	232	310
9	363	259	207	236	313
10	367	265	209	239	315
11	366	269	209	238	314
12	360	265	205	234	311
13	342	250	195	222	302
14	359	271	205	233	311
15	353	270	201	229	308
16	347	262	198	226	305
17	350	264	200	228	306
18	337	251	192	219	300
19	341	259	195	222	302
20	353	273	201	229	308
21	346	265	198	225	304
22	343	264	196	223	303
23	342	264	195	222	302
24	330	261	188	214	296
25	333	267	190	216	297
26	340	276	194	221	301
27	339	275	193	220	301
28	330	271	188	214	296
29	325	268	185	211	294
30	329	271	188	214	296
Average	483	295	276	314	357

TABLE 7
UPPER IDAHO - 1948
c.f.s.

Date	Total Divert. Flow	Idaho Divert. Flow	57% Divert. Flow	65% Divert. Flow	Priority Right
Jul. 15	786	397	438	511	453
16	775	395	432	504	453
17	760	392	433	494	453
18	746	386	425	485	453
19	716	372	408	464	453
20	745	407	425	484	453
21	736	426	420	478	453
22	679	393	383	441	453
23	681	383	389	443	453
24	669	379	381	435	453
25	655	376	373	426	453
26	609	339	347	396	431
27	609	345	347	396	431
28	585	326	334	380	407
29	600	331	342	390	422
30	610	330	348	396	432
31	604	329	345	393	426
Aug. 1	598	318	341	389	420
2	587	311	335	382	419
3	559	295	319	363	397
4	555	289	317	361	395
5	556	297	~~314~~ 317	361	396
6	542	295	309	352	389
7	538	290	307	350	387
8	532	285	304	346	384
9	525	280	299	341	380
10	509	264	291	331	355
11	502	263	286	326	351
12	484	250	276	315	342
13	468	240	267	304	342
14	472	237	270	307	342
15	465	233	265	302	342
16	447	221	255	291	342
17	433	215	247	281	335
18	392	177	224	255	306
19	424	205	242	276	322
20	404	182	~~233~~ 230	263	312
21	405	187	231	263	313
22	403	189	230	262	312
23	408	186	233	265	314
24	405	186	231	263	313
25	403	187	~~230~~ 235	262	312
26	410	190	234	266	315
27	391	183	223	254	306
28	360	177	206	234	290
Aug. 29	361	172	206	235	290
30	360	169	206	234	290
31	367	167	209	239	312
Sept. 1	382	168	218	248	301
2	371	157	212	241	296
3	365	155	208	237	295
4	364	153	208	237	295
5	385	172	220	250	303
6	379	170	216	247	300
7	368	161	210	239	295
8	356	162	199	231	309
9	339	157	193	220	301
10	364	168	208	237	295
11	347	158	198	225	305
12	349	170	199	227	306
13	352	176	201	229	307
14	349	176	199	227	306
15	347	177	198	226	305
16	346	178	198	225	304
17	340	173	194	221	301
18	345	185	197	224	304
19	379	214	216	246	300
20	389	223	222	253	305
21	381	221	217	248	301
22	385	221	220	250	303
23	374	222	214	243	297
24	377	216	215	245	299
25	403	237	230	262	312
26	387	223	221	252	304
27	366	215	209	238	295
28	~~375~~ 377	~~237~~ 239	~~214~~ 215	244	298
29	364	229	208	237	295
30	357	230	204	232	295
Average	472	246	269	307	349

(November 1950)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

File Number | Washington
District

PLATE 1

CENTRAL DIVISION

RELATION OF RIGHTS AND SUGGESTED METHODS OF DIVISION

ACCUMULATED RIGHTS EACH STATE
SECOND-FEET

0 100 200 300 400

IDAHO RIGHTS

IDAHO 65%

IDAHO 55%

WYOMING 45%

WYOMING 35%

WYOMING RIGHTS

TOTAL ACCUMULATED RIGHTS BOTH STATES
SECOND-FEET

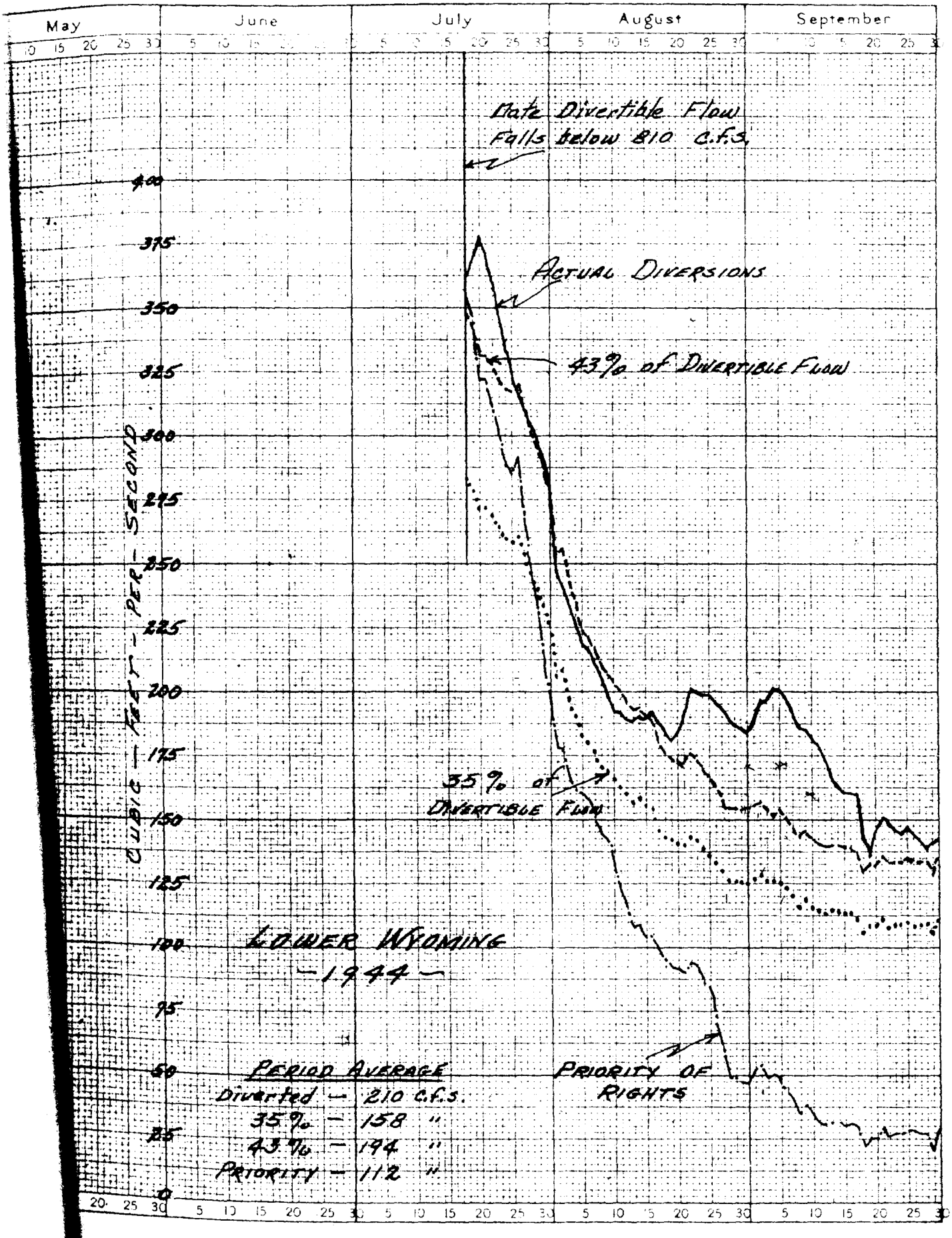
100 200 300 400 500 600 700 800

Sheet ... of ... sheets. Prepared by ... Date ... Checked by ... Date ...

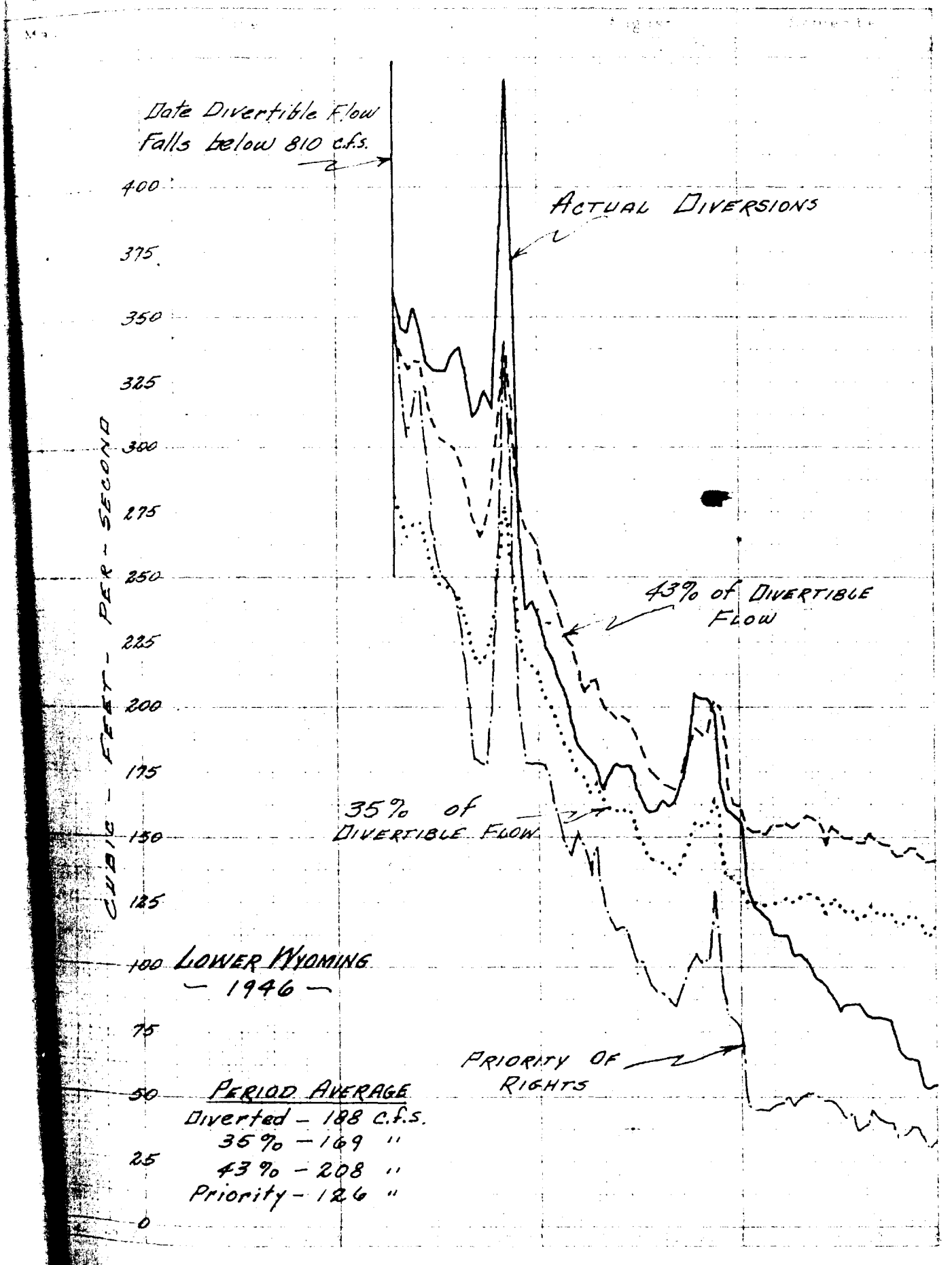
LOWER WYOMING — 1944

File No. Washington

PLATE



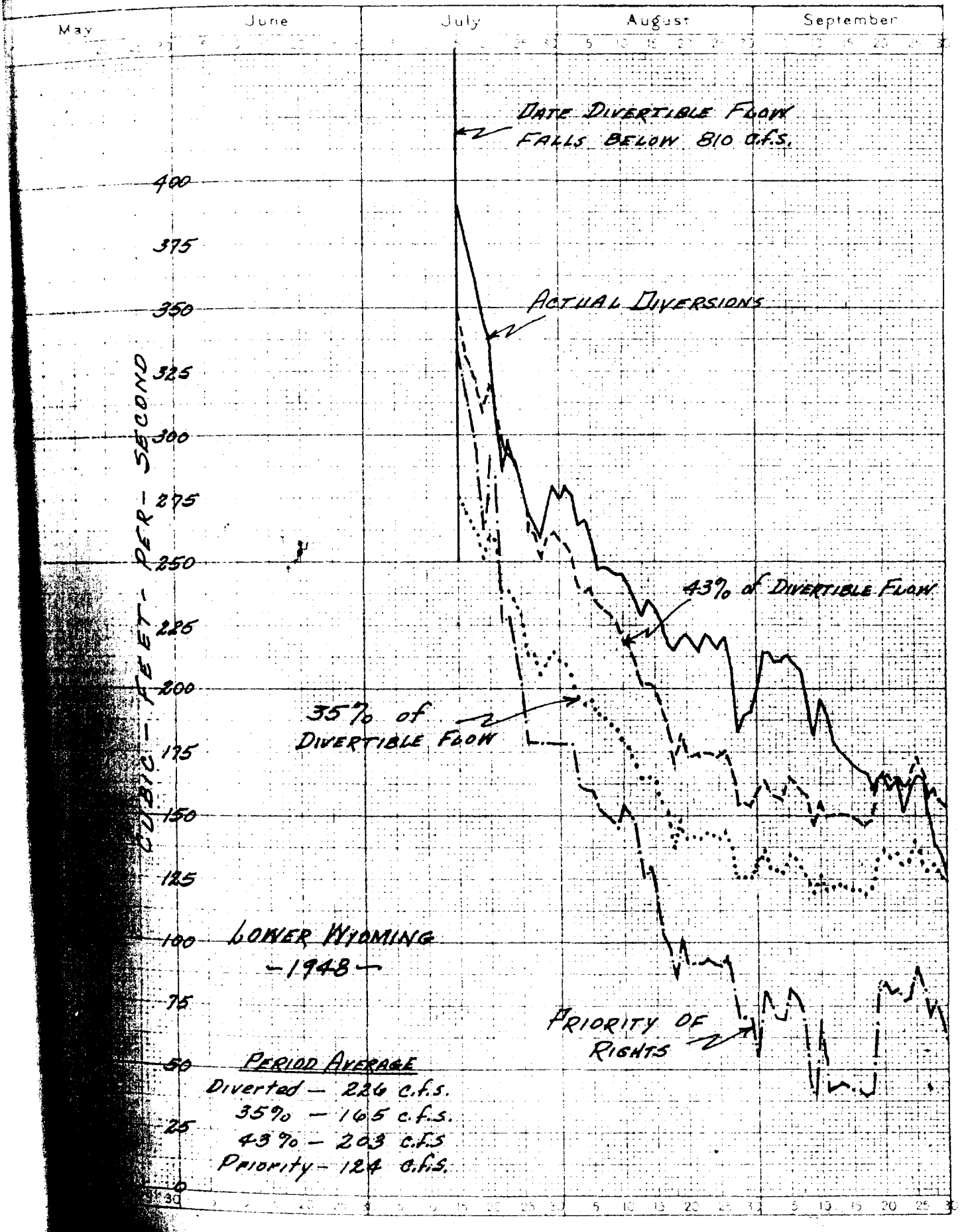
LOWER WYOMING — 1946



LOWER WYOMING — 1948

File No. Washington / Field

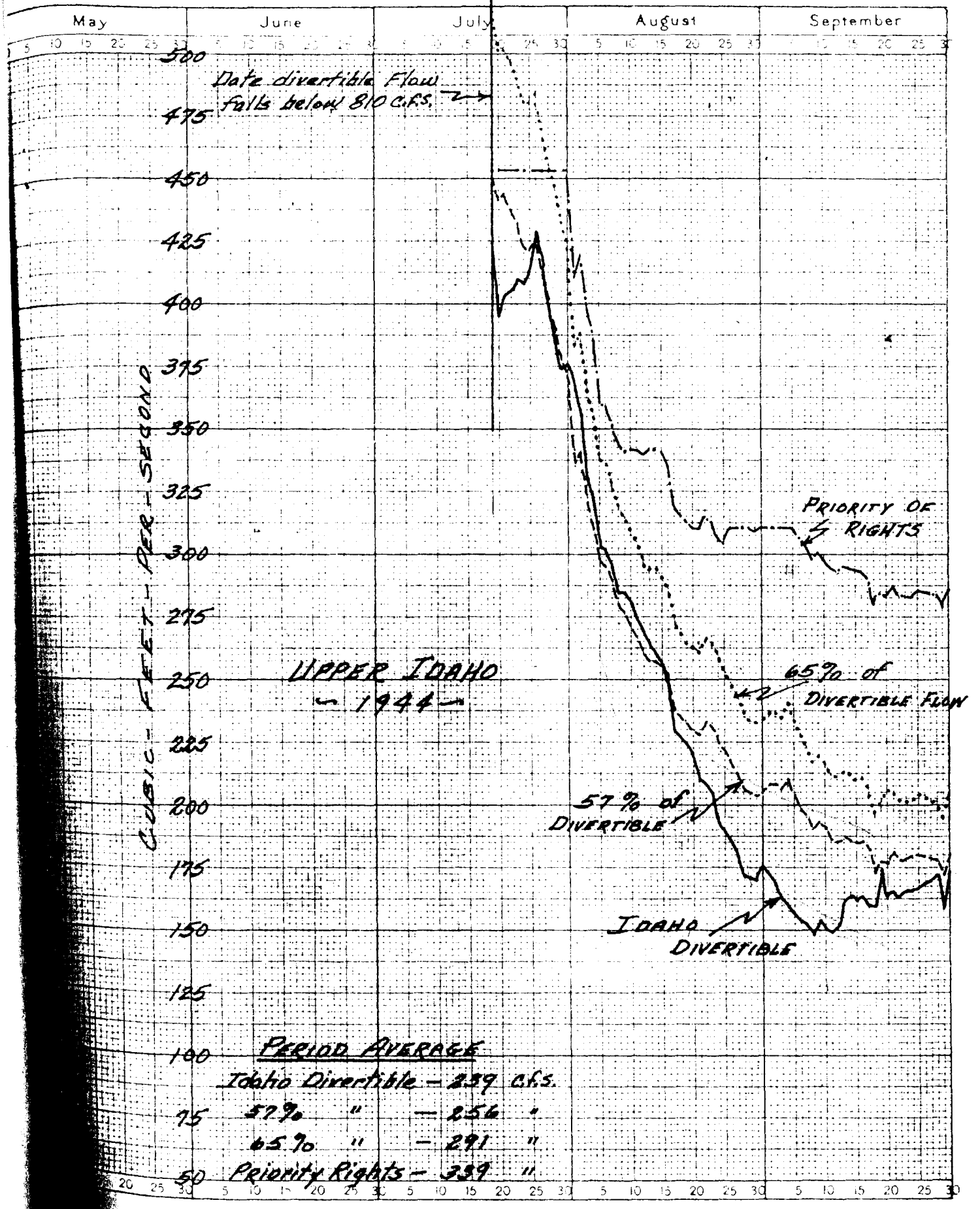
PLATE



UPPER IDAHO – 1944

Washington PLATE

File No. / Field



PERIOD AVERAGE

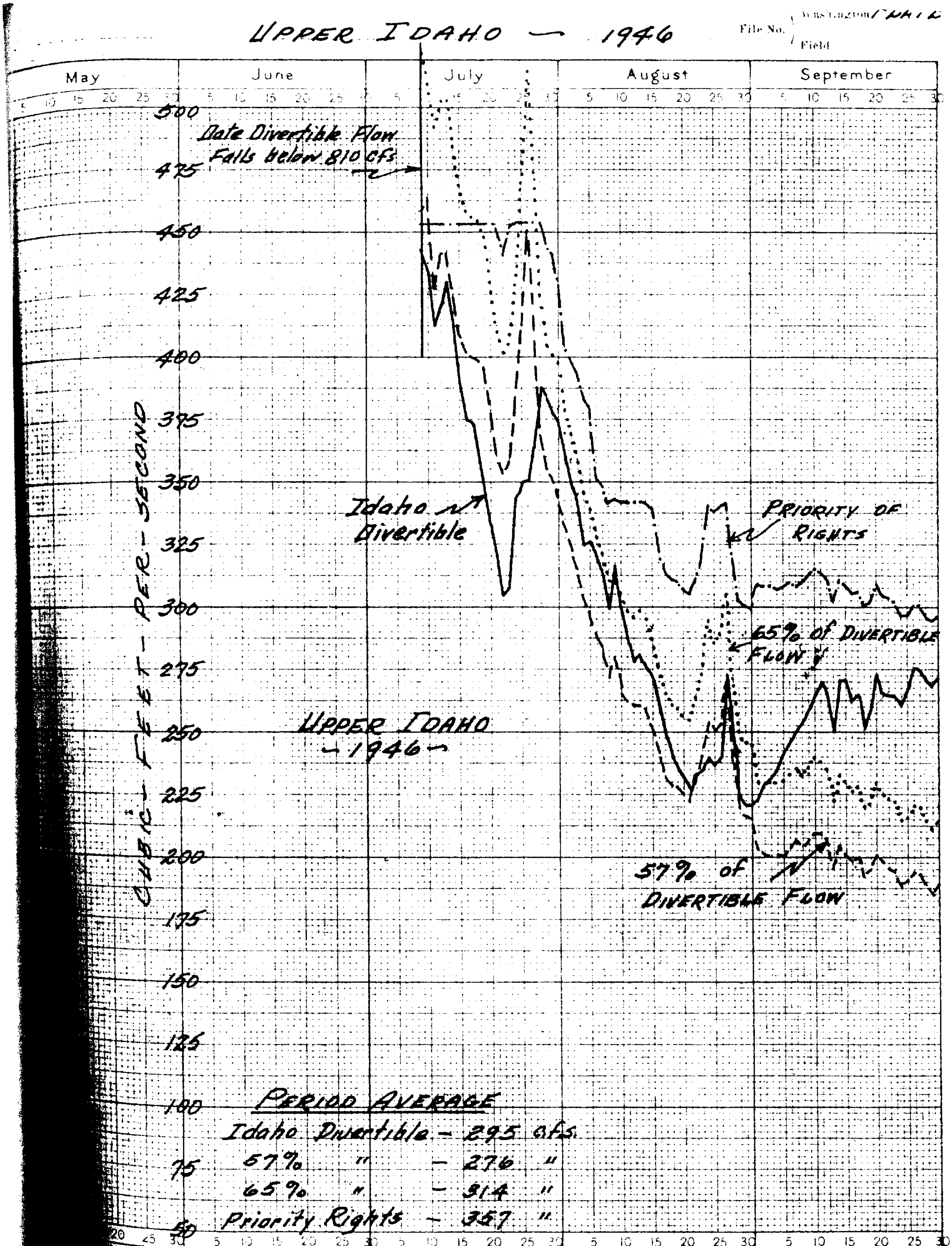
Idaho Divertible – 239 c.f.s.

57% " – 256 "

65% " – 291 "

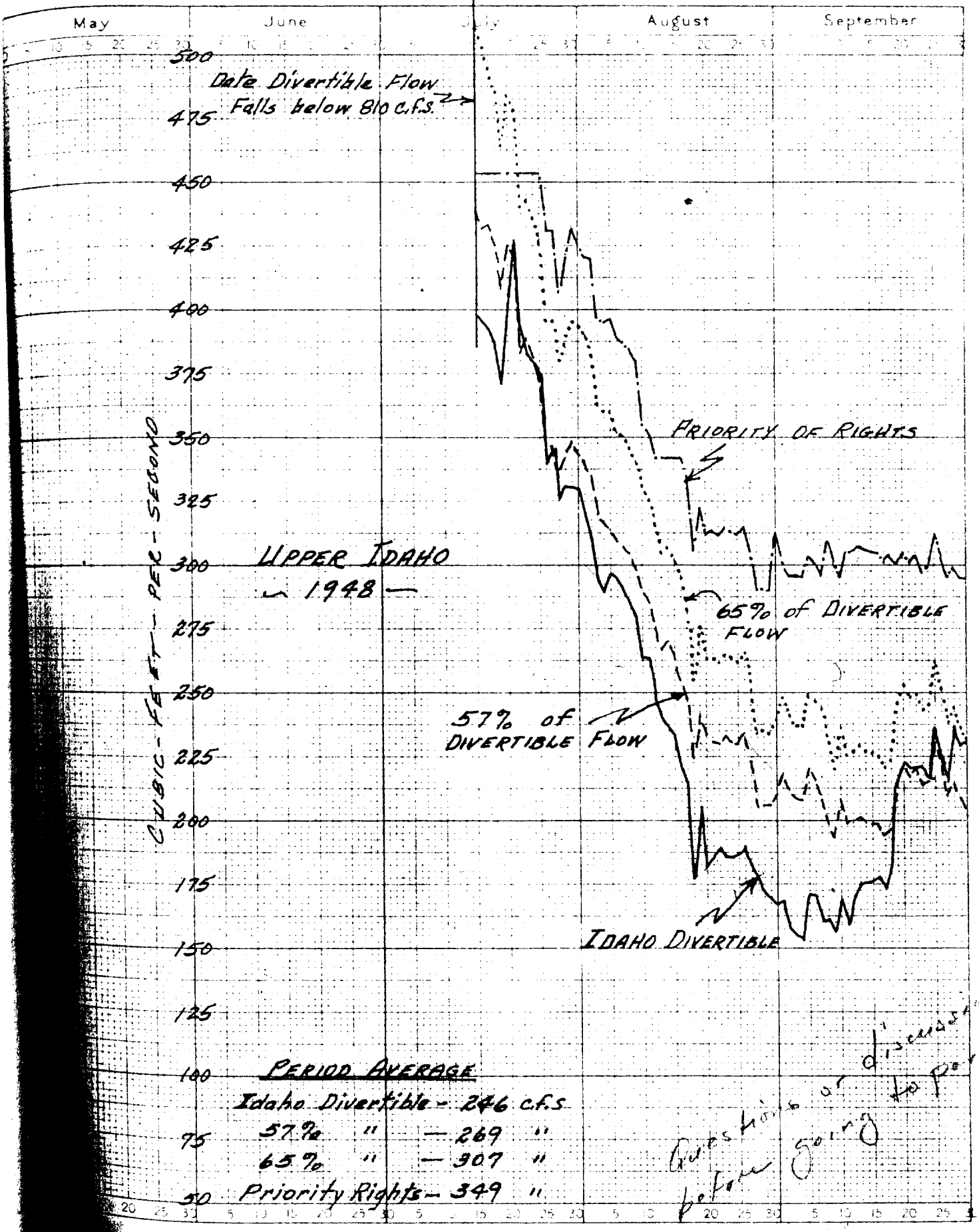
Priority Rights – 339 "

File No. Washington / TABLE 4
Field



Washington PLATE 1

UPPER IDAHO — 1948



PART 2

The Logan Area office of the Bureau of Reclamation has assisted in Part 2 of this report by extending tabular studies similar to those in Report #25, to include assumed storage allowance of 30,000 and 36,000 acre-feet. This study differs principally in two respects from corresponding analysis in Report #25.

(1) A reserve for irrigation in Bear Lake was established at 787,500 acre-feet (elevation 5,914.50 ft) in accordance with the motion adopted at the Oct. 16th meeting.

(2) Available storable water at Woodruff Narrows was computed from Oct. 1 to Apr. 30 with no additional storage allowance after Apr. 30. This was also in accordance with the motion adopted.

Reference to the summary of Report #25 indicates that for storage amounting to a maximum of 30,000 acre-feet, an irrigation reserve of 884,000 acre-feet was required; for 40,000 acre-feet an irrigation reserve of 906,000 acre-feet was required. It was determined that the above amounts were necessary if irrigation interests below Bear Lake were not affected. However, in using a limit of 787,500 acre-feet, even though storage was not permitted after Apr. 30, a shortage to irrigation releases occurs in 1935 for both amounts of storage studied. For 30,000 acre-feet of storage this shortage amounts to 94,100 acre-feet, and for 36,000 acre-feet of storage the shortage amounts to 103,800 acre-feet. This is based

Tables 8 and 9 on the following page summarize the availability and estimated effects of upstream storage amounts as studied.

Notes on detail tabulation:

Much of the basic data in Rep. 25 applicable to post B.L. operation was not repeated in Plates 8 & 9.

The analysis was made in the same manner as in 25

TABLE 8
AVAILABILITY AND SHORTAGES OF WATER
FOR UPSTREAM STORAGE

Annual upstream storage allowance (acre-feet)	Years fully available	Average annual amount available (acre-feet)	Maximum annual shortage (acre-feet)	Consecutive shortages	
				Years	Total amount (acre-feet)
30,000	21 in 25	29,000	7,000	2	12,500
36,000	20 in 25	34,000	13,000	3	30,000

TABLE 9
ESTIMATED EFFECT OF UPSTREAM STORAGE
ON WATER SUPPLIES

Annual upstream storage allowance (acre-feet)	Decrease in average annual water supply for irrigation (acre-feet)	Decrease in average annual water supply for power (acre-feet)
30,000	3,700	24,100
36,000	4,100	27,500

On Plates 8 and 9 are tabular studies, similar to those in Report #25, showing the availability and effects on Bear Lake of upstream storage. These tables were prepared for assumed storage allowances of 30,000 and 36,000 acre-feet, each in conjunction with an irrigation reserve in Bear Lake of 787,500 acre-feet. A graphical picture of the available supplies at Woodruff Narrows and resulting storage allowances is shown on Plate 10.

Notes on Plates 8 and 9
(Report 26)

torage Period

Col. (4) - Algebraic sum of the change in B. L. content during the storage period and the past storage or storable water used for power (Col. 16) Plate 3, Report 25).

Col. (5) - (4) minus (3) Supply adjusted for estimated depletion of new storage.

Col. (6) - When past power releases (Col. 5, Plate 3, Report 25), are sufficient to take care of upstream depletion, power releases are reduced by the amount of estimated depletion in Col. (3). This will be true each year until the content falls to the "reserve" limit, at which time only that portion of the storage above the limit is released for power. When the adjusted contents at the end of the storage period decreases below the required reserve, there is no water for power ~~above~~ release.

Col. (7) - Contents on Sept. 30 of preceeding year plus adjusted supply in Col. (5) minus adjusted power releases, Col. (6). Held to a minimum of the irrigation reserve when extra water is available for power purposes.

Storage Delivery Period

Col. (8) - The difference between the change in content and power plus irrigation releases result in evaporation loss for the delivery period.

Col. (9) - During the delivery period, if Bear Lake contents were above 787,5[illegible] this release was left as actually occurred (except 1946, 1947, when the 12,000 minimum was used in order to return the Lake to it's actual content in 1948). In 1926 adjusted contents in Col. (7) passed thru the 'reserve limit', during the delivery period. Consequently, the actual flow for power was reduced proportionately.

1- Some basic info. on post operation not incl. here.
2- Adj. in Lake operation same as report 25

Discuss Columns and last 4 averages

BEAR LAKE OPERATION ADJUS
(Base

1. Supplies at Woodruff Narrows dur
2. An irrigation reserve in Bear La
3. 30,000 acre feet allowable upstr

Water year	Flow available for storage at Woodruff Narrows during period Oct. 1 to April 30	Flow available for storage at Woodruff Narrows limited to a maximum of 30,000 A.F.	ADJUSTED Storage Period: Estimated depletion to Bear Lake from upstream storage	Net water supply available (for storage period) (See Report #25)	Adjusted supply during period (Col. 4 -3)	Adjusted storage of storable flows used for power at Cutler	Adjusted content of Bear Lake (end of period)	BEA Defic in wa sup (due evap rati (See port
	1	2	3	4 (6)	5	6	7	
1923								
1924	78,200	30,000	28,500	407,200	378,700	296,400	1,368,300	55
1925	37,000	30,000	28,500	276,000	247,500	212,900	1,086,000	31
1926	63,300	30,000	28,500	157,100	128,600	154,500	901,600	71
1927	38,400	30,000	28,500	289,100	260,600	141,600	787,500	49
1928	62,200	30,000	28,500	383,800	355,300	235,600	787,500	73
1929	47,100	30,000	28,500	391,000	362,500	188,100	787,500	33
1930	54,800	30,000	28,500	206,100	177,600	64,900	787,500	47
1931	45,200	30,000	28,500	94,700	66,200	0	705,800	106
1932	41,400	30,000	28,500	279,800	251,300	0	614,900	40
1933	30,500	30,000	28,500	176,600	148,100	0	648,000	79
1934	24,600	24,600	24,600	27,800	3,200	0	423,600	131
1935	22,900	22,900	22,900	89,800	66,900	0	417,100	79
1936	43,400	30,000	28,500	394,400	365,900	0	365,900	39
1937	55,600	30,000	28,500	333,300	304,800	0	572,400	52
1938	50,300	30,000	28,500	338,600	310,100	0	740,000	33
1939	52,800	30,000	28,500	188,700	160,200	0	805,800	70
1940	23,400	23,400	23,400	36,100	12,700	0	588,500	96
1941	28,200	28,200	26,800	78,500	51,700	0	325,500	41
1942	63,700	30,000	28,500	223,600	195,100	0	382,600	67
1943	49,500	30,000	28,500	357,000	328,500	0	496,400	52
1944	44,000	30,000	28,500	284,200	255,700	0	623,100	80
1945	38,400	30,000	28,500	202,900	174,400	0	597,300	35
1946	71,400	30,000	28,500	441,600	413,100	0	943,000	54
1947	57,400	30,000	28,500	384,400	355,900	0	1,184,200	22
1948	63,400	30,000	28,500	318,500	290,000	94,000	1,290,000	45
Average	47,500	29,200	27,800	254,400	226,600	55,500		59

* A minimum release of 12,000 A.F., during the storage delivery period, is al
due to inefficiency in operation.

29,200
71,800
100

JUSTED FOR UPSTREAM STORAGE

ased on)

during the period October 1 to April 30

Lake set at elevation 5914.5 ft. (787,500 ac.ft.)

stream storage

Plate No. 8

AR LAKE OPERATION							PAST OPERATION	
	Storage Delivery Period				Annual Releases		Annual Releases	
ficiency water supply ue to vapo-ation) ee Re-ort #25)	* Adjusted storage or storable flows used for power at Cutler	Storage releases used for irrigation (See report #25)	Decrease in irrigation releases (over past conditions)	Adjusted content of Bear Lake (end of period) Col. (7) - (8/9/10)	Adjusted storage or storable flows used for power at Cutler (Col. 6 / 9)	Adjusted storage releases used for irrigation	Storage or storable flows used for power at Cutler	Storage releases used for irrigation
8	9	10	11	12	13	14	15	16
				1,286,000				
55,100	121,600	140,200	0	1,051,400	418,000	140,200	446,500	140,200
31,500	90,000	37,000	0	927,500	302,900	37,000	331,400	37,000
71,700	(44,000)	117,400	0	668,500	198,500	117,400	303,100	117,400
49,600	12,000	58,100	0	667,800	153,600	58,100	294,300	58,100
73,800	12,000	88,600	0	613,100	217,600	88,600	120,800	88,600
33,700	12,000	67,000	0	674,800	200,100	67,000	159,700	67,000
47,500	12,000	88,400	0	639,600	76,900	88,400	134,200	88,400
106,600	12,000	223,600	0	363,600	12,000	223,600	71,300	223,600
40,500	12,000	62,500	0	499,900	12,000	62,500	8,000	62,500
79,900	12,000	135,700	0	420,400	12,000	135,700	0	135,700
131,300	12,000	230,100	0	50,200	12,000	230,100	2,200	230,100
79,200	12,000	25,900	94,100	0	12,000	25,900	4,000	120,000
39,700	12,000	46,600	0	267,600	12,000	46,600	0	46,600
52,800	12,000	77,700	0	429,900	12,000	77,700	23,300	77,700
33,300	12,000	49,100	0	645,600	12,000	49,100	14,500	49,100
70,900	12,000	147,100	0	575,800	12,000	147,100	65,500	147,100
96,900	12,000	205,800	0	273,800	12,000	205,800	7,100	205,800
41,800	12,000	84,200	0	187,500	12,000	84,200	18,900	84,200
67,100	12,000	135,600	0	167,900	12,000	135,600	27,200	135,600
52,500	12,000	64,500	0	367,400	12,000	64,500	55,900	64,500
80,500	12,000	107,700	0	422,900	12,000	107,700	24,400	107,700
35,700	12,000	19,700	0	529,900	12,000	19,700	33,700	19,700
54,300	12,000	48,400	0	828,300	12,000	48,400	65,700	48,400
22,000	12,000	56,200	0	1,094,000	12,000	56,200	158,700	56,200
45,000	77,800	90,200	0	1,077,000	171,800	90,200	205,300	90,200
59,700	23,400	96,300	3,700		78,900	96,300	103,000	100,000

allowed for power and is classified as unavoidable release

103,000 − 78,900 = 24,100

100,000 − 96,300 = 3,700

24,100 + 3,700 = 27,800

Notes on Plates 8 and 9
(Report 26)

[redacted] Mod

Col. (4) - Algebraic sum of the change in B. L. content during the storage period and the past storage or storable water used for power (Col. 16) Plate 3, Report 25).

Col. (5) - (4) minus (3) Supply adjusted for estimated depletion of new storage.

Col. (6) - When past power releases (Col. 2, Plate 3, Report 25), are sufficient to take care of [redacted] depletion, power releases are reduced by the amount of [redacted] depletion in Col. (3). This will be true each year until [redacted] the "reserve" limit, at which time only that portion of the storage above the limit is released for power. When [redacted] contents at the end of the storage period decreases [redacted] the required reserve, there is no water for power [redacted]

Col. (7) - Contents [redacted] Sept. 30 of preceding year plus adjusted supply in Col. (5) minus adjusted power releases, Col. [redacted] held to a minimum of the irrigation reserve when extra water [redacted] available for power purposes.

Storage Delivery Period

Col. (8) - The difference between the change in contents and power plus irrigation releases, [redacted] result of evaporation loss for the delivery period.

Col. (9) - [redacted] the delivery period [redacted] Bear Lake contents were above 787,5[redacted] and release was left as [redacted] actually occurred (except 1946, 1947, when the 12,0[redacted] minimum was used in order to return the Lake to it's actual content in 1948). In 1926 adjusted contents in Col. (7) passed thru the 'reserve limit', during the delivery period. Consequently, the actual flow for power was reduced proportionately.

BEAR LAKE OPERATION ADJUS
(Base

1. Supplies at Woodruff Narrows duri
2. An irrigation reserve in Bear Lak
3. 36,000 acre feet allowable upstre

Water year	Flow available for storage at Woodruff Narrows during period Oct. 1 to April 30	Flow available for storage at Woodruff Narrows limited to a maximum of 36,000 A.F.	ADJUSTED BEA					
			Storage Period					
			Estimated depletion to Bear Lake from upstream storage	Net water supply available (for storage period) (See report #25)	Adjusted supply during period (Col. 4 - 3)	Adjusted storage or storable flows used for power at Cutler	Adjusted content of Bear Lake (end of period)	Defic in w sup (due eva rati (See #:
	1	2	3	4	5	6	7	8
1923								
1924	78,200	36,000	33,100	407,200	374,100	291,800	1,368,300	55,
1925	37,000	36,000	33,100	276,000	242,900	208,300	1,086,000	31,
1926	63,300	36,000	33,100	157,100	124,000	149,900	931,600	71,
1927	38,400	36,000	33,100	289,100	256,000	137,000	787,500	49,
1928	62,200	36,000	33,100	383,800	350,700	231,000	787,500	73,
1929	47,100	36,000	33,100	391,000	357,900	183,500	787,500	33,
1930	54,800	36,000	33,100	206,100	173,000	60,300	787,500	47,
1931	45,200	36,000	33,100	94,700	61,600	0	701,200	106,
1932	41,400	36,000	33,100	279,800	246,700	0	605,700	40,
1933	30,500	30,500	29,000	176,600	147,600	0	638,300	79,
1934	24,600	24,600	24,600	27,800	3,200	0	413,900	131,
1935	22,900	22,900	22,900	89,800	66,900	0	107,400	79,
1936	43,400	36,000	33,100	394,400	361,300	0	361,300	39,
1937	55,600	36,000	33,100	333,300	300,200	0	563,200	52,
1938	50,300	36,000	33,100	338,600	305,500	0	726,200	33,
1939	52,800	36,000	33,100	188,700	155,600	0	787,400	70,
1940	23,400	23,400	23,400	36,100	12,700	0	570,100	96,
1941	28,200	28,200	27,400	78,500	51,100	0	306,500	41,
1942	63,700	36,000	33,100	223,600	190,500	0	359,000	67,
1943	49,500	36,000	33,100	357,000	323,900	0	468,200	52,
1944	44,000	36,000	33,100	284,200	251,100	0	590,300	80,
1945	38,400	36,000	33,100	202,900	169,800	0	559,900	35,
1946	71,400	36,000	33,100	441,600	408,500	0	901,000	54,
1947	57,400	36,000	33,100	384,400	351,300	0	1,137,600	22,
1948	63,400	36,000	33,100	318,500	285,400	142,800	1,290,000	15,
Average	47,500	34,000	31,600	254,400	222,800	52,100		59,

* A minimum release of 12,000 A.F., during the storage delivery period, is a
due to inefficiency in operation.

USTED FOR UPSTREAM STORAGE

Plate No. 9

sed on)
ring the period October 1 to April 30
ake set at elevation 5914.5 ft. (787,500 ac. ft.)
ream storage

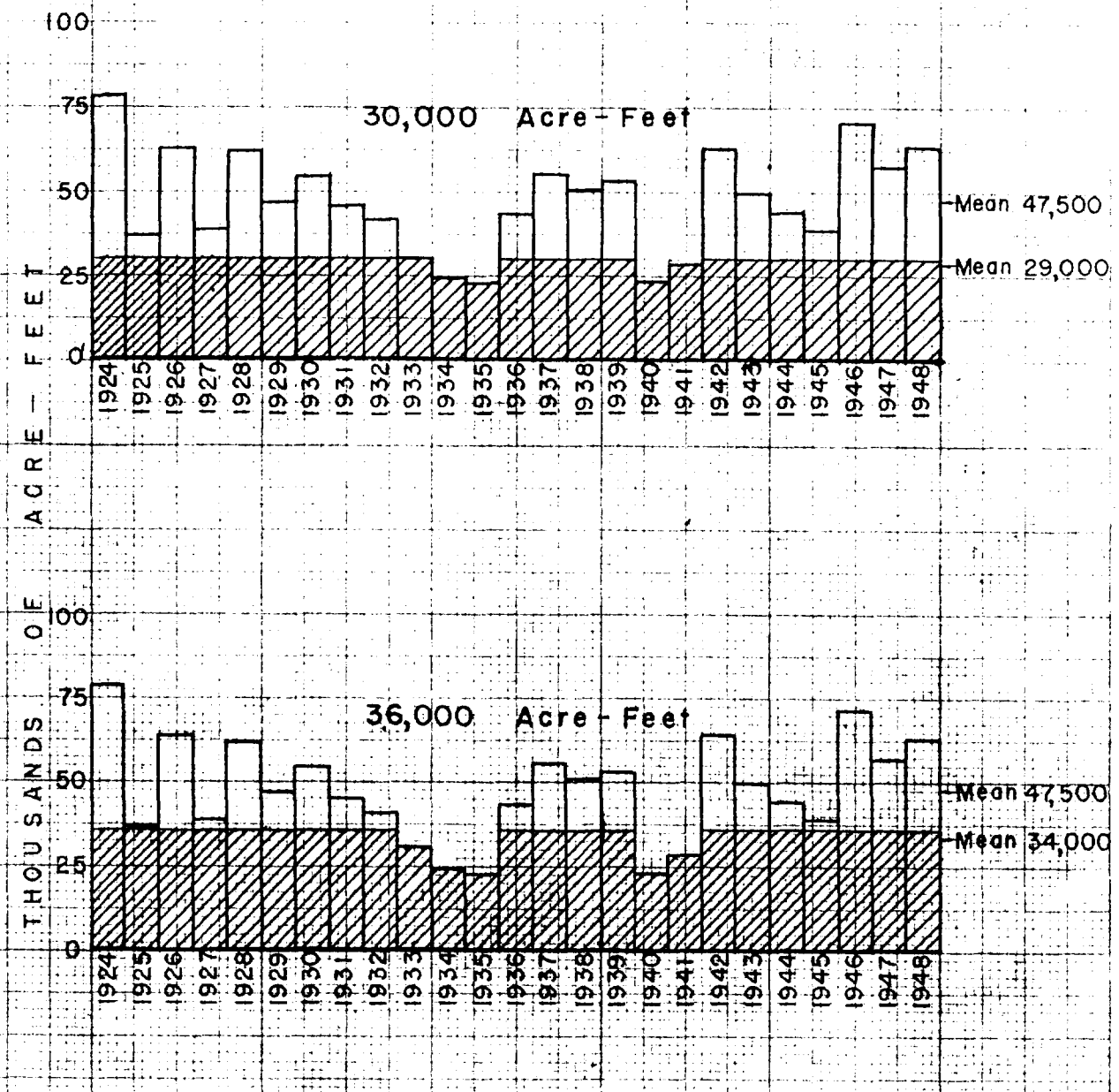
A-R LAKE OPERATION							PAST OPERATION	
	Storage Delivery Period				Annual Releases		Annual Releases	
iciency water supply lue to vapo- tion) e report #25)	* Adjusted storage or storable flows used for power at Cutler	Storage releases used for irrigation (See report #25)	Decrease in irrigation releases (over past conditions)	Adjusted content of Bear Lake (end of period) Col. (7)-(8/9/10)	Adjusted storage or storable flows used for power at Cutler (Col. 6 / 9)	Adjusted storage releases used for irrigation	Storage or storable flows used for power at Cutler	Storage releases used for irrigation
8	9	10	11	12	13	14	15	16
				1,286,000				
55,100	121,600	140,200	0	1,051,400	413,400	140,200	446,500	140,200
31,500	90,000	37,000	0	927,500	298,300	37,000	331,400	37,000
71,700	44,000	117,400	0	668,500	193,900	117,400	303,100	117,400
49,600	32,000	58,100	0	667,800	149,000	58,100	294,300	58,100
73,800	12,000	88,600	0	613,100	213,000	88,600	120,800	88,600
33,700	12,000	67,000	0	674,800	195,500	67,000	159,700	67,700
7,500	12,000	88,400	0	639,600	72,300	88,400	134,200	88,400
106,600	12,000	223,600	0	359,000	12,000	223,600	71,100	223,600
40,500	12,000	62,500	0	490,700	12,000	62,500	8,000	62,500
79,900	12,000	135,700	0	410,700	12,000	135,700	0	135,700
131,300	12,000	230,100	0	40,500	12,000	230,100	2,200	230,100
79,200	12,000	16,200	103,800	0	12,000	16,200	4,000	120,000
39,700	12,000	16,600	0	263,000	12,000	16,600	0	16,600
52,800	12,000	77,700	0	420,700	12,000	77,700	23,300	77,700
33,300	12,000	49,100	0	631,800	12,000	49,100	14,500	49,100
70,900	12,000	147,100	0	557,400	12,000	147,100	65,500	147,100
96,900	12,000	205,800	0	255,400	12,000	205,800	7,100	205,800
41,800	12,000	84,200	0	168,500	12,000	84,200	18,900	84,200
67,100	12,000	135,600	0	144,300	12,000	135,600	27,200	135,600
52,500	12,000	64,500	0	339,200	12,000	64,500	55,900	64,500
80,500	12,000	107,700	0	390,100	12,000	107,700	24,400	107,700
35,700	12,000	19,700	0	492,500	12,000	19,700	33,700	19,700
54,300	12,000	48,400	0	786,300	12,000	48,400	65,700	48,400
22,000	12,000	56,200	0	1,047,400	12,000	56,200	158,700	56,200
45,000	77,800	90,200	0	1,077,000	120,600	90,200	205,300	90,200
59,700	23,400	95,900	4,100		75,500	95,900	103,000	100,000

s allowed for power and is classified as unavoidable release

103,100 − 75,500 = 27,500

100,000 − 95,900 = 4,100

31,600



AVAILABLE SUPPLIES and ASSUMED STORAGE AMOUNTS at WOODRUFF NARROWS

Unruled — Total Flow at Woodruff Oct 1 to Apr 30

Crosshatched — Maximum Storage Amounts as shown

PART 3

It was suggested that storage studies in this report include possibilities of exchange-storage by the Upper users in a reservoir at Woodruff Narrows in connection with the Bear River and Francis-Lee Canals. From a study of Reports (13) and (19), the following points are evident:

(1) On a basis of 1 cfs for each 70 acres in the Upper Wyoming section, the Bear River and Francis-Lee Canals have combined rights of 32.59 cfs. There are earlier dated rights of 11.10 cfs ahead of the Bear River Canal right of 22.98 cfs, and earlier rights of 58.47 cfs ahead of the Francis-Lee right of 9.61 cfs.

(2) With distribution on a basis of priority in this section, the Bear River Canal right would seldom, if ever, be cut prior to July 15 and and Francis-Lee Canal right would rarely be cut prior to July 15.

(3) During the period that exchange-storage above Woodruff Narrows would be needed, rights of the two canals available for exchange would total about 64 ac. ft. daily.

(4) A study of supplemental requirements above Woodruff Narrows (Report #19) shows that by excluding the extreme dry years of 1931, 1934, 1939, and 1940, the exchange period would not exceed a maximum of 25 days. This period is based on a closing date of July 15, for storage delivery and exchange.

(5) On this basis it may be estimated that 1,600 ac. ft. in a reservoir at Woodruff-Narrows would be sufficient for exchange purposes. If some allowance were made for evaporation loss, this estimate might be raised to 2,000 ac. ft.

Also included in the motion adopted [illegible] meeting was a request for storage supplies and requirements relative [illegible] reservoir at Hilliard. This study has been previously made in Reports numbered (18) and (19) from which the following information is taken.

A reservoir at the Hilliard site would provide supplemental water for about 15,000 acres located between Myers Narrows and Woodruff Narrows in Wyoming. In addition, fairly large amounts could be used on land, approximating 17,000 acres, above Myers Narrows through exchange for natural flow.

The source of water supply for Hilliard Reservoir would be runoff from Sulphur Creek and diversions during ice-free periods from Mill Creek and Bear River. In most years the offstream diversions would be limited to October, November and April during the storage period due to ice conditions. Although stream flow records are available only since 1942, it is estimated that supplies from the combined sources would fill a reservoir of 10,000 acre-feet each year. Table 10, taken from Report #18, lists combined supplies for period of available records.

TABLE 10
Hilliard Reservoir Storable Supplies
Acre-feet

Water Year Ending Sept.30	Sulphur Creek		Mill Creek		Total Sulphur and Mill Creeks		Req'd.from Bear River to make 10,000 ac.-ft.	
	Oct.1 to Apr. 15	Oct.1 to Apr. 30	Oct. Nov. Apr. 1-15	Oct. Nov. Apr. 1-30	Oct.1 to Apr. 15	Oct.1 to Apr. 30	Oct.1 to Apr. 15	Oct.1 to Apr. 30
1943	5;200	7;100	2;700	6;000	7;900	13;100	2;100	0
1944	3;000	6;500	1;400	1;800	4;400	8;300	5;600	1;700
1945	2;900	6;000	1;600	2;600	4;500	8;600	5,500	1,400
1946	8;800	12;100	2;400	7;100	11;200	19;200	0	0
1947	6;800	7;700	2;100	3;600	8;900	11;300	1;100	0
1948	3,000	9,700	2,800	4,600	5,800	14,300	4,200	0

In Report 19, it is stated that supplemental storage requirements in the Upper Wyoming Section may be estimated from an average headgate requirement for a full water supply, May 1 to July 15, of 2.5 acre-feet per acre. On this basis, a full requirement for lands below Myers Narrows (15,000 acres) would be 37,500 acre-feet. Table 11, taken from Report #19, shows an estimated storage requirement at Hilliard.

TABLE 11

Water Year Ending Sept. 30	Storage Required at Hilliard acre-feet
1924	5,000
1925	0
1926	2,800
1927	400
1928	1,600
1929	0
1930	3,000
1931	6,600
1932	400
1933	3,000
1934	14,200
1935	1,600
1936	2,000
1937	1,200
1938	1,000
1939	4,400
1940	8,600
1941	400
1942	2,200
1943	200
1944	0
1945	0
1946	4,600
1947	0
1948	4,400
Average	2,700

Note:- Above figures do not include space requirement for evaporation loss.

For 15,000 acres between Myers & Woodruff Narrows.

Based on a total headgate requirement of 2.5 acre-feet per acre.

PART 5

storage

This section deals with a study of 36,000 acre-feet/above Bear Lake, of which not to exceed 30,000 would be storable from Oct. 1 to Apr. 30, and the balance following Apr. 30, when Bear River at Border is in excess of 700 c.f.s.

Report #25 gives the flows available for storage at Woodruff Narrows under the above conditions. Table 12 summarizes these available flows, deficiencies and estimated depletions to the Bear Lake area.

TABLE 12

Year	Flow Available for Storage at Woodruff Narrows			Deficiency Prior to Apr. 30 (30,000 af)	Deficiency after Apr. 30 (6,000 af)	Available Storage Limited to 36,000 af	Estimated Depletion Bear Lake from Upstream Storage
	Oct. 1 to Apr. 30	After Apr. 30	Total				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1924	78,200	19,600	97,800	0	0	36,000	33,000
1925	37,000	2,900	39,900	0	3,100	32,900	31,000
1926	63,300	1,100	64,400	0	4,900	31,100	29,200
1927	38,400	7,500	45,900	0	0	36,000	33,100
1928	62,200	51,300	113,500	0	0	36,000	33,100
1929	47,100	29,600	76,700	0	0	36,000	33,100
1930	54,800	100	54,900	0	5,900	30,100	28,600
1931	45,200	0	45,200	0	6,000	30,000	28,500
1932	41,400	9,700	51,100	0	0	36,000	33,100
1933	30,500	8,800	39,300	0	0	36,000	33,100
1934	24,600	0	24,600	5,400	6,000	24,600	24,600
1935	22,900	3,700	26,600	7,100	2,300	26,600	25,200
1936	43,400	27,800	71,200	0	0	36,000	33,100
1937	55,600	15,000	70,600	0	0	36,000	33,100
1938	50,300	14,500	64,800	0	0	36,000	33,100
1939	52,800	1,300	54,100	0	4,700	31,300	29,400
1940	23,400	0	23,400	6,600	6,000	23,400	23,400
1941	28,200	6,300	34,500	1,800	0	34,200	31,800
1942	63,700	0	63,700	0	6,000	30,000	28,500
1943	49,500	13,500	63,000	0	0	36,000	33,100
1944	44,000	30,400	74,400	0	0	36,000	33,100
1945	38,400	2,300	40,700	0	3,700	32,300	30,400
1946	71,400	7,600	79,000	0	0	36,000	33,100
1947	57,400	37,300	94,700	0	0	36,000	33,100
1948	63,400	28,600	92,000	0	0	36,000	33,100
Average	47,500	12,700	60,200	840	1,900	33,200	31,000