10-1965

L.A. General Data

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ANDROSCOGGIN RIVER STUDIES

TWENTY-THIRD

ANNUAL REPORT

1965

by

Walter A. Lawrance

Lewiston, Maine
October, 1965

TWENTY-THIRD

ANNUAL REPORT

1965

INDEX

Part One

Lewiston-Auburn General Data

1965

Summary

1. River odor was not objectionable in the Lewiston-Auburn area during the entire 1965 season. Kraft odor was objectionable several days in the Autumn (1964) and Spring (1965).

2. The Pollution Factor for the control period averaged 0.08; in 1941 it was 5.1. Sulphite waste liquor discharged to the Androscoggin river averaged 88.8 tons per week; in 1941 the average was 5820 tons per week. The International Paper Company's sulphite mill is scheduled to permanently close about October 30, 1965.

3. The planned increase in Kraft pulp production at Jay, Maine and Berlin, N.H., will increase the B.O.D. load to the river and may result in a serious deterioration of water quality.

4. Considering the very low flows, the dissolved oxygen and biochemical demands in the river water passing Lewiston, were better than expected.

5. Local press editorials were very favorable. The local "pollution committees" appear to have been inactive this year.

Part Two

Androscoggin River and Pool Analyses

1965

Summary

1. The dissolved oxygen content in the river water from Berlin to Virginia Bridge was more than adequate for biochemical oxygen demands. On this basis this stretch of the river should meet the requirements for C classification.

2. Due in part to very low flows, the river from Dixfield to North Turner Bridge had a very low oxygen content for much of the season . North Turner and Turner Center Bridge stations had the lowest oxygen content for several years.

3. Reaeration in the Pool was excellent; microbial film was absent. Aquatic plant growth is increasing in the shallow areas. Coarse fish have been caught at the Waterman road landing.

4. The average O.C.P. loss in the Pool was 4.6 ppm; the 17 year average is 5.3 ppm.

5. Seven cross-section samplings made at Dixfield to establish the validity of the sampling station.

6. Comparison tests indicate there is no significant difference between the D.O. results when the titration is conducted in the Field or in the Laboratory.

7. Comparisons of different procedures for determining D.O. were investigated. When differences exist the alkaline hypochlorite method yields slightly higher values than the azide procedure.

Part Three

Mill Pollution

1965

Summary

1. Based on this season's analytical results and expressed in Population Equivalents:

   (a) Brown Company's Pollution load to the river was equal to 162,240; 1964, 192,350 and 1963, 249,500.

   (b) At Gilead, Maine the total load had been reduced to 187,680; a 13.7% loss. At Virginia the P.Eq. was 86,160 a reduction of 54.1%. An overall reduction of 67.8%; 1964, 66%

   (c) Oxford Paper Company's pollution contribution was 449,040. The total load at Dixfield was 543,600 P.Eq.; at North Turner Bridge 217,920, a reduction of 60%

   (d) At Riley the pollution load appears to be 33.70 T/d or a population equivalent 404,400. The reduction between Dixfield and Riley is 23.4% or 29.2% depending upon the basis used.

   (e) International Paper Company's load to river was not determined this year.

2. The total pollution leaving Deer Rips Dam averaged 76,440 P.Eq.; about twice that at Bell's Ice House.

Part Four

Biochemical Activity in the Pool

1965

Summary

1. Biochemical Oxygen Demands and Dissolved Oxygen were determined each week day from Mid-June to Mid-September. A period of eleven weeks was chosen for comparative study. Time of passage was assumed uniform at nine days.

2. The average net reduction of B.O.D. in the Pool was 65% or 11.79 tons per day. This does not include the Benthal contribution.

3. This year, as in 1964 and 1963, the Pool area having the largest reduction of B.O.D. (26.5%) lies between Turner Center Bridge and Mile 4.25. The Mile 2.5 to Deer Rips Dam sector has a larger reduction (32.6%) but a portion lies outside of the Pool.

4. The oxygen sag-point changes with flow, temperature and pollution load. This season it was located about Mile three.

5. A 65% reduction in B.O.D. was accompanied by a net loss of 22.6% D.O.

6. The absence of microbial film has increased the reaeration in the Pool.

7. During the past three summers the total average soluble pollution load entering the Pool was approximately the same and much less than in previous years.

TWENTY-THIRD ANNUAL REPORT

PART ONE

LEWISTON-AUBURN GENERAL DATA

1965

Introduction. The arrangement of this report is similar to that employed for the previous two years. It is somewhat different from that used earlier due to the sulphite pulping process being confined to the Chisholm area. The permanent shut-down of the International Paper Company's sulphite mill will be too late to affect this season's analytical results.

Daily Report Data. The daily reports numbered one to eighty-seven inclusive, contain a record of

a. River odor, type and intensity
b. Air temperature
c. General weather conditions
d. Direction of wind
e. Water passing over Lewiston Falls
f. Surface appearance of the river
g. Conditions at Gulf Island and Deer Rips Dams (occasionally)

Continuing the proceedure initiated last year, Sunday inspections were omitted.

River Odor, Types etc. River odor was non-existent in the Lewiston-Auburn area, except on four days when a slight musty odor was recorded and one day when a mouldy odor was present. On all five occasions only a small area was covered. There was no general odor coverage

during the summer, however, there were several days last Fall and again this Spring, when a decided Kraft odor was present over considerable areas of the two cities extending outward from Deer Rips Dam. Odor at the two Dams was absent or at a very low level. On a few occasions hydrogen sulphide was present over the tailrace at Gulf Island Dam, but was not observed at Deer Rips Dam.

Air Temperatures. Table #I contains figures for the mean hourly temperatures, June through September.

TABLE #1

Mean Hourly Temperatures (°F)

Year	June	July	August	September
1965	64.89	67.62	67.30	59.22
1964	64.43	68.46	62.12	56.44
1963	65.97	70.89	63.80	56.07
1962	64.82	65.39	65.68	57.35
81 year average	63.24	68.86	66.66	59.21
Deviation from average	+1.65	-1.24	+0.64	+0.01

June and August were warmer than the long range, but July temperatures were subnormal. A three day period of very high temperatures, during the third week of September, enabled the average to equal the long range figure.

Precipitation. The Summer season began with a considerable deficit of water in storage due to smaller precipitation during the Winter and Spring. Table #2 contains the precipitation data for Lewiston 1961-1965 inclusive.

TABLE #2

Year	June	July	August	September
1965	2.15	1.39	2.30	1.91
1964	1.58	4.63	3.75	1.28
1963	1.02	1.23	5.71	1.74
1962	1.40	2.81	4.57	3.05
1961	3.15	3.46	1.61	3.92
91 year average	3.31	3.47	3.09	3.49
Deviation from Aver.	-1.16	-2.08	-0.79	-1.58

The precipitation deficit for four months ending September 30 was 5.61 inches. A very heavy precipitation occurred September 24-25 throughout the upper Androscoggin Valley.

River Surface Conditions. Whitish foam and film were present, usually in small amounts, on the river surface from Lewiston Falls to the Grand Trunk Railway bridge. Occasionally some brownish scum along the Auburn shore was also observed. This season the surface usually was clear from this Railway bridge to south of South Bridge.

Floating sludge was present in the Pool north of Mile three to above Turner Center Bridge, during June and to about mid July, in quantities which appeared to be somewhat

larger than that in 1964. For the remaining part of the summer, floaters were seldom seen.

Pollution Load Factors. The factors are calculated from the equivalent tons of sulphite waste liquor discharged to the river, per million cubic feet of water. From June first to October second, the International Paper Company's average discharge to the river was 88.8 equivalent tons per week; in 1964 the average was 87.8 The weekly data are listed in Table P.L.F. #1. Due to lower flows the factors are slightly higher than those of last summer. The 1965 summer factor is 0.08; the 1941 factor was 5.1.

P.L.P. #1

Weekly Pollution Factors*
(Based on Sulphite Waste Liquor)

Week Ending	International Paper Company Equivalent Tons per Week	Factor**
June 6	75.1	0.05
13	94.8	0.07
20	97.9	0.06
27	97.9	0.07
July 4	96.7	0.09
11	00.0	0.00
18	96.9	0.09
25	98.4	0.09
Aug. 1	97.1	0.10
8	96.3	0.10
15	95.3	0.09
22	85.4	0.07
29	95.7	0.10
Sept. 5	93.6	0.06
12	91.8	0.09
19	95.8	0.09
26	93.8	0.08
Oct. 3	95.0	0.08
Season average	88.8	0.08

*Brown Company and Oxford Paper Company Factors were zero.

**Based on Gulf Island Dam Flows.

River Flow. With the exception of June, river flow was very sub-normal throughout the season; the average for July was almost one thousand cfs below the twenty-eight year average. The July through September average, has now been sub-normal for three successive years.

For convenient references an appendix to this section of the report contains the average monthly and yearly river flow data for the period January 1927 to September 1965 inclusive, as reported by the guage stations at Berlin, N.H., Rumford, Maine, and Gulf Island Dam. The flow at Livermore Falls is calculated. It may be observed, that the average flows recorded January through September 1965, are lower at Berlin and Rumford but slightly higher at Livermore Falls and Gulf Island than those for 1941.

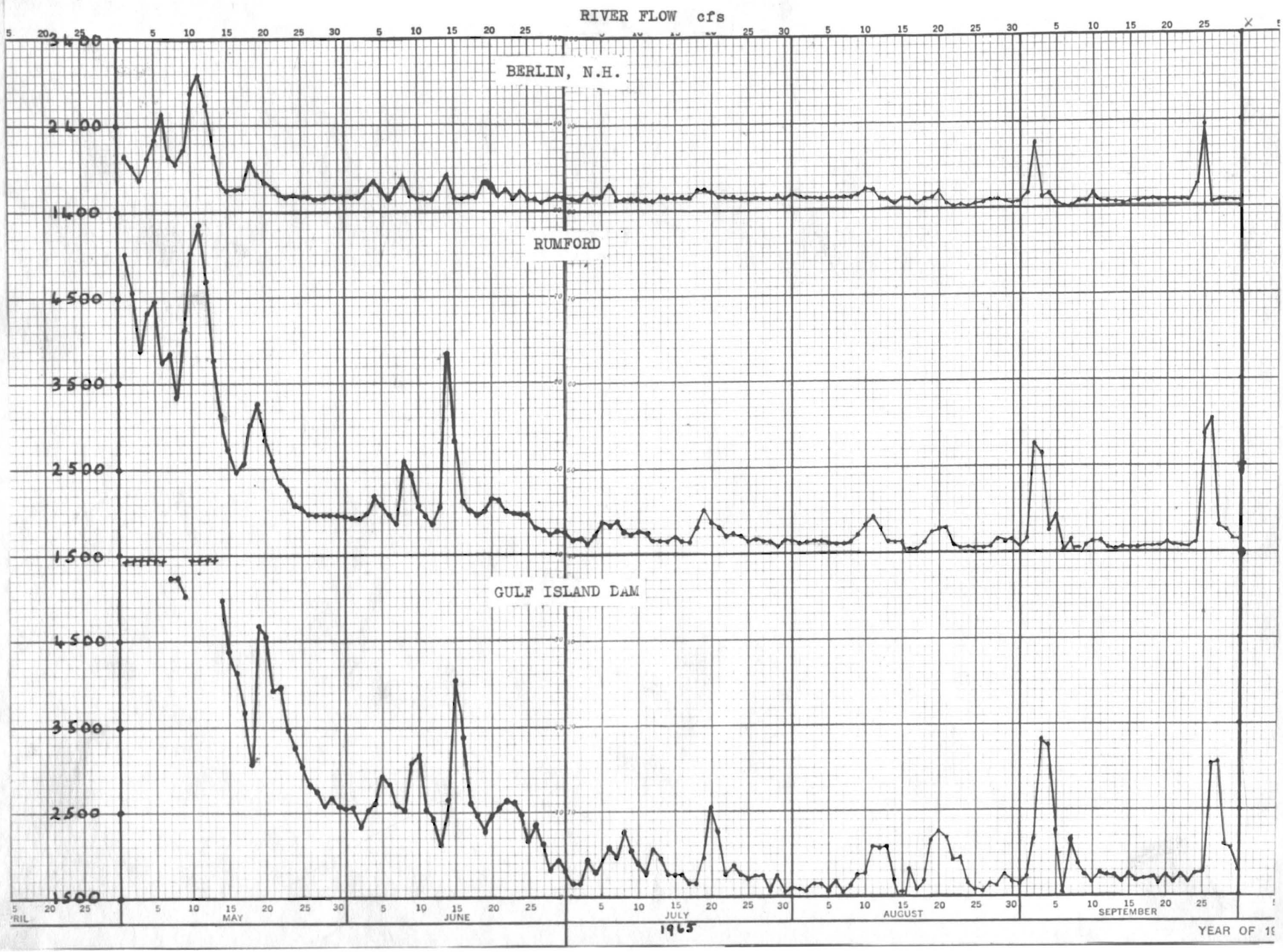
TABLE A.D.F. #1

Average Daily Flows

C.F.S.

Gulf Island Dam

Year	May	June	July	August	September	J.A.S. Average
1965	4600	2552	1832	1747	1990	1856
1964	5345	2466	2440	2326	2251	2339
1963	10414	3175	2279	2397	2299	2325
1962	8429	2730	2345	3275	3327	2982
1961	10545	5192	3450	2452	2422	2775
1960	14346	4782	3093	2637	3464	3064
1938-1965 Averages (28 Years)	10006	4732	2829	2463	2915	2735


RIVER FLOW cfs
BERLIN, N.H.
3400
2400
1400
RUMFORD
6500
3500
2500
1500
GULF ISLAND DAM
4500
3500
2500
1500
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1965
YEAR OF 19

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ANDROSCOGGIN RIVER FLOW

C. F. S.

MAY, 1965

Date	BERLIN	RUMFORD	LIVERMORE FALLS	GULF ISLAND DAM
1	2083	5020	5810	6930
2	1907	4560	6210	7230
3	1791	3890	5610	6510
4	2086	4320	4850	5670
5	2239	4460	5390	6310
6	2527	3650	5350	6100
7	2035	3830	4550	5230
8	1949	3360	4590	5240
9	2105	4140	4250	5010
10	2785	5030	5000	5740
11	2965	5380	5960	6750
12	2636	4700	6190	6890
13	2021	3770	5410	6010
14	1729	3010	4430	4990
15	1643	2740	3740	4370
16	1662	2470	3460	4080
17	1692	2540	3120	3670
18	1978	3010	2830	3070
19	1823	3250	3920	4690
20	1728	2830	3960	4560
21	1669	2600	3420	3920
22	1592	2370	3330	3950
23	1568	2280	2950	3450
24	1603	2070	2800	3250
25	1591	2050	2590	3040
26	1578	1990	2460	2810
27	1525	1980	2390	2730
28	1547	1970	2310	2590
29	1580	1960	2350	2670
30	1562	1950	2300	2590
31	1550	1940	2270	2550

ANDROSCOGGIN RIVER FLOW

C. F. S.

JUNE, 1965

Date	BERLIN	RUMFORD	LIVERMORE FALLS	GULF ISLAND DAM
1	1562	1920	2270	2550
2	1575	1920	2150	2340
3	1661	1990	2240	2510
4	1741	2270	2320	2600
5	1628	2190	2620	2920
6	1506	1950	2530	2820
7	1569	1870	2300	2590
8	1759	2590	2220	2510
9	1568	2420	2860	3090
10	1537	2050	2820	3160
11	1543	1930	2310	2530
12	1533	1870	2190	2410
13	1691	2060	2000	2110
14	1800	3820	2370	2630
15	1535	2820	4080	4300
16	1542	2120	3120	3370
17	1573	2010	2380	2600
18	1569	1970	2250	2460
19	1718	2000	2140	2280
20	1668	2150	2250	2470
21	1586	2040	2350	2550
22	1642	2000	2350	2620
23	1543	1980	2320	2590
24	1610	1970	2240	2470
25	1537	1960	2080	2180
26	1534	1800	2170	2350
27	1499	1780	1910	2010
28	1544	1720	1800	1810
29	1562	1760	1830	1920
30	1538	1750	1780	1800

ANDROSCOGGIN RIVER FLOW

C. F. S.

JULY, 1965

Date	BERLIN	RUMFORD	LIVERMORE FALLS	GULF ISLAND DAM
1	1540	1670	1710	1680
2	1525	1690	1680	1680
3	1592	1720	1810	1920
4	1553	1710	1760	1790
5	1574	1870	1600	1510
6	1706	1820	1980	2080
7	1516	1890	1910	1980
8	1516	1750	2080	2250
9	1535	1730	1850	1930
10	1547	1740	1820	1890
11	1510	1740	1760	1770
12	1502	1660	1910	2060
13	1543	1660	1820	1960
14	1553	1660	1710	1750
15	1546	1690	1700	1740
16	1556	1660	1710	1720
17	1566	1660	1660	1660
18	1631	1790	1670	1680
19	1622	2020	1880	1950
20	1587	1870	2060	2530
21	1548	1790	2080	2260
22	1559	1710	1770	1750
23	1539	1730	1800	1870
24	1527	1680	1740	1750
25	1532	1650	1700	1710
26	1544	1670	1700	1740
27	1524	1640	1710	1750
28	1525	1630	1590	1550
29	1568	1590	1690	1750
30	1533	1660	1560	1540
31	1593	1640	1630	1600

ANDROSCOGGIN RIVER FLOW

C. F. S.

August, 1965

Date	BERLIN	RUMFORD	LIVERMORE FALLS	GULF ISLAND DAM
1	1551	1610	1610	1590
2	1540	1630	1590	1570
3	1556	1640	1640	1640
4	1536	1650	1640	1640
5	1537	1600	1600	1560
6	1540	1600	1640	1680
7	1540	1600	1550	1510
8	1541	1630	1610	1620
9	1566	1700	1690	1740
10	1633	1820	1740	1780
11	1634	1910	1950	2070
12	1508	1790	1990	2050
13	1505	1630	1940	2070
14	1474	1620	1660	1690
15	1423	1630	1710	1460
16	1418	1490	1730	1810
17	1456	1530	1540	1590
18	1509	1610	1610	1680
19	1533	1730	1900	2150
20	1595	1780	2010	2250
21	1450	1790	1950	2090
22	1413	1590	1850	1910
23	1444	1530	1780	1950
24	1411	1560	1590	1640
25	1447	1530	1570	1570
26	1474	1520	1540	1540
27	1497	1570	1580	1640
28	1502	1660	1590	1610
29	1482	1620	1710	1750
30	1455	1630	1650	1680
31	1483	1560	1620	1620

ANDROSCOGGIN RIVER FLOW

C. F. S.

SEPTEMBER, 1965

Date	BERLIN	RUMFORD	LIVERMORE FALLS	GULF ISLAND DAM
1	1583	1670	1650	1720
2	2164	2750	1930	2160
3	1526	2630	3050	3310
4	1568	1760	2970	3260
5	1464	1920	2020	2250
6	1402	1500	1700	1520
7	1426	1650	1840	2130
8	1484	1470	1770	1880
9	1485	1580	1620	1740
10	1571	1610	1620	1660
11	1481	1640	1700	1780
12	1468	1550	1700	1760
13	1456	1530	1660	1760
14	1427	1550	1620	1690
15	1447	1540	1660	1760
16	1458	1540	1620	1690
17	1453	1550	1630	1710
18	1480	1530	1590	1620
19	1471	1540	1540	1630
20	1485	1600	1640	1720
21	1469	1580	1630	1650
22	1475	1570	1660	1720
23	1452	1550	1620	1660
24	1683	1600	1650	1740
25	2348	2890	1700	1780
26	1415	3030	2980	3050
27	1481	1800	3220	3390
28	1466	1750	1960	2100
29	1434	1650	1920	2060
30	1468	1660	1730	1800

Water Temperatures. Water temperatures at Gulf Island Dam were higher than average during May, but only slightly higher in June and August; July and September were subnormal. The "heat wave" experienced in the third week of September produced a rapid increase in water temperatures as much as four degrees centegrade in some areas.

TABLE T#1

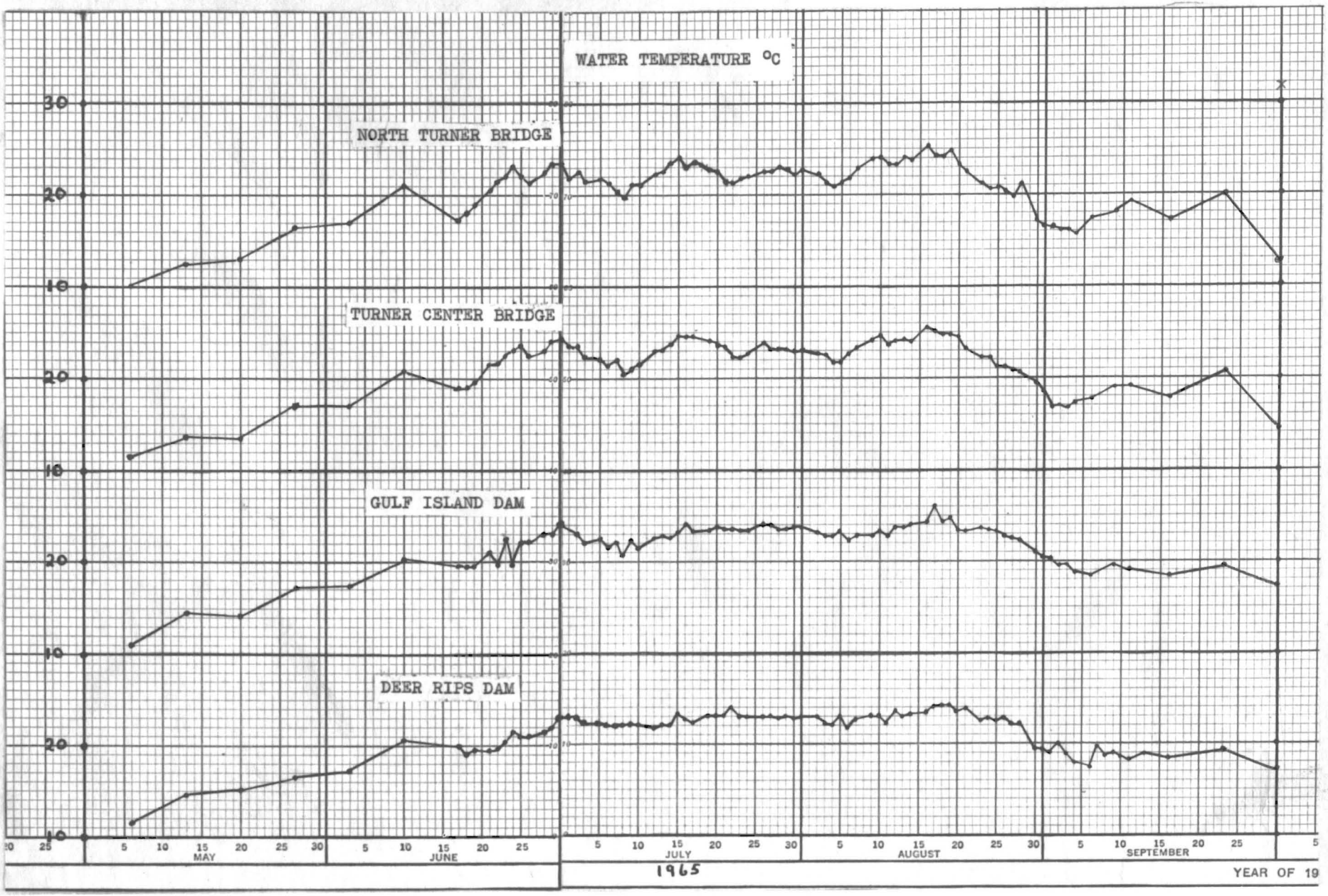
Water Temperatures (°C)

Gulf Island Dam
(Monthly Averages)

Year	May*	June	July	Aug.	Sept.
1965**	14.1	20.0	22.8	23.2	19.0
1964	15.1	20.3	22.0	20.7	19.9
1963	12.0	21.6	23.5	22.3	17.9
1962	11.5	21.3	21.9	21.5	19.0
1961	10.9	19.2	23.0	23.5	22.4
23 year average	12.4	19.8	23.5	22.9	19.3
1965 Comparison with average	+1.7	+0.2	-0.7	+0.3	-0.3

*Based on Thursday reports
**June through mid-September based on daily reports.

Lewiston 1965. For the sixth consecutive year, there was no objectionable river odor in the down-town Lewiston-Auburn area and there was no general coverage of odor during the summer months. However, last Fall and again this Spring there were a few days when Kraft odor was present in the region of Deer Rips


WATER TEMPERATURE °C
NORTH TURNER BRIDGE
TURNER CENTER BRIDGE
GULF ISLAND DAM
DEER RIPS DAM
30
20
10
20
10
20
10
20
10
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1965
YEAR OF 19

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Dam and occasionally in the College Campus area. Biochemical Oxygen Demands usually were below 1.50 ppm and occasionally below 1.0 ppm. Dissolved Oxygen in the water passing Chestnut Street Bridge station was seldom below two ppm. Water surface conditions usually were good and seldom unsightly. Local press editorial and news items were favorable. The local "pollution committees" appear to have been inactive so far this year.

TABLE #7

Lewiston 1965 River Data*

Date	Water Temp. °C	B.O.D. 5 day ppm	D.O. ppm	G.I.D. Flow C.F.S.
June 3	17.0	2.18	3.68	2510
10	19.8	1.56	2.53	3160
17	19.2	1.28	2.68	2600
24	20.8	1.40	2.85	2470
July 1	22.5	1.02	2.75	1680
8	21.7	0.85	3.83	2250
15	23.0	0.95	3.03	1740
22	23.0	1.15	3.63	1750
29	23.0	2.64	1.09	1750
Aug. 5	23.0	0.70	3.06	1560
12	23.2	1.33	3.68	2050
19	24.2	0.80	2.30	2150
26	22.8	0.87	2.70	1540
Sept. 2	19.2	0.88	4.98	2160
9	18.5	1.40	4.40	1740
16	18.3	0.80	4.95	1690
23	19.0	0.85	3.83	1660
30	16.9		4.90	1800

*Thursday data.

ANDROSCOGGIN RIVER FLOWS

Summary Daily Average Flows

1927 - 1965

Year	Berlin	Rumford	Livermore Falls*	Gulf Island Dam
1927	2182	3621	3450	5336
1928	2795	4228	4421	6172
1929	2514	3633	3989	5080
1930	2263	3468	3391	4708
1931	1943	3075	3225	4297
1932	2499	3898	4288	5210
1933	2701	3973	3966	5201
1934	2444	3661	4034	4783
1935	2493	3681	4332	4857
1936	3410	4832	--	6579
1937	2996	4837	5435	6557
1938	2559	4047	4500	5512
1939	2533	3578	3995	4540
1940	2190	3455	3871	4681
1941	1763	2352	2639	2824
1942	2227	3590	3943	4443
1943	2925	4351	4983	5688
1944	2358	3554	4015	4597
1945	3140	5184	6006	7083
1946	2425	3767	4413	5078
1947	3035	4276	5167	5708
1948	1950	3888	3466	3865
1949	1880	2787	3305	3712

*Union Water Power Company Estimates

ANDROSCOGGIN RIVER FLOWS (continued)

Year	Berlin	Rumford	Livermore Falls*	Gulf Island Dam
1950	2374	3026	4531	5087
1951	2585	4530	5067	5764
1952	2391	3860	4505	5049
1953	2280	3991	4851	5591
1954	3742	5878	6930	7908
1955	2692	3926	4294	4667
1956	2175	3032	3647	4152
1957	1910	2918	3284	3611
1958	2931	4408	5129	5857
1959	2536	4401	5968	5504
1960	2808	4487	5278	6007
1961	2067	3153	3775	4215
1962	2290	3794	4553	5201
1963	2593	3776	4589	5289
1964	2164	3029	3566	4024
1965 (9 months)	1671	2265	2812	3051
1965				

*Union Water Power Company Estimates

BERLIN RIVER FLOW

Monthly Daily Average

Year	1927	1928	1929	1930	1931
January	1823	2413	2224	1407	1656
February	1834	2412	2253	1419	1618
March	1948	2451	2256	1658	1617
April	2846	3487	4378	3491	3183
May	2132	7198	6647	4345	2160
June	1956	3428	2241	4172	2137
July	1928	2108	2066	2044	1773
August	1778	2024	1743	1842	1719
September	1741	1961	1718	1787	1773
October	1834	2002	1606	1694	1764
November	3277	1973	1518	1637	1740
December	3084	2064	1520	1664	1972
TOTAL	26181	33521	30170	27160	23312
Year Aver.	2182	2793	2514	2263	1943

Year	1932	1933	1934	1935	1936
January	2390	2374	1938	2096	1601
February	2061	2218	2035	2288	1597
March	1962	2125	2109	2331	7943
April	3527	4818	6193	3857	5042
May	4490	6973	4140	3536	8056
June	3072	2848	2027	5255	1980
July	1892	2088	2070	2142	1770
August	1846	1837	1857	1751	1683
September	2304	1788	1752	1699	1642
October	2036	1695	1659	1614	1759
November	2164	1712	1680	1632	1965
December	2244	1934	1863	1719	5886
TOTAL	29988	32410	29323	29920	40924
Year Aver.	2499	2701	2444	2493	3410

BERLIN RIVER FLOW

Monthly Daily Average

Year	1937	1938	1939	1940	1941
January	2825	2313	2384	1628	1817
February	2607	2170	2295	1690	1882
March	2948	2631	2665	1664	1847
April	3750	4938	4044	2229	3439
May	10053	3889	5738	6106	1747
June	2544	1902	2678	2575	1616
July	1944	1815	1940	1858	1582
August	1868	1836	1791	1684	1511
September	1817	2535	1705	1692	1408
October	1803	1876	1733	1616	1375
November	1818	1936	1767	1753	1441
December	1970	2872	1681	1783	1488
TOTAL	35947	30713	30401	26278	21153
Year Aver.	2996	2559	2533	2190	1763

Year	1942	1943	1944	1945	1946
January	1387	1646	2489	2658	2515
February	1410	1617	2091	2542	2507
March	1503	1649	2371	4252	3801
April	4606	2663	3414	6177	2508
May	2926	6071	5448	6938	4096
June	4613	6163	1965	2521	2213
July	1915	2041	1763	2272	2014
August	1705	2460	1728	1822	1868
September	1632	2508	1647	1815	1735
October	1618	2002	1688	2153	1814
November	1680	3324	1777	2437	1834
December	1725	2956	1916	2097	2196
TOTAL	26720	35100	28297	37684	29101
Year Aver.	2227	2925	2358	3140	2425

BERLIN RIVER FLOW

Monthly Daily Average

Year	1947	1948	1949	1950	1951
January	2674	1446	1891	1675	2582
February	2873	1409	1884	2100	2537
March	3416	1447	1988	2119	2560
April	3869	3031	3474	3671	5399
May	8525	4309	2128	2960	4554
June	4487	1744	1745	2148	2151
July	2018	1639	1603	2666	1819
August	2115	1808	1768	1983	1983
September	1875	1749	1592	2032	1947
October	1648	1431	1490	1906	1703
November	1549	1554	1442	2344	1929
December	1374	1836	1549	2883	2159
TOTAL	36423	23403	22554	28487	31023
Year Aver.	3035	1950	1880	2374	2585

Year	1952	1953	1954	1955	1956
January	2230	1263	1718	3059	1821
February	2289	1377	1781	2664	1814
March	2416	3635	1926	2796	1824
April	4539	4423	5921	5009	2654
May	3312	4501	5741	4526	4474
June	4256	1637	4755	3077	2685
July	1823	1773	2740	1946	1748
August	1808	1817	2312	2101	1734
September	1713	1807	6486	2145	1879
October	1598	1726	4951	1809	1841
November	1433	1660	3216	1654	1995
December	1275	1745	3362	1516	1611
TOTAL	28692	27364	44909	32302	26080
Year Aver.	2391	2280	3742	2692	2173

BERLIN RIVER FLOW

Monthly Daily Average

Year	1957	1958	1959	1960	1961
January	1836	2544	2288	3103	1703
February	1806	3011	2105	3242	1632
March	1771	3081	2015	3129	1637
April	2021	5680	3867	5323	2500
May	2043	4637	2074	5145	2970
June	1608	2516	3208	2179	3029
July	1726	1988	2363	1958	2045
August	1807	2139	2054	1957	2051
September	1847	2382	2052	1970	2022
October	1790	2456	2397	1935	1916
November	1777	2362	2723	1912	1697
December	2893	2439	3281	1842	1606
TOTAL	22925	35177	30427	33698	24808
Year Aver.	1910	2931	2536	2808	2067

Year	1962	1963	1964	1965
January	1579	2531	2574	1797
February	1565	2496	2498	1714
March	1580	2756	2507	1706
April	3838	3846	3428	1773
May	3119	4466	2366	1895
June	1804	2163	1797	1596
July	1785	1781	1779	1554
August	2097	1938	1921	1505
September	2234	2024	1955	1533
October	2540	2011	1833	
November	2744	2718	1672	
December	2594	2587	1639	
TOTAL	27479	31117	25969	
Year Aver.	2290	2593	2164	

RUMFORD RIVER FLOW

Monthly Daily Average

Year	1927	1928	1929	1930	1931
January	2311	3695	3316	1862	1825
February	2281	3509	2912	1888	1782
March	3625	4315	3856	2776	2173
April	5209	7187	7953	7809	7167
May	4443	9927	10369	7027	4850
June	2990	4977	2978	6013	4701
July	2843	2796	2453	2933	2422
August	2417	2726	2028	2540	2045
September	2378	2966	1977	2034	2433
October	3900	2847	2025	1982	2384
November	7225	3003	1915	2731	2496
December	4826	2785	1818	2016	2625
TOTAL	43448	50733	43600	41611	36901
Year Aver.	3621	4228	3633	3468	3075

Year	1932	1933	1934	1935	1936
January	3561	2865	2392	4246	2082
February	2673	2634	2304	2776	1849
March	2522	2562	2722	3257	17419
April	8013	10377	12198	8030	8667
May	6529	10283	6420	6412	10381
June	3660	3632	2684	7349	2472
July	2451	2759	2519	2861	2025
August	2367	2886	2095	2104	1823
September	3797	2127	2554	2075	1833
October	3715	2866	2206	1860	2903
November	4522	2415	3014	2317	2699
December	2963	2273	2828	2090	3806
TOTAL	46773	47679	43936	44177	57989
Year Aver.	3898	3973	3661	3681	4832

RUMFORD RIVER FLOW

Monthly Daily Average

Year	1937	1938	1939	1940	1941
January	4169	3705	2980	1708	2351
February	3530	3118	2638	1765	2443
March	3781	4347	3010	1742	2132
April	7962	9043	7487	5439	6213
May	16386	5720	10355	12610	2550
June	4003	2474	3520	4036	1924
July	2857	2574	2323	2367	2015
August	2306	2339	2091	1948	1686
September	2197	4787	1867	2445	1517
October	3608	2649	2081	1905	1567
November	4248	2550	2423	3039	1934
December	3191	5258	2157	2451	1901
TOTAL	58038	48564	42932	41455	28233
Year Aver.	4837	4047	3578	3455	2352

Year	1942	1943	1944	1945	1946
January	1803	1859	2915	9380	3366
February	1517	1937	2331	3110	2993
March	2360	2420	2661	7703	7919
April	9850	5450	6973	10559	5146
May	5026	11326	10295	11016	6364
June	6918	6724	3623	3837	2965
July	2301	2488	2405	2973	2266
August	1838	3201	1878	2155	2915
September	1888	3308	2041	2280	2192
October	2013	4195	2330	3654	3298
November	2731	5732	2536	3429	2914
December	2437	3575	2657	2110	2866
TOTAL	40682	52215	42645	62206	45204
Year Aver.	3390	4351	3554	5184	3767

RUMFORD RIVER FLOW

Monthly Daily Average

Year	1947	1948	1949	1950	1951
January	3487	1436	3380	2583	3331
February	4537	1427	2305	2486	4005
March	5119	3235	3249	2824	3761
April	8040	6436	7031	9153	13506
May	13229	8362	3714	5826	7236
June	7141	2672	2304	3188	2904
July	3288	1853	1776	2964	2440
August	2495	1938	1828	2136	2264
September	2063	1754	1750	2202	2276
October	1652	1631	1657	2169	1790
November	1897	3097	2098	5434	4534
December	1429	2473	2353	6290	3269
TOTAL	54357	36314	33445	46655	51316
Year Aver.	4276	3888	2787	3028	4530

Year	1952	1953	1954	1955	1956
January	3044	1986	2023	3560	3383
February	2970	2151	2430	3197	2109
March	3212	9457	3191	3680	2022
April	11485	10039	12265	10549	5602
May	7482	8025	10910	7086	8122
June	6745	2141	6356	4239	3567
July	2103	2000	3730	2218	1790
August	1927	2111	3063	2664	1770
September	1845	1963	9298	2206	2010
October	1716	1977	6346	2230	2020
November	1608	2891	5183	3013	2618
December	2181	3151	4741	1450	1370
TOTAL	46318	47892	70536	47112	36383
Year Aver.	3860	3991	5878	3926	3032

RUMFORD RIVER FLOW

Monthly Daily Average

Year	1957	1958	1959	1960	1961
January	2379	3319	2979	3864	1995
February	2191	3328	2499	3939	2254
March	2551	3696	2668	3607	2597
April	4533	12654	9018	11641	5246
May	3354	9065	3193	10662	8544
June	2065	3333	4813	3160	4062
July	2201	2743	2753	2528	2525
August	1953	2529	2397	2245	2239
September	1897	2593	2675	2967	2209
October	1952	3595	5583	3020	2088
November	3186	3375	7144	2928	2152
December	6759	2669	6095	2279	1926
TOTAL	35021	52899	52817	53840	37837
Year Aver.	2918	4408	4401	4487	3153

Year	1962	1963	1964	1965
January	1954	3093	3683	2165
February	1761	2765	3105	2067
March	2162	3388	3805	2327
April	9026	7335	6901	3407
May	5997	6976	3701	3201
June	2208	2601	2122	2089
July	2080	2109	1977	1722
August	2890	2182	2205	1637
September	2882	2163	2066	1773
October	5180	2193	1991	
November	5420	6436	2437	
December	3971	4070	2360	
TOTAL	45532	45311	36353	
Year Aver.	3794	3776	3029	

LIVERMORE RIVER FLOW

Monthly Daily Average

Year	1927	1928	1929	1930	1931
January	2611	5723	4055	1983	1881
February	2403	5331	3216	2000	1871
March	4135	4757	4532	3963	2593
April	4732	6220	9546	7493	7648
May	3974	8979	10466	5507	4367
June	3236	4596	3301	4914	4959
July	2900	2970	2776	2876	2687
August	2480	3019	2161	2490	2154
September	2354	2996	2060	2024	2676
October	3307	3129	2029	2136	2554
November	4706	3098	2057	2985	2748
December	4562	3230	1864	2315	2764
TOTAL	41400	53047	47863	40686	38702
Year Aver.	3450	4421	3989	3391	3225

Year	1932	1933	1934	1935	1936
January	3329	2826	2318	3048	2138
February	2873	2541	2014	2835	1878
March	2989	2480	2694	3609	--
April	10074	11444	15862	11669	--
May	6068	9466	6971	8201	--
June	3484	3445	2906	8422	--
July	2359	2454	2475	3635	--
August	2258	2817	1998	2162	1667
September	3921	1947	2664	1974	1738
October	3801	3298	2401	1749	3048
November	7462	2539	3114	2439	2692
December	3037	2329	2994	2243	--
TOTAL	51455	47586	48411	51986	Insufficient
Year Aver.	4288	3966	4034	4332	Data

LIVERMORE RIVER FLOW
Monthly Daily Average

Year	1937	1938	1939	1940	1941
January	--	4012	3075	1605	2704
February	3561	2424	2855	1715	3108
March	*4300	5124	3200	1828	2708
April	*9847	11398	9327	6140	7174
May	*19600	6885	12365	15099	3168
June	3527	2616	3800	4913	2389
July	2596	*2911	2269	2674	1965
August	2315	2468	2177	1827	1509
September	2288	4872	1881	2386	1464
October	3369	2738	2130	1918	*1575
November	5062	2707	2482	3758	1906
December	3425	5848	2384	2591	*2000
TOTAL	59790	54003	47945	46454	31668
Year Aver.	5435	4500	3995	3871	2639

Year	1942	1943	1944	1945	1946
January	1793	1900	3115	9700	3783
February	1360	2100	*2625	3260	3120
March	3080	2689	3012	8918	9484
April	12398	6740	8396	12858	6671
May	6143	13184	*11581	13196	7740
June	8568	7855	3948	4757	3545
July	2482	2718	2574	3399	2441
August	1868	3450	1918	2238	3243
September	1900	3400	2185	2373	2285
October	2050	4876	2538	4360	4193
November	2875	7130	2966	4137	3491
December	2600	3754	3326	2870	3282
TOTAL	47317	59796	48181	72066	52958
Year Aver.	3943	4983	4015	6006	4413

*Estimated

LIVERMORE RIVER FLOW

Monthly Daily Average

Year	1947	1948	1949	1950	1951
January	3800	1541	4743	2875	3701
February	5579	1561	2576	2824	4777
March	5985	4057	4210	3568	4561
April	9805	7593	8769	11714	12040
May	14895	9874	4509	6123	7992
June	8098	3429	2624	3572	3124
July	3684	2022	1876	3101	2679
August	2643	1975	1839	2237	2393
September	2168	1771	1798	2310	2460
October	1725	1675	1709	2279	1880
November	2075	3478	2370	6095	6131
December	1554	2614	2631	7673	4064
TOTAL	62009	41590	39654	54371	60802
Year Aver.	5167	3466	3305	4531	5067

Year	1952	1953	1954	1955	1956
January	5651	2357	2202	3966	4747
February	3436	2850	2787	3640	2299
March	3929	12198	4263	4168	2210
April	14275	15682	14656	12549	7377
May	9078	9325	12920	7919	10007
June	7672	2443	6809	4686	4348
July	2182	2079	4485	2341	1900
August	1918	2167	3286	2758	1920
September	1842	1946	11959	2209	2120
October	1754	1996	7680	2139	2150
November	1655	3273	6501	3738	2901
December	2666	3898	5609	1420	1790
TOTAL	54058	58214	83164	51533	43769
Year Aver.	4505	4851	6930	4294	3647

LIVERMORE RIVER FLOW

Monthly Daily Average

Year	1957	1958	1959	1960	1961
January	2626	4211	3178	4487	2290
February	2415	3858	2766	4727	2380
March	3299	4361	3082	4102	3345
April	5252	15443	11267	14905	8473
May	4043	11085	3726	12706	9639
June	2300	3694	5390	4082	4708
July	2274	2921	3076	2797	2854
August	2046	2682	2551	2496	2355
September	1931	2680	2992	3232	2327
October	1985	3839	6369	3414	2213
November	3541	3883	8098	3546	2473
December	7699	2946	7124	2845	2239
TOTAL	39411	61553	59619	63339	45296
Year Aver.	3284	5129	5968	5278	3775

Year	1962	1963	1964	1965
January	2240	3362	4384	2478
February	1957	3029	3620	2391
March	2483	3739	4713	3155
April	11260	10306	8643	4486
May	7551	8894	4653	3994
June	2504	2931	2314	2342
July	2217	2203	2226	1783
August	3077	2291	2368	1703
September	3127	2167	2167	1887
October	6213	2287	2144	
November	7144	8261	2748	
December	4867	5592	2809	
TOTAL	54640	55062	42789	
Year Aver.	4553	4589	3566	

GULF ISLAND DAM RIVER FLOW

Monthly Daily Average

Year	1927	1928	1929	1930	1931
January	2785	4886	4238	2186	2042
February	2573	4379	3367	2210	1973
March	6502	4809	5920	5466	3094
April	8574	12413	14089	12167	12600
May	7576	15099	16755	8691	7716
June	4178	8323	3905	8274	7162
July	3239	3930	2743	3503	2860
August	2765	3258	2154	3142	2293
September	2748	3641	1971	2182	2719
October	5008	3342	1994	2306	2845
November	10799	3392	2060	3843	3310
December	7284	3590	1768	2528	2945
TOTAL	64031	74062	60964	56498	51559
Year Aver.	5336	6172	5080	4708	4297

Year	1932	1933	1934	1935	1936
January	4856	3127	2634	3639	2849
February	3248	2988	2490	3179	2446
March	3195	3050	3469	4226	28500
April	13155	17062	19129	12840	13505
May	8053	13125	8281	8990	13898
June	4184	4218	3011	9729	2929
July	2726	2735	2696	3829	2115
August	2624	3396	2055	2265	1802
September	5121	3326	3668	2234	1845
October	4475	3964	2650	1917	3647
November	7267	2950	3769	2813	3210
December	3615	2465	3549	2622	2201
TOTAL	62519	62406	57401	58283	78949
Year Aver.	5210	5201	4783	4857	6579

GULF ISLAND DAM RIVER FLOW

Monthly Daily Average

Year	1937	1938	1939	1940	1941
January	5121	6499	3533	1799	3007
February	4752	3958	3088	1813	3259
March	4961	6109	3407	2115	2709
April	11709	13446	11408	10767	8235
May	22503	8097	14458	17589	3197
June	5575	3068	4501	5806	2170
July	3172	4306	2461	2920	2136
August	2420	2711	2250	2073	1727
September	2216	5107	1894	2625	1481
October	4620	3187	2100	1932	1584
November	6547	3116	2890	4000	2216
December	5089	7537	2690	2730	2161
TOTAL	78685	66141	54480	56169	33883
Year Aver.	6557	5512	4540	4681	2824

Year	1942	1943	1944	1945	1946
January	2262	2128	3345	13300	4184
February	1619	2316	2743	3850	3343
March	4207	3517	3487	10139	11537
April	13526	8089	10642	15273	8197
May	7053	14985	13253	15384	8454
June	9544	8912	4362	5701	4026
July	2770	2976	2727	3824	2586
August	1966	3759	1984	2327	3535
September	1929	3548	2354	2471	2464
October	2112	5490	2761	5117	4946
November	3218	8530	3501	4872	4003
December	3107	4009	4002	2740	3666
TOTAL	53313	68259	55161	84998	60941
Year Aver.	4443	5686	4597	7083	5078

GULF ISLAND DAM RIVER FLOW

Monthly Daily Average

Year	1947	1948	1949	1950	1951
January	4086	1636	5631	3178	4000
February	6493	1672	2812	3088	5451
March	6758	4848	4828	4241	5420
April	11387	8538	10229	14109	20138
May	16344	11260	5262	6693	8691
June	8737	3932	2917	3896	3244
July	4046	2159	1951	3187	2883
August	2751	2014	1650	2314	2500
September	2241	1776	1839	2404	2617
October	1780	1718	1757	2366	1960
November	2282	3825	2616	6923	7505
December	1653	2996	2846	8639	4755
TOTAL	68498	46374	44538	61038	69164
Year Aver.	5708	3865	3712	5087	5764

Year	1952	1953	1954	1955	1956
January	4157	2694	2352	4269	5921
February	3834	3443	3126	4027	2464
March	4617	15374	5165	4605	2369
April	16907	16103	16959	14294	9267
May	10265	10265	14423	8497	11327
June	8335	2685	7449	5061	4945
July	2225	2146	4824	2410	2000
August	1908	2215	3598	2632	1880
September	1837	1938	14138	2206	2220
October	1782	2039	8823	2178	2270
November	1696	3676	7651	4220	3212
December	3025	4513	6385	1400	1950
TOTAL	60588	67091	94893	55999	49825
Year Aver.	5049	5591	7908	4667	4152

GULF ISLAND DAM RIVER FLOW

Monthly Daily Average

Year	1957	1958	1959	1960	1961
January	2893	5054	3352	4954	2530
February	2663	4312	2979	5399	2592
March	3905	4942	3449	4601	3942
April	5928	18152	13241	17699	10630
May	4567	12420	4115	14346	10545
June	2541	3970	5964	4782	5192
July	2343	3105	3222	3093	3156
August	2120	2785	2707	2637	2452
September	1956	2751	3212	3464	2422
October	2019	4116	7112	3765	2319
November	3841	4210	9151	4127	2745
December	8559	3188	7540	3212	2056
TOTAL	43335	70287	66044	72079	50581
Year Aver.	3611	5857	5504	6007	4215

Year	1962	1963	1964	1965
January	2482	3608	5008	2725
February	2121	3242	4036	2875
March	2895	4113	5490	3860
April	13506	12882	10236	5476
May	8429	10417	5345	4600
June	2730	3175	2466	2552
July	2345	2281	2440	1832
August	3274	2398	2514	1747
September	3328	2298	2251	1990
October	7128	2328	2273	
November	8565	10170	3038	
December	5611	6563	3185	
TOTAL	62412	63475	48282	
Year Aver.	5201	5290	4024	