10-1966

Pool Studies

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TWENTY-FOURTH ANNUAL REPORT

Part Two

ANDROSCOGGIN RIVER AND POOL ANALYSES

1966

Introduction. Part two of this report contains the results and comparisons of analytical and test data, chiefly dissolved oxygen, obtained from river water sampled at different locations in the river and the Pool. This year additional stations were located at Swan's Pit, and Pump House (at Jay); Jay Mill test station is somewhat west of the previous Jay sampling point. Sampling at Mile One in the Pool was discontinued. Chemical Demand (O.C.P.) test was abandoned at all stations except at North Turner Bridge and Deer Rips Dam. Hydrogen ion (pH) tests were made at all stations. For B.O.D. refer to Parts three and four. For stations upstream from North Turner Bridge comparisons are made on a monthly basis. The Pool data are compared on a weekly basis for a period of eleven weeks, adjusted for a fixed time of passage.

Dissolved Oxygen. Dissolved Oxygen data have been tabulated for all of the sampling stations along the Androscoggin river. Plots have been drawn for most of the stations. The analytical results may be summarized as follows.

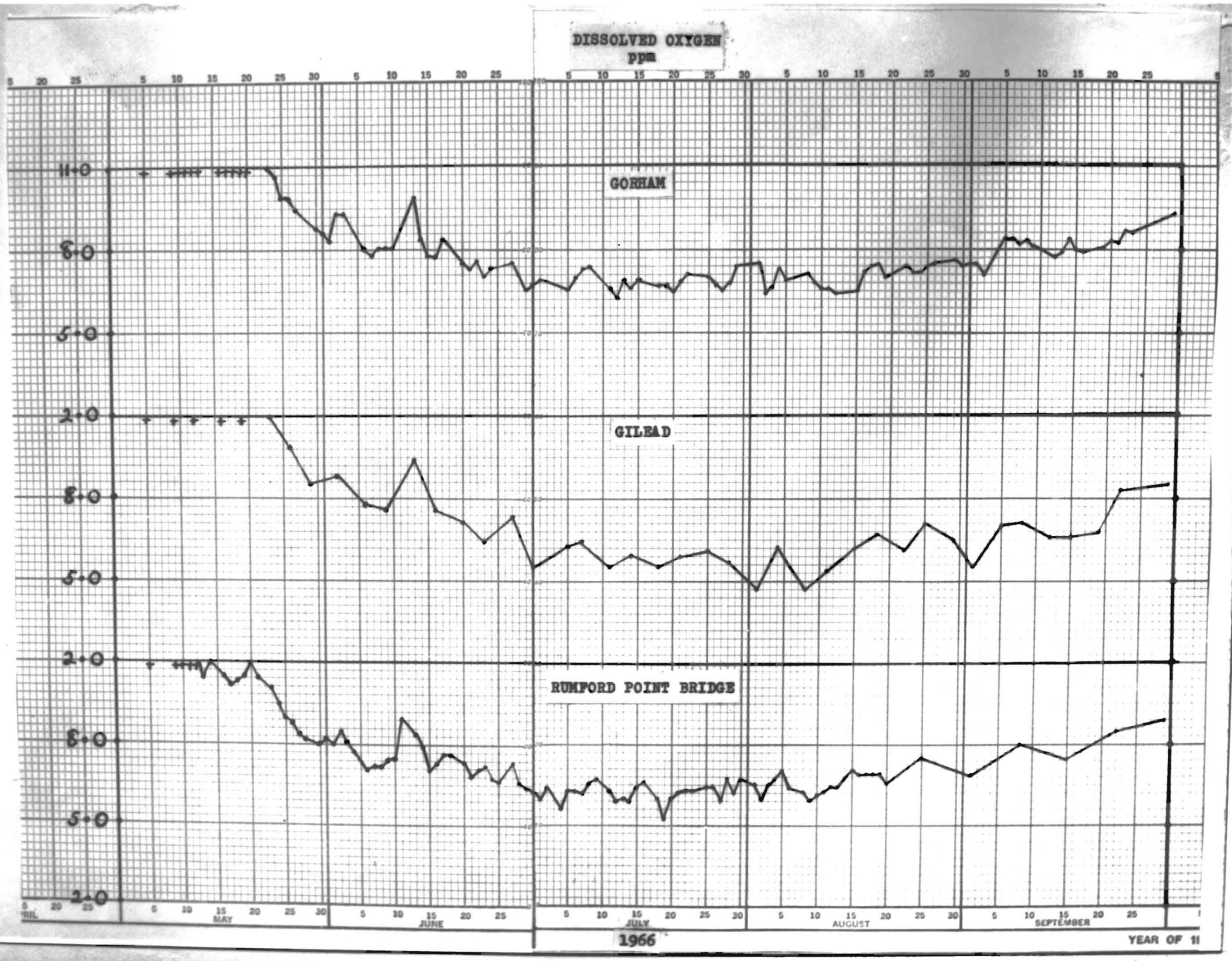
1. Bell's Ice House. Through the June-September 23 period river flows were moderately uniform and the dissolved oxygen was at or near 80% saturation. With only very limited data, the average daily load of available oxygen was 88,860 lbs; the 1965 and 1964 loads were 70,220 lbs. and 87,540 lbs. respectively.

2. Gorham, N.H. During the 1966 season there were no tests below 6.0 ppm. The lowest test recorded was on July 12 when the D.O. was reported as 6.31 ppm. The average daily load of available oxygen was 82,660 lbs., that available last year was 57,660 lbs.; the 1964 and 1963 figures were 85,820 lbs. and 90,240 lbs. respectively.

3. Gilead, Maine. Unfortunately the test data are very limited at this important station; only two samples were obtained each week. The writer recommends that a continuous D.O. recorder be located at the bridge and perhaps at Bethel or at least daily sampling from May through October 15. There were only two tests reported below 5.0 ppm, both were 4.66 ppm and were known to be caused by "spills" at the Berlin mills. During the 1964-1966 period the records show

1966	2	days	below	FIVE	ppm	10	days	below	SIX	ppm
1965	3	"	"	"	"	10	"	"	"	
1964	0	"	"	"	"	0	"	"	"	

However, caution must be used interpreting these figures because of the limited testing.


DISSOLVED OXYGEN
ppm
GORHAM
GILEAD
RUMFORD POINT BRIDGE
11·0
8·0
5·0
2·0
8·0
5·0
2·0
8·0
5·0
2·0
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1966
YEAR OF 1

4. Rumford Point Bridge. Dissolve Oxygen analyses were made six days each week from May five through August twenty when, upon request from Oxford Paper Company, only one (Thursday) test was made until mid October. Comparisons with three previous years show

1966	0	days	below	FOUR	ppm	0	days	below	FIVE	ppm
1965	0	"	"	"	"	4	"	"	"	"
1964	0	"	"	"	"	1	"	"	"	"
1963	0	"	"	"	"	0	"	"	"	"

5. Virginia Bridge. This sampling station has become very important in the State of Maine classification studies. D.O. determinations were made at least five days each week through the season; the average daily available oxygen was 93,120 lbs. The August daily average was the lowest during this season with 75,720 lbs. available. The 1965 season average was 64,620 lbs. per day.

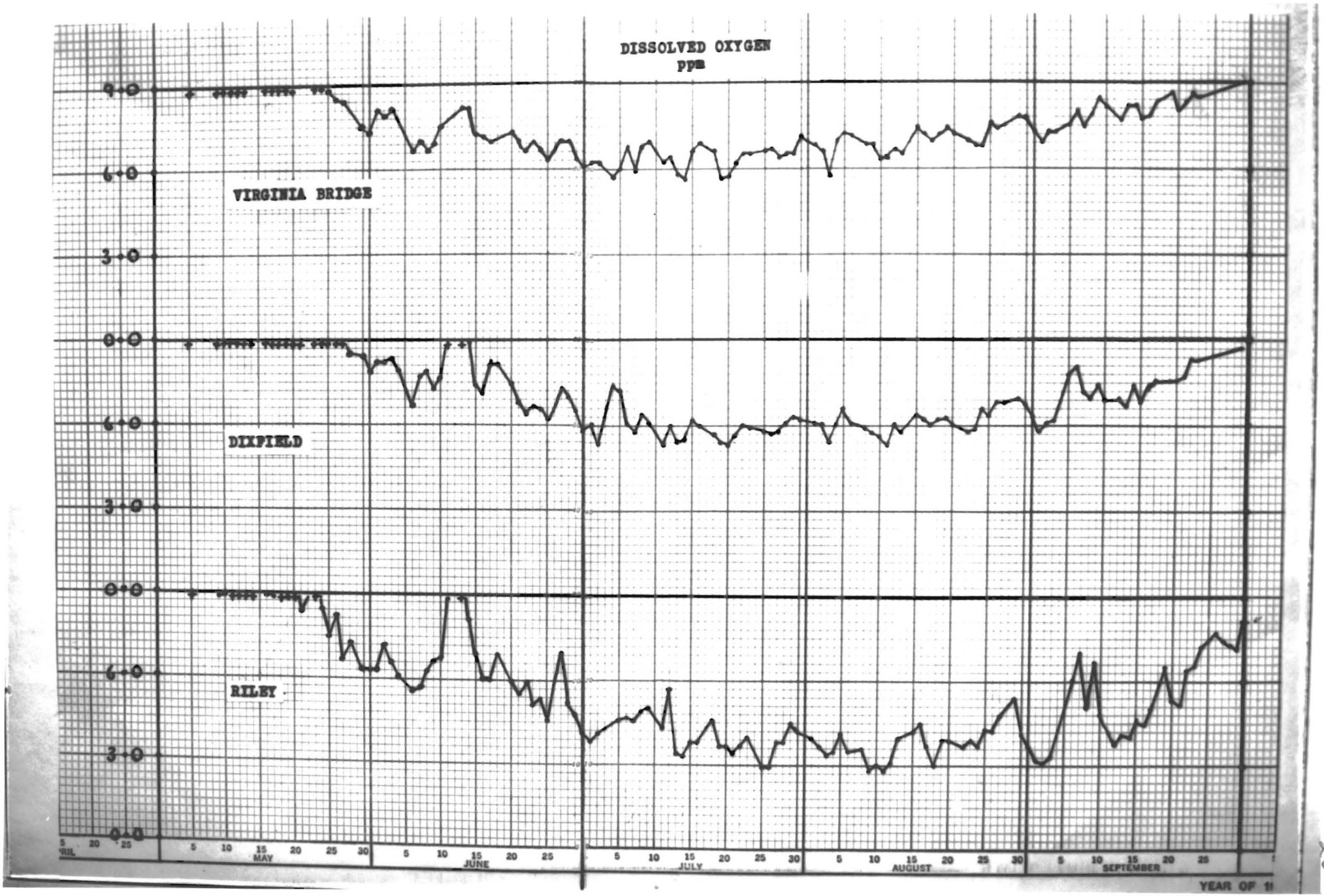
1966	0	days	below	FIVE	ppm	8	days	below	SIX	ppm
1965	3	"	"	"	"	21	"	"	"	"
1964	1	"	"	"	"	12	"	"	"	"
1963*	2	"	"	"	"	12	"	"	"	"

*Limited data available; two samples per week. The eight days below six ppm D.O. were all above 5.55 ppm.

6. Dixfield. The recorded D.O. data for the period 1963 through 1966 indicates that

1966	0	days	below	FOUR	ppm	0	days	below	FIVE	ppm
1965	4	"	"	"	"	24	"	"	"	"
1964	0	"	"	"	"	7	"	"	"	"
1963	2	"	"	"	"	12	"	"	"	"

The daily average lbs. available oxygen at Dixfield bridge station for the seasons 1963 through 1966 were, 78,500, 75,260, 57,900, and 93,040 respectively.


DISSOLVED OXYGEN
ppm
VIRGINIA BRIDGE
DIXFIELD
RILEY
9.0
6.0
3.0
0.0
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
YEAR OF 1

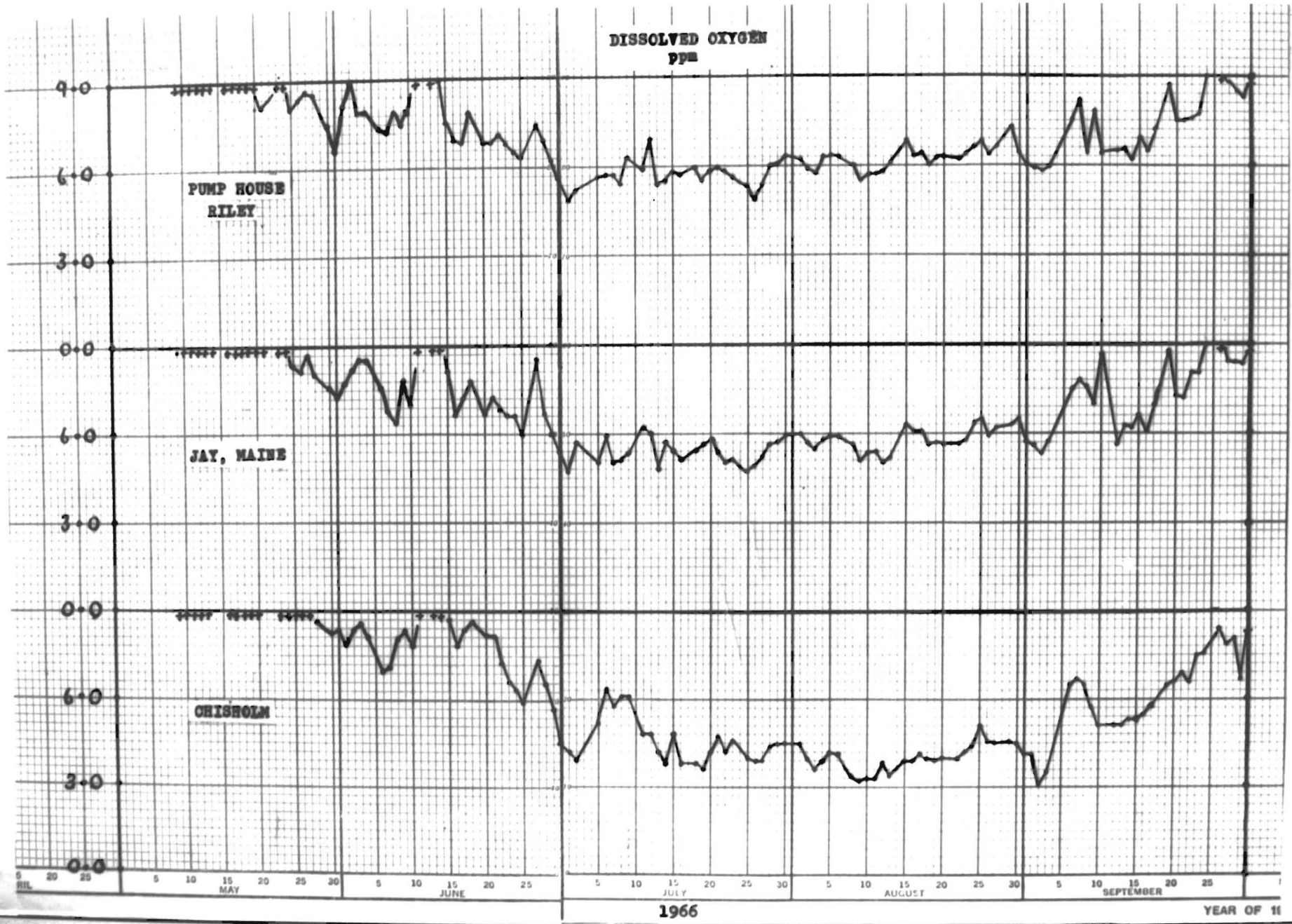
For several years questions have been raised concerning the sampling location at Dixfield bridge. A series of tests made in 1965 indicated that the wastes had not uniformly dispersed through a cross section of the river, but the samples of water obtained at the usual location approximated an average of the variations between the East and West sections of the river. Changing the location to a point downstream may be desirable.

7. Swan's Pit. Sampling was begun at this location on August 22 and made five times per week (Thursday sampling was omitted) until September 23. The time of passage, from the Mill to Swan's Pit, has been estimated by Mr. Cooper as approximately eight hours. Insufficient data exists to pass judgment, as to the desirability of this location, when compared with that at Dixfield. Cross section studies have not been made. Usually the D.O.'s and B.O.D.'s are somewhat lower than those recorded for Dixfield.

8. Riley In previous years tests were made only on Thursdays of each week. This year D.O. determinations were made six days each week from March 1 to September 30. This season's analytical data indicated a daily average D.O. load of 45,020 lbs. Some of the concentration levels were:

1966	61	days	below	FIVE	ppm	0	days	below	TWO	ppm
1965*	17	"	"	"	"	8	"	"	"	"
1964*	9	"	"	"	"	1	"	"	"	"

*Tests on Thursdays only.


DISSOLVED OXYGEN
ppm
9.0
6.0
3.0
0.0
PUMP HOUSE
RILEY
6.0
3.0
0.0
JAY, MAINE
6.0
3.0
0.0
CHISHOLM
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1966
YEAR OF 11

Calculations made from the daily, except Sunday, D.O. data for each of four months averaged (lbs.)

June	July	August	September
140,760	50,760	42,820	65,740

Season average 75,020 lbs.

The sampling station is located just above the Dam. This year International Paper Company allowed the full flow of the river to pass over the Dam to accomplish an appreciable increase (22,110 lbs/day) in the dissolved oxygen.

9. Jay. The completion of the new mill at Jay and the collapse of a large section of the old bridge, a sampling station was established on the portion of the bridge on the West side of the river. Cross section tests indicate a reasonable agreement with the West side results. Daily D.O. determinations were made, five were below five ppm, but none below four ppm.

Jay pulp mill was down from September four until September 23 with the exception of about ten hours operation during September eight.

The D.O. load (lbs/day) for the months June through September as calculated from the daily analyses was

	June	July	August	September
Jay	168,900	67,100	65,540	86,880
Riley	140,760	50,760	42,820	65,740
Gain	28,140	16,440	22,720	21,140

Season's average D.O. daily gain 22,110 lbs.

10. Chisholm. Otis. Dissolved Oxygen was much higher during the 1966 season than in 1965, however, there were long periods when less than five ppm were present. Comparison with 1965 and 1964 reveals:

	Below FIVE ppm	Below FOUR ppm	Below ONE ppm
1966	51 days	20 days	0 days
1965	92 "	77 days	40 "
1964	58 "	40 "	0 "

The daily average oxygen loads (lbs.) calculated from the daily data, June through September, were:

	June	July	August	September
Jay	168,900	67,100	65,540	86,880
Chisholm Otis	173,400	60,640	45,200	72,780
Change	+ 4,500	-6,460	-20,340	-14,100

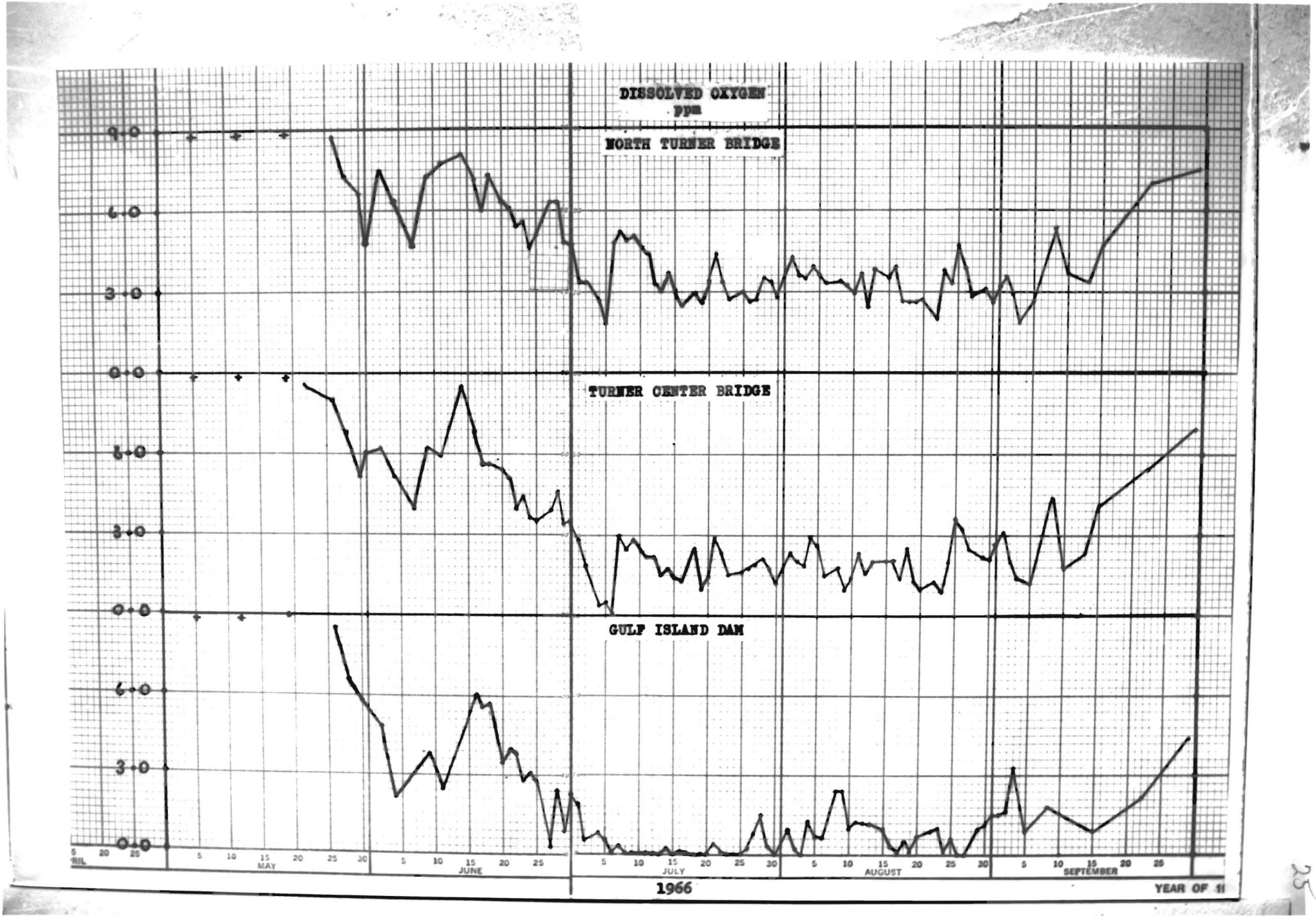
Chisholm, season average 88,000 lbs.

The loss of dissolved oxygen between Jay and Otis, does not appear to be very consistent.

11. North Turner Bridge. The daily average dissolved oxygen load (lbs) during June was comparatively large in relation to the three remaining months.

	June	July	August	September
Chisholm	173,400	60,640	65,540	86,880
N.T.B.	154,160**	43,600	38,300	49,300*
Loss	19,240	17,040	27,240	(37,580)

*Limited data
**Three weeks


DISSOLVED OXYGEN
ppm
NORTH TURNER BRIDGE
TURNER CENTER BRIDGE
GULF ISLAND DAM
9.0
6.0
3.0
0.0
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1966
YEAR OF 1

D.O. levels for the past five seasons indicate;

	Above FIVE ppm	Below FOUR ppm
1966	19 days	51 days
1965	8 "	63 "
1964*	30 "	14 "
1963	48 "	31 "
1962	81 "	37 "

*During the period of operation at O.P.Co. Mills

Although river flows were "satisfactory" this year the available D.O. was at comparatively low levels during July and August.

The daily average ppm during the testing season for the past eighteen years is tested below.

	Dissolved Oxygen		Summer Daily Averages	
1966	4.04 ppm		1957	1.95 ppm
1965	2.23		1956	2.43
1964	5.44		1955	1.94
1963	4.51		1954	5.84
1962	4.77		1953	1.75
1961	3.42		1952	1.49
1960	4.13		1951	2.84
1959	3.80		1950	3.43
1958	3.62		1949	2.00

12. Turner Center Bridge. During the eleven or twelve week test period of the Pool, much of the dissolved oxygen available at the North Turner entrance and that obtained by reaeration, was consumed during the two day passage to this sampling station. Benthal deposits are very active in the area between the two bridges, as evidenced by the extensive gas production, large loss of dissolved oxygen and only a small loss of B.O.D. The table recorded below indicates the magnitude of the task that would be required to maintain five ppm of dissolved oxygen.

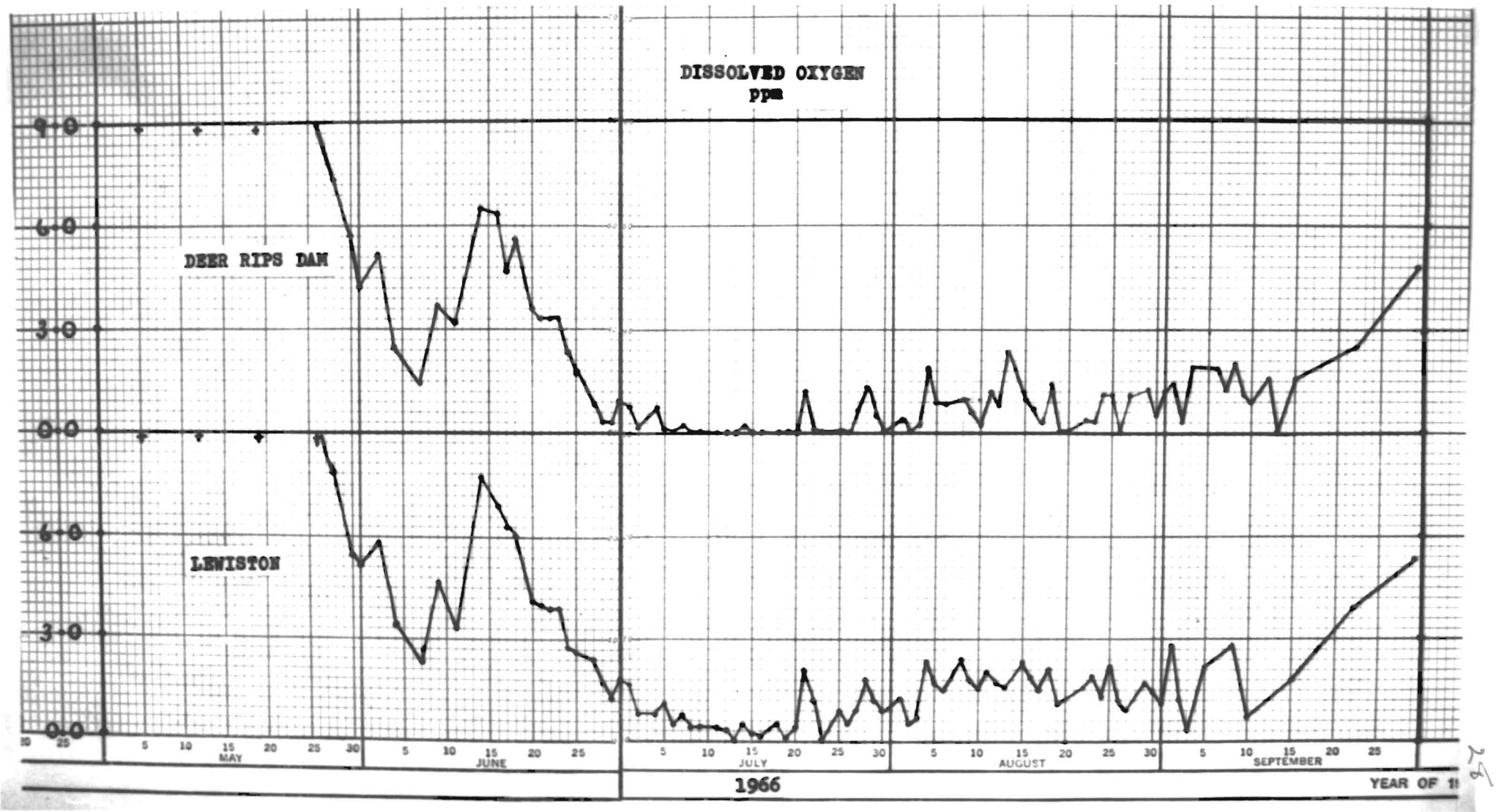
	Below FIVE ppm	Below TWO ppm	Below ONE ppm
1966	77 days	39 days	5 days
1965	80 "	49 "	19 "
1964	68 "	3 "	0 "
1963	74 "	9 "	3 "
1962	--	14 "	2 "
1961	-- "	32 "	10 "
1960	--	16 "	0 "
1959	**	44 "	29 "
1958	--	29 "	7 "

13. Gulf Island Dam. Analytical and other data obtained at station are recorded in the tables and plots. Water samples are representative of the ten foot levels but conditions at this level may not be similar to those at the fifty to sixty foot depths. For this reason interpretation of the data is often difficult and at times unreliable.

14. Deer Rips Dam. The dissolved oxygen present in the water at this station was generally the lowest since 1962. This season there were sixteen test days when the analyses were reported as zero D.O.; only one zero day was recorded in 1965. The data listed below indicates a very serious situation.

	Below TWO ppm	Below ONE ppm
1966	77 days	52 days
1965	53 "	20 "
1964	31 "	13 "
1963	58 "	43 "
1962	70 "	54 "

During the eleven week special test period (June 27-Sept. 11) the daily average available oxygen load was 8,340 lbs. and the average five day B.O.D. load was 28,120 lbs. The


DISSOLVED OXYGEN
ppm
DEER RIPS DAM
LEWISTON
9.0
6.0
3.0
0.0
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1966
YEAR OF

daily averages for week #3 (July 11-17 incl.) were D.O. 380 lbs., B.O.D. 55,080 lbs. (cf Part Four).

Zoogleal film was observed on many days and in large areas. This film interfears with reaeration especially on windy days.

15. Lewiston. The frequency of low oxygen levels was higher than in any season since 1961.

	Below ONE ppm		Below o.5 ppm	
1966	26	days	13	days
1965	0	"	0	"
1964	1	"	1	"
1963	18	"	13	"
1962	22	"	12	"
1961	42	"	7	"
1960	54	"	26	"

Conclusions. River water quality based on dissolved oxygen content, generally was, with one exception, much higher than last year and compares favorably with that of 1964 and 1963. The oxygen levels at Deer Rips were very low, through most of the season. The very large decrease in D.O., between North Turner and Turner Center Bridges, indicates very active benthal and an increase in the pollution load at Jay.

Dissolved Oxygen. Summer Average
Tons/day

Location	1966	1965	1964	1963
1. Bell's Ice House	44.43	35.11	43.77	44.50
2. Gorham (Public Service)	41.33	28.83	42.91	45.12
3. Gilead, Maine	38.96	29.57	42.78	38.62
4. Virginia Bridge	46.52	32.31	38.38	40.57
5. Dixfield	45.01	28.95	37.63	39.25
6. Riley	37.51°	14.01*	25.70**	25.88*
7. Jay	48.55°	12.34	35.46	31.36
8. Chisholm	44.00°	11.54	38.75	38.73
9. North Turner Bridge***	27.91	11.66	34.45	32.68
10. Turner Center Bridge***	16.39	8.07	29.08	27.12
11. Deer Rips Dam***	4.17	8.88	16.85	13.55

°All tests June thru September
*Limited data: Thursday only 16 weeks June 3 - Sept. 16
** " " " " 12 " June 4 - Aug. 20
***Eleven week special test period.

The Riley-Jay data indicate that the use of the Riley Dam as a source of reaeration has been very successful. An average daily increase in D.O. of 22,110 lbs. was obtained during the period June through September.

The stretch of the river between Berlin, N.H. and Virginia Bridge, Rumford, would have met C classification through the season, with the exception of two days when the D.O. at Gilead was recorded as 4.66 ppm. Both of these lows were due to "spills" at Berlin. Although there were eight test days when the D.O. was below 6.0 ppm, the lowest analyses was 5.55 ppm, (July 19). Downstream from Rumford at Riley was in a better condition than last year but on sixty-one test days the D.O. was below five ppm. Owing to reaeration at the Riley dam, only five days were recorded* below five ppm. The lowest D.O. determination was 4.2 ppm on July 27. Between Jay and Chisholm a rapid deterioration was experienced; fifty-one days below five ppm and twenty below four ppm. The lowest D.O. day was

*at Jay

September two when the analysis indicated 3.1 ppm. Conditions in the Pool are described in Part Four of this report.

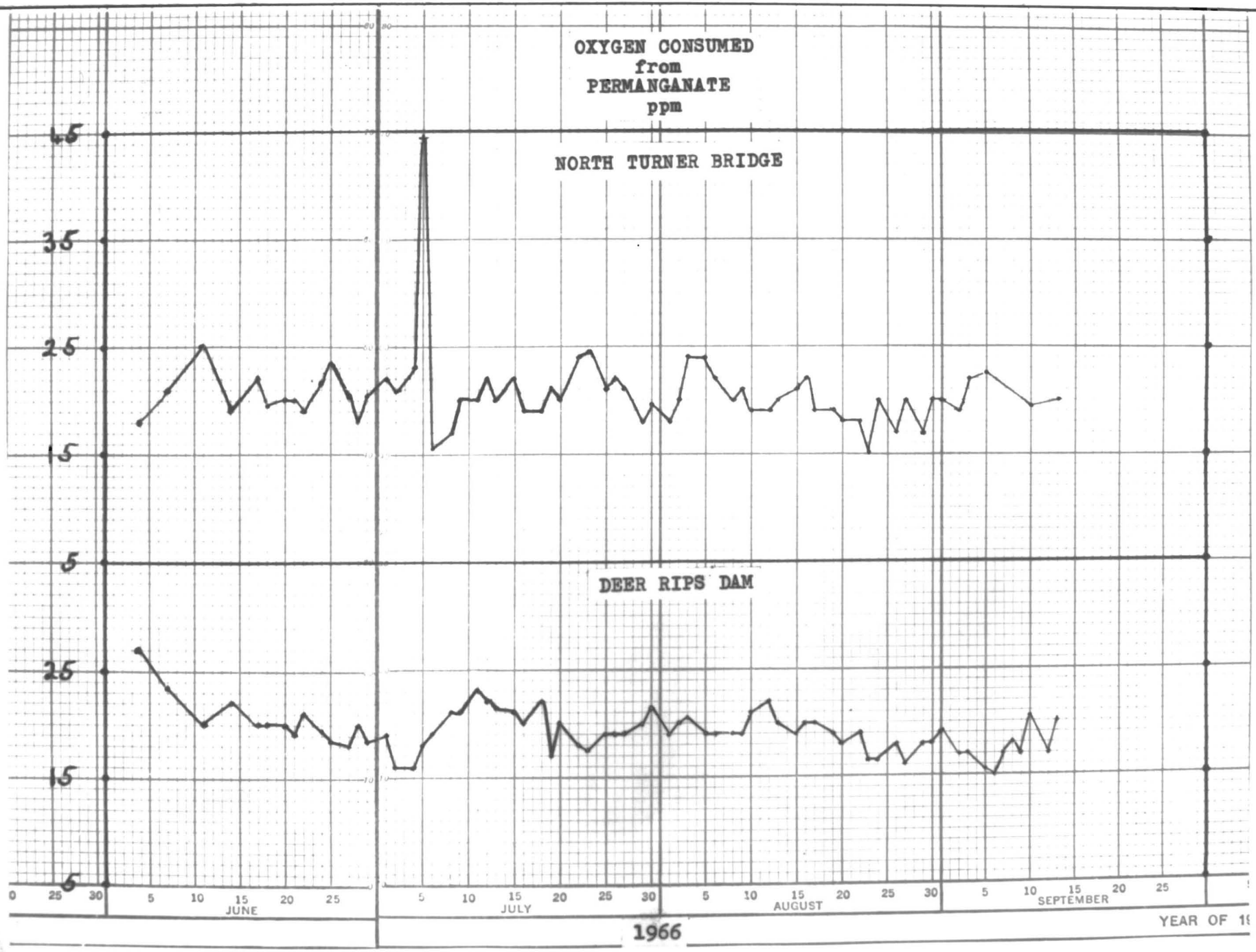
Oxygen Consumed from Permanganate. Since the abandonment of sulphite pulp process by the three companies, the principle value of this test resides in the rapid identification and extent of a change in the pollution load. However, serious increases in pollution load usually result in an increase in pH and this test is very rapid. This year the O.C.P. test was made only at North Turner Bridge and Deer Rips Dam. A glance at the accompanying plot would show one dramatic illustration of the value of this test.

A study of the tabulated data recorded below appears to indicate, that the test now has little in common with the results obtained in previous years. There never has been a close correlation between this test and the B.O.D., but this year there was none.

Pool O.C.P. ppm
Average Daily Loss
(N.T.B.-G.I.D.)

1966*	1.4 ppm	1957	5.0 ppm
1965*	4.6 "	1956	7.5 "
1964	2.4 "	1955	5.4 "
1963	3.0 "	1954	6.6 "
1962	3.4 "	1953	3.7 "
1961	4.5 "	1952	5.4 "
1960	7.9 "	1951	7.0 "
1959	5.9 "	1950	7.5 "
1958	4.6 "	1949	5.7 "

*Deer Rips Dam


OXYGEN CONSUMED
from
PERMANGANATE
ppm
NORTH TURNER BRIDGE
45
35
25
15
5
DEER RIPS DAM
25
15
5
0 25 30 5 10 15 20 25 5 10 15 20 25 30 5 10 15 20 25 30 5 10 15 20 25
JUNE
JULY
AUGUST
SEPTEMBER
1966
YEAR OF 19

Hydrogen Ion Concentration pH — pH determinations were made on all water samples obtained at all stations. The test has proved to be of value in indicating "spills" and large alkaline losses. The pH was seldom below 6.5 and on one occasion a figure of 8.5 was obtained. Generally the pH is somewhat higher near the mills than further downstream. A small loss of pH occurs during passage of the water through the Pool.

Biochemical Oxygen Demand. — The results obtained by the B.O.D. procedure are recorded in Parts Three and Four of this report.