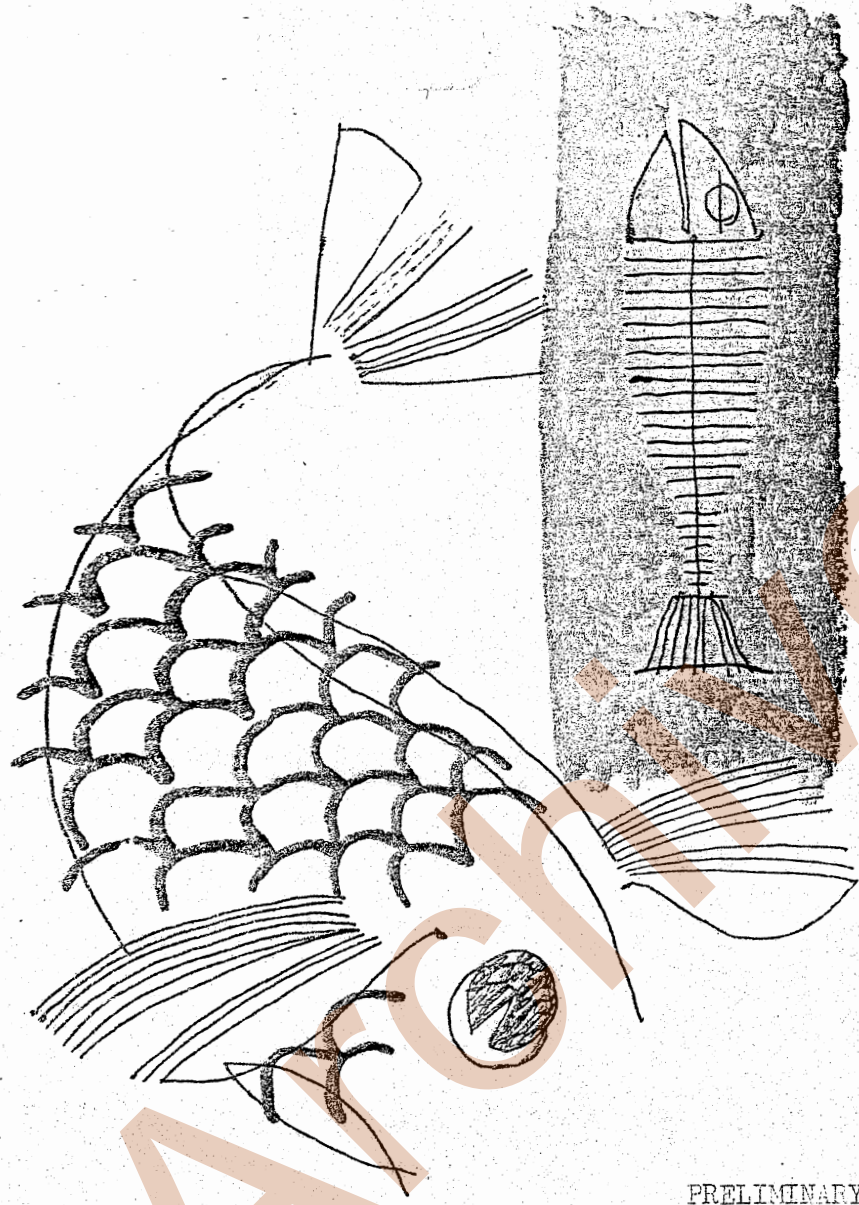


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PRELIMINARY COMPATIBILITY STUDIES  
OF G.C.O.S. SAND TAILINGS POND  
WATER WITH ATHABASCA RIVER

JUNE 21, 1968

ENVIRONMENTAL HEALTH SERVICES DIVISION

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INDEX

	Page
INTRODUCTION	1
DISCUSSION	1-2-3
CONCLUSIONS	3

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PRELIMINARY COMPATIBILITY STUDIES OF

G.C.O.S. SAND TAILINGS POND WATER WITH

ATHABASCA RIVER

INTRODUCTION

On May 30, 1968 G.C.O.S. requested permission to discharge  $110 \times 10^6 \text{ Ft}^3$  of effluent from the sands tailings pond at the Fort McMurray site into the Athabasca River during periods of high river flow. G.C.O.S. outlined the events which made this request necessary in order that an adequate base be developed for a stable 200 foot dike.

Samples of the tailings pond water were obtained on June 3, 1968 to assess it's compatibility with the river water. Samples of the A.P.I. separator retention pond effluent, waste water storage pond, and Lake Athabasca were also obtained.

DISCUSSION

Analytical results are included in the Appendix.

A. Chemical Analyses

(i) A.P.I. Separator Retention Ponds Effluent (A-1)

High values were observed for odor number 10,000, oil content 25 mg/l, and phenol concentration 760 p.p.b.

(ii) Waste Water Storage Pond Effluent (A-2)

All parameters were satisfactory except a high odor number of 1000 - CH(hydrocarbon).

(iii) Tailings Pond Water (A-3)

The following parameters were considered to be excessive:

odour number 1000 - CH

total solids 11,494 mg/l

suspended solids 10,360 mg/l

oils and greases 103.8 mg/l

phenols 150 p.p.b.

(iv) Athabasca River Upstream of G.C.O.S. (A-4)

High turbidity of 63 mg/l was observed and most probably characteristic of flood flow. G.C.O.S. have noted that the suspended solids of the raw river water during July 1965 ranged from 475 to 870 p.p.m. and averaged 680 p.p.m.

Oil content of a mud sample was 34 mg/l.

(v) Lake Athabasca at Fort Chipewyan (A-5)

Water quality was satisfactory although ammonia-nitrogen and phenols were monitored at 0.6 mg/l and 5 p.p.b. respectively.

B. Calculated Compatibility of Tailings Pond Water With Athabasca River

Appendix A-6 and A-7 represent the calculated increase of various river constituents due to Tailings Pond water being discharged to the Athabasca River at river flow of 20,000 c.f.s. at dilutions of 1:500 and 1:1000 respectively. The latter dilution would increase odor number by 10.

C. Settleability Tests

(1) Appendix A-8 represents the rate of settleability of various blends of Tailings Pond water with river water. Rapid settling of the blended mixtures occurred within the first 10 hours.

(2) Equal portions of Tailings Pond water and A.P.I. Separator retention pond water effluent were combined and diluted with river water. Settleability profiles are represented in Appendix A-9

(3) Appendix A-10 represents settleability profiles of Tailings Pond water and a 1:1 blend of Tailings Pond water with A.P.I. Separator retention pond water effluent.

(4) Appendix A-11 represents the settleability profile of the A.P.I. Separator retention pond water effluent.

(5) Analyses of the supernatant liquid obtained from the settleability tests (196 hours) are listed in Appendix A-12.

#### CONCLUSIONS

Analytical data suggest that a discharge of  $10 \times 10^6$  I.G.P.D. from the Tailings Pond would minimize effects on the Athabasca River and yet allow the discharge of  $110 \times 10^6$  ft<sup>3</sup> to occur during a 2 month period when river flows exceed 20,000 c.f.s.

Sedimentation of the high solids content could be induced by directing the Tailings Pond water to the retention ponds prior to discharge from the waste water storage pond. Assuming that the regular process waste water discharge is maintained at  $10 \times 10^6$  I.G.P.D., settling time of the Tailings Pond water ( $10 \times 10^6$  I.G.P.D.) would be 7 hours in the retention ponds and 8.4 days in the waste water storage pond.

E.E. Kupchanko

June 21, 1968

APPENDIX

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INDEX TO APPENDIX

A.P.I. Separator Retention Pond Effluent -----	A-1
Waste Water Storage Pond Effluent -----	A-2
Tailings Pond Water -----	A-3
Athabasca River Upstream of G.C.O.S. -----	A-4
Lake Athabasca at Fort Chipewyan -----	A-5
Calculated Compatibility of Tailings Pond Water With Athabasca River -----	A-6-7
Settleability -----	A-8-9-10-11
Supernatant Liquid Analyses -----	A-12

GREAT CANADIAN OIL SANDS LTD. — SETTLINGPOND EFFLUENT

Sampled June 3, 1968

Biochemical Oxygen Demand	24	(mg/l)
Chemical Oxygen Demand	197	(mg/l)
pH	7.7	
Alkalinity (as CaCO <sub>3</sub> )	85	(mg/l)
Oils and Greases	26	(mg/l)
Threshold Odor Number	10,000	
Total Solids	240	(mg/l)
Volatiles	74	(mg/l)
Fixed	166	(mg/l)
Suspended Solids	64	(mg/l)
Volatiles	30	(mg/l)
Fixed	34	(mg/l)
Phenols	760	(ppb)
Arsenic	65	(ppb)



GREAT CANADIAN OIL SANDS LTD. POND EFFLUENT

Sampled June 3, 1968

			<u>lbs/day</u>
Biochemical Oxygen Demand	11	(mg/l)	1430
Chemical Oxygen Demand	112		13260
pH	7.6		
Alkalinity (as CaCO <sub>3</sub> )	105	(mg/l)	13620
Threshold Odor Number	1000	CH	
Oils and Greases	4.6	(mg/l)	59.8
Total Solids	330	(mg/l)	42800
Volatiles	96	(mg/l)	12500
Fixed	234	(mg/l)	30400
Suspended Solids	19	(mg/l)	2470
Volatiles	5	(mg/l)	650
Fixed	14	(mg/l)	1820
Phenols	64	(ppb)	8.3
Arsenic	75	(ppb)	9.2

FLOW RATE=13 x 10<sup>6</sup> I.G.P.D.

GREAT CANADIAN OIL SANDS LTD. TAILINGSPOND

Sampled June 3, 1968

Biochemical Oxygen Demand	145	(mg/l)
Chemical Oxygen Demand	3557	(mg/l)
pH	8.4	
Alkalinity	315	(mg/l)
Threshold Odor Number	10,000	GH
Total Solids	11,494	(mg/l)
Volatiles	1,882	(mg/l)
Fixed	9,612	(mg/l)
Suspended Solids	10,360	(mg/l)
Volatiles	1,690	(mg/l)
Fixed	8,670	(mg/l)
Oils and Greases	103.8	(mg/l)
Phenols	150	(ppb)
Arsenic	0.0	(ppb)

Summary of AnalysisATHABASCA RIVER UPSTREAM OF GREAT CANADIAN OIL SANDS LIMITED (ONE MILE UPSTREAM)

Sampled June 3, 1968      FLOW = 30,800 c.f.s.

Biochemical Oxygen Demand		1.0	(mg/l)
pH		8.2	
Alkalinity (as CaCO <sub>3</sub> )		99	(mg/l)
Threshold Odor Number		4	Musty
Turbidity as SiO <sub>2</sub>		63	(mg/l)
Total Hardness ( as CaCO <sub>3</sub> )		110	(mg/l)
Chlorides		1.0	(mg/l)
Ammonia Nitrogen (NH <sub>3</sub> -N)		0.3	(mg/l)
Nitrate Nitrogen (NO <sub>3</sub> -N)		0.09	(mg/l)
Total Residue		240	(mg/l)
	Volatile	70	(mg/l)
	Fixed	170	(mg/l)
Sulfates		30	(mg/l)
Color	425 mu	75	
	450 mu	50	
	500 mu	7	
Phenols		3	(ppb)
Oils and Greases		3.4	(mg/l)
Fluorides		0.09	(mg/l)
Tannins and Lignins		0.7	(mg/l)

Sampled June 11, 1968

Biochemical Oxygen Demand		0.9	
pH		8.3	
Alkalinity (as CaCO <sub>3</sub> )		89	(mg/l)
Threshold Odor Number		40	
Turbidity (as SiO <sub>2</sub> )		25	(mg/l)
Hardness (as CaCO <sub>3</sub> )		102	(mg/l)
Chlorides		54	(mg/l)
Ammonia Nitrogen (NH <sub>3</sub> -N)		0.6	(mg/l)
Nitrate Nitrogen (NO <sub>3</sub> -N)		0.07	(mg/l)
Sulfates		59	(mg/l)
Total Residue		180	(mg/l)
	Volatiles	66	(mg/l)
	Fixed	114	(mg/l)
Color	425	65	
	450	50	
	500	40	
Phenols		5	(ppb)
Oils and Greases		0.3	(mg/l)

FLOW FROM TAILINGS POND 20 MILLION GALLONSPER DAY, RIVER FLOW 20,000 c.f.s.Approximate dilution ratio 1/500

Biochemical Oxygen Demand	.290	(mg/l)
Chemical Oxygen Demand	7.2	(mg/l)
Threshold Odor Number	20	CH
Total Solids	23	(mg/l)
Volatiles	3.8	(mg/l)
Fixed	19.2	(mg/l)
Suspended Solids	20.8	(mg/l)
Volatiles	3.4	(mg/l)
Fixed	17.4	(mg/l)
Oils and Greases	0.206	(mg/l)
Phenolics	.3	(ppb)

Great Canadian Oil Sands Ltd. Tailings Pond added directly  
to Athabasca River.

FLOW FROM TAILINGS POND 10 MILLION GALLONS

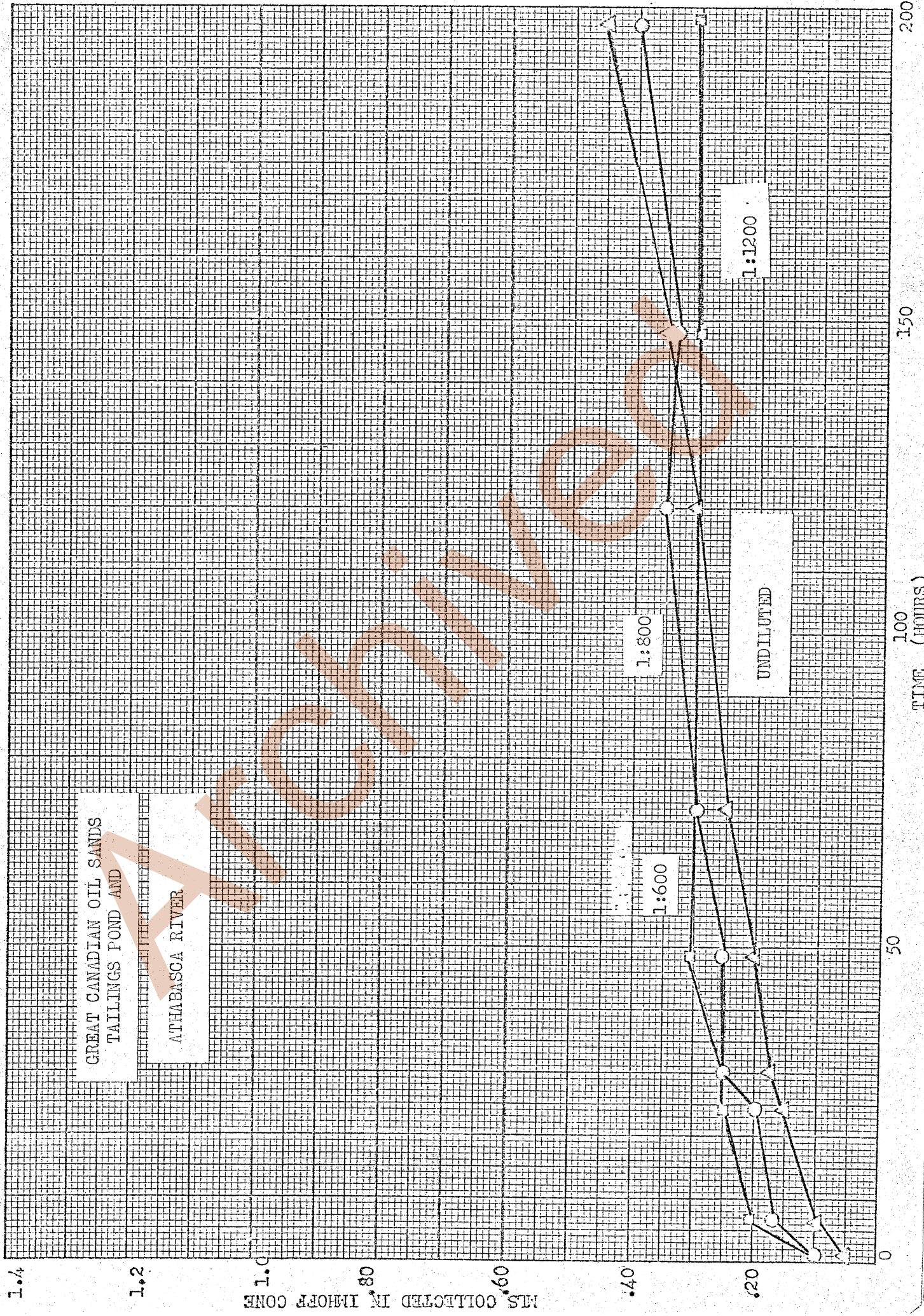
PER DAY

RIVER FLOW 20,000 c.f.s.

Approximate dilution ratio 1/1000

Increase of various constituents.

Biochemical Oxygen Demand	.145	
Chemical Oxygen Demand	3.6	(mg/l)
Threshold Odor Number	10 CH	
Total Solids	11.5	(mg/l)
Volatiles	1.9	(mg/l)
Fixed	9.6	(mg/l)
Suspended Solids	10.4	(mg/l)
Volatiles	1.7	(mg/l)
Fixed	8.7	(mg/l)
Oils and Greases	0.103	(mg/l)
Phenolics	.15	(ppb)



GREAT CANADIAN OIL SANDS  
TAILINGS POND AND

ATHABASCA RIVER

MGS COLLECTED IN IMHOFF CONE

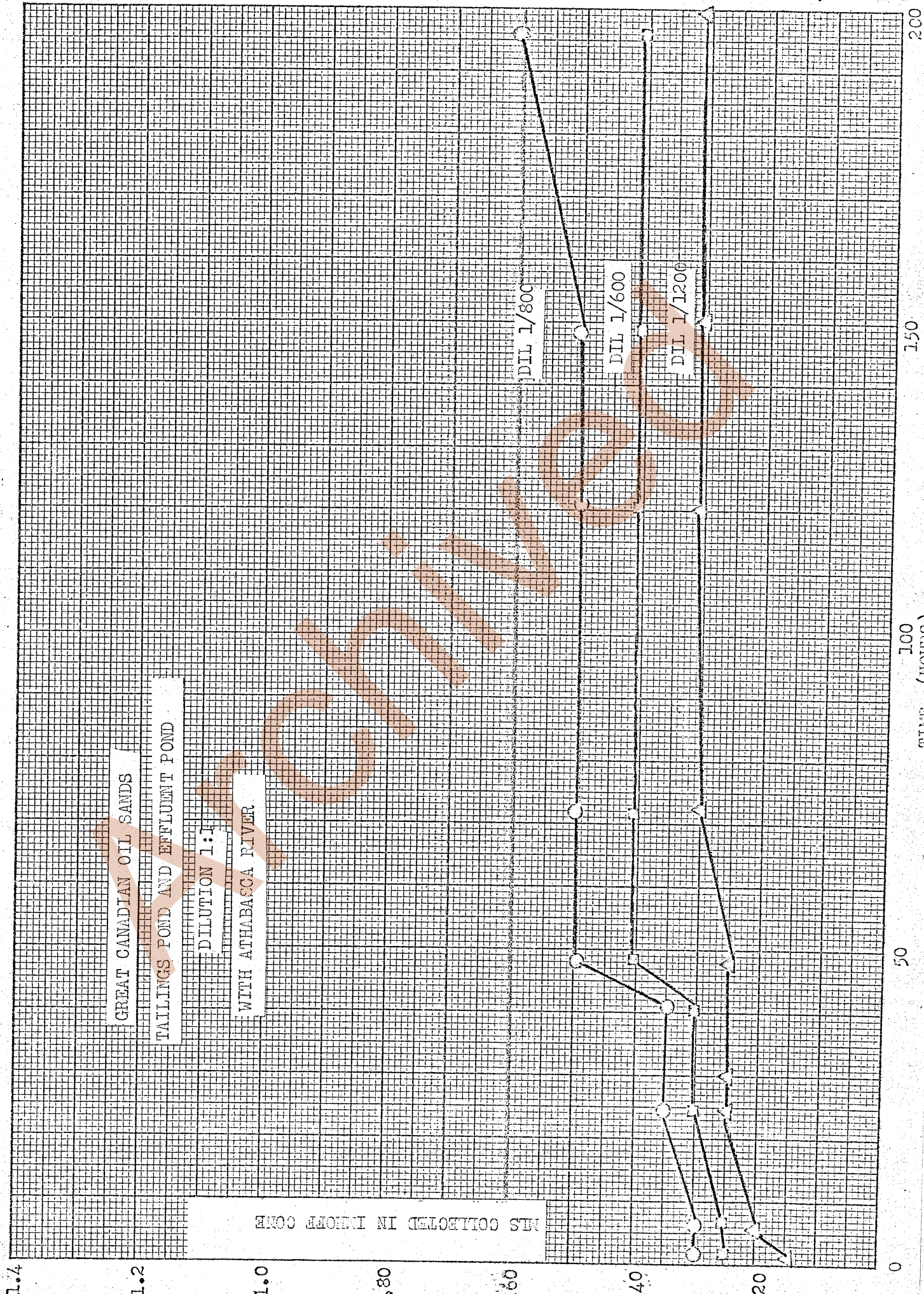
TIME (HOURS)

50

100

150

200





KE 10 X 10 TO 1/2 INCH 46 1323  
7 X 10 INCHES  
MADE IN U.S.A.  
KEUFFEL & ESSER CO.



G.C.O.S.

MIXTURE OF A.P.I. SEPARATOR RETENTION POND EFFLUENT AND TAILINGS POND WATER (1:1)

G.C.O.S. TAILINGS POND WATER

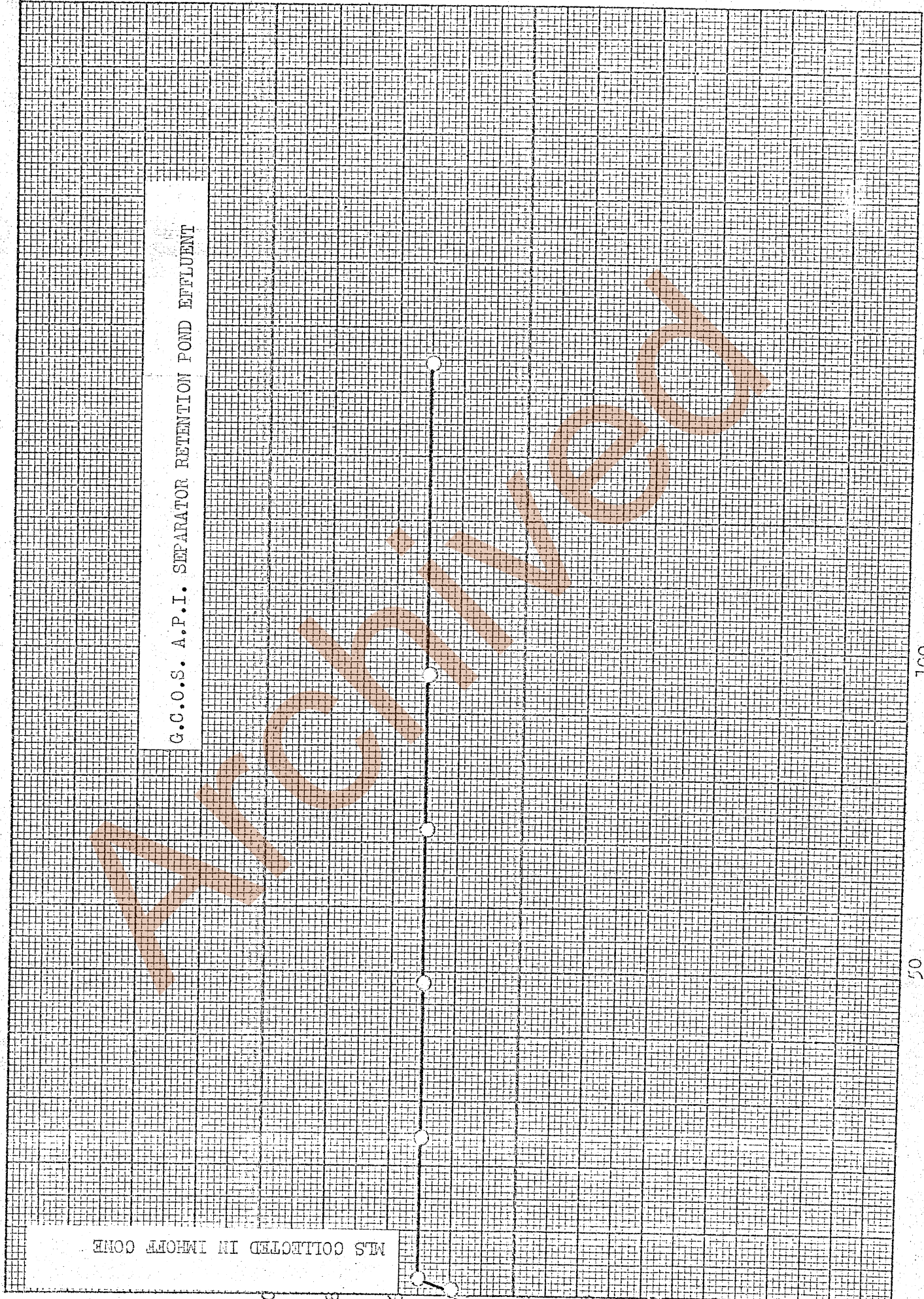
MIS. COLLECTED IN IMHOFF CONE

150  
TIME (HOURS)

50

0

10 X 10 TO 1/2 INCH 46 1323  
7 X 10 INCHES  
KEUFFEL & ESSER CO.  
MADE IN U.S.A.



G.C.O.S. A.P.I. SEPARATOR RETENTION POND EFFLUENT

M/S COLLECTED IN IMHOFF CONE

TIME (HOURS)

50

100

150

ANALYSES OF SUPERNATANT LIQUID FROM SETTLEABILITYTESTS

(AFTER 196 HOURS)

A. Tailings Pond water diluted with Athabasca River

DILUTION	SUSPENDED SOLIDS	IGNITION LOSS
1:1200	9 mg/l	9 mg/l
1:800	4 mg/l	4 mg/l
1:600	5 mg/l	5 mg/l

B. 1:1 Mixture of Tailings Pond water and A.P.I. Separator retention pond effluent diluted with Athabasca River

DILUTION	SUSPENDED SOLIDS	IGNITION LOSS
1:1200	3 mg/l	3 mg/l
1:800	6 mg/l	6 mg/l
1:600	5 mg/l	4 mg/l

C.	<u>Oils &amp; Greases</u>	<u>Suspended Solids</u>	<u>Ignition Loss</u>
Tailings Pond Water	22 mg/l	1080 mg/l	420 mg/l
Tailings Pond water + A.P.I. Separator retention pond effluent (1:1)	14 mg/l	98 mg/l	41 mg/l
A.P.I. Separator retention pond effluent	5.6 mg/l	4 mg/l	4 mg/l