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# Environmental Impact Information of the Proposed Equity Mining Capital Ltd. Development near Houston, British Columbia

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Manuscript Report  
75 - 1

Pacific Region  
June, 1975

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ENVIRONMENTAL IMPACT INFORMATION OF  
THE PROPOSED EQUITY MINING CAPITAL LTD.  
DEVELOPMENT NEAR HOUSTON, BRITISH COLUMBIA

by

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Environment Canada

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## SUMMARY AND CONCLUSIONS

During 1974, Environment Canada undertook an additional study of the watershed adjacent to Equity Mining Capital Ltd.'s proposed development near Goosly Lake to supplement water quality baselines established in 1973 (Hallam and Kussat). Chemistry analyses and 96 hour LC<sub>50</sub> bioassays were performed on the tailings.

- (i) Water quality analyses revealed that total and dissolved metal levels in the watershed adjacent to Equity Mining Capital Ltd.'s Sam Goosly development were found to be similar to those encountered during the summer of 1973.
- (ii) In addition to the work performed in 1973, background levels of bionutrients were documented. Phosphates existed in low concentrations and nitrate-nitrites were below measurable quantities. Sulfates, on the other hand, fluctuated radically between adjacent stations.
- (iii) Simulated tailings samples representing the decant from flocculated and unflocculated thickener overflow, supplied from bench-scale studies were demonstrated to be non-toxic to coho salmon at 100% concentration under 96 hour LC<sub>50</sub> static bioassay conditions. Chemical analyses of the samples revealed that the use of a flocculant was environmentally more attractive due to the significant reduction of the deleterious levels of lead and zinc associated with the small fraction on non-filterable residues.
- (iv) Under 50% recycling conditions, the final discharge from the tailings impoundments would theoretically contain 100% of the dissolved or suspended matter produced by the mill at one-half the mill process volume but at twice the concentration. The effect of

this on the biota of Goosly Lake is not known, but it is suggested that the metals dissolved in the effluent will present a greater hazard in these soft waters.

- (v) The mine process water requirements over a 12-month period represents approximately 10.7% of the lake's volume. During low-flow periods, such as mid-winter when exchange volumes drop below 20 cfs, the discharge of tailings could have a tremendous adverse effect on the biota, particularly in the immediate locality of the discharge point.
- (vi) The baseline data generated in this report and E.P.S. Surveillance Report 5-PR-74-4 will facilitate post operational environmental assessments of water quality changes.

## 1 INTRODUCTION

During 1973, Environment Canada undertook a summer and fall study of the watershed adjacent to Equity Mining Capital Ltd.'s proposed development near Goosly Lake to establish water quality baselines prior to the commencement of production in late 1975 (Hallam and Kussat).

The predicted commencement date for the Sam Goosly development now seems too optimistic. Slime control problems resulting from the extensive grinding needed to release the finely disseminated mineral particles from the ore have been encountered at the pilot plant stage. The resulting complications have caused delays in solving the extractive metallurgy and have subsequently retarded the development.

Nevertheless, even with insufficient details of the various effluent qualities, pollution control permits for discharges from the open pit, ore dressing mill and leaching circuit have been applied for.

At the moment, Environment Canada is concerned with the prospects of only 50% recycling of the mill process water, complications that can be expected with the settleability of solids from the tailings slurry, and the possibility of nutrient loading of Goosly Lake from the leaching circuit and open pit. Historically there has been very little success in dealing with slimes and to date no control measures have been stipulated to guarantee the quality or consistency of tailings supernatant and leaching circuit discharges.

It is seriously doubted that Goosly Lake, a small waterbody (597 acres) that supports seven species of resident fish and provides a rearing habitat for five anadromous species, can adequately assimilate the effluents of the ore dressing mill, open pit, domestic sewage and the leaching circuit, especially if production is doubled as scheduled.



In anticipation of future problems with suspended solids and excess nutrient loading, the Environmental Protection Service, on July 26, 1974, collected additional data on the watershed adjacent to the Goosly Development to supplement the baseline studies of 1973 (Hallam and Kussat). This report presents the results of the survey, and includes complimentary data on Goosly Lake, supplied by the British Columbia Fish and Wildlife Branch, flow rates of Buck Creek provided by Water Survey of Canada, and 96 hr LC<sub>50</sub> bioassay and chemistry results on simulated effluent.

## 2 MATERIALS AND METHODS

Permanent sampling stations established during the baseline studies of 1973 (Hallam and Kussat) were referred to for the following acquisition of samples (see Figure 1).

### 2.1 Water Quality Sampling

Four one-litre samples were collected in polyethylene bottles at each site. The first was preserved in the field with 5 ml of conc  $\text{HNO}_3$  for extractable metal analyses. The second was filtered using a Sartorius membrane filtering apparatus and  $0.45\mu$  cellulose nitrate paper. The filtrate was preserved with 5 ml of conc  $\text{HNO}_3$  and analyzed for dissolved metals. All analyses except lead determinations were performed by direct aspiration with a Jarrel - Ash 82-800 atomic absorption (A.A.) unit. Lead was complexed with A.P.D.C. extracted and aspirated prior to A.A.

The third sample was kept cool and in the dark until analyzed for nitrate, phosphate and sulphate content. Nitrate and nitrite analyses are performed on a Technicon automated system with a colorimeter readout. All nitrates are reduced to nitrites on a copper-cadmium reduction column and acidified. Under acidic conditions, the  $\text{NO}_2$  ion reacts with sulfanilamide and N-1-naphthylethylenediamine dihydrochloride to form a reddish purple azo dye. The intensity of the dye is measured at  $550\text{ m}\mu$  using a 5 cm flow cell.

Phosphates are converted to orthophosphates by acid digestion which react with the molybdate ion  $(\text{MoO}_4)^{-2}$  to form complex heteropoly acids. These are in turn reduced with ascorbic acid to form the molybdenum acid complex colour. The colour absorbance is measured at  $882\text{ m}\mu$  on a Technicon colorimeter. Sulfates are determined by titration against a known concentration of barium chloride in a non-aqueous medium at a pH range between 1.5 and 4.0. Interferences are removed by ion exchange and Thorin is used as an indicator, forming a peachy pink endpoint.

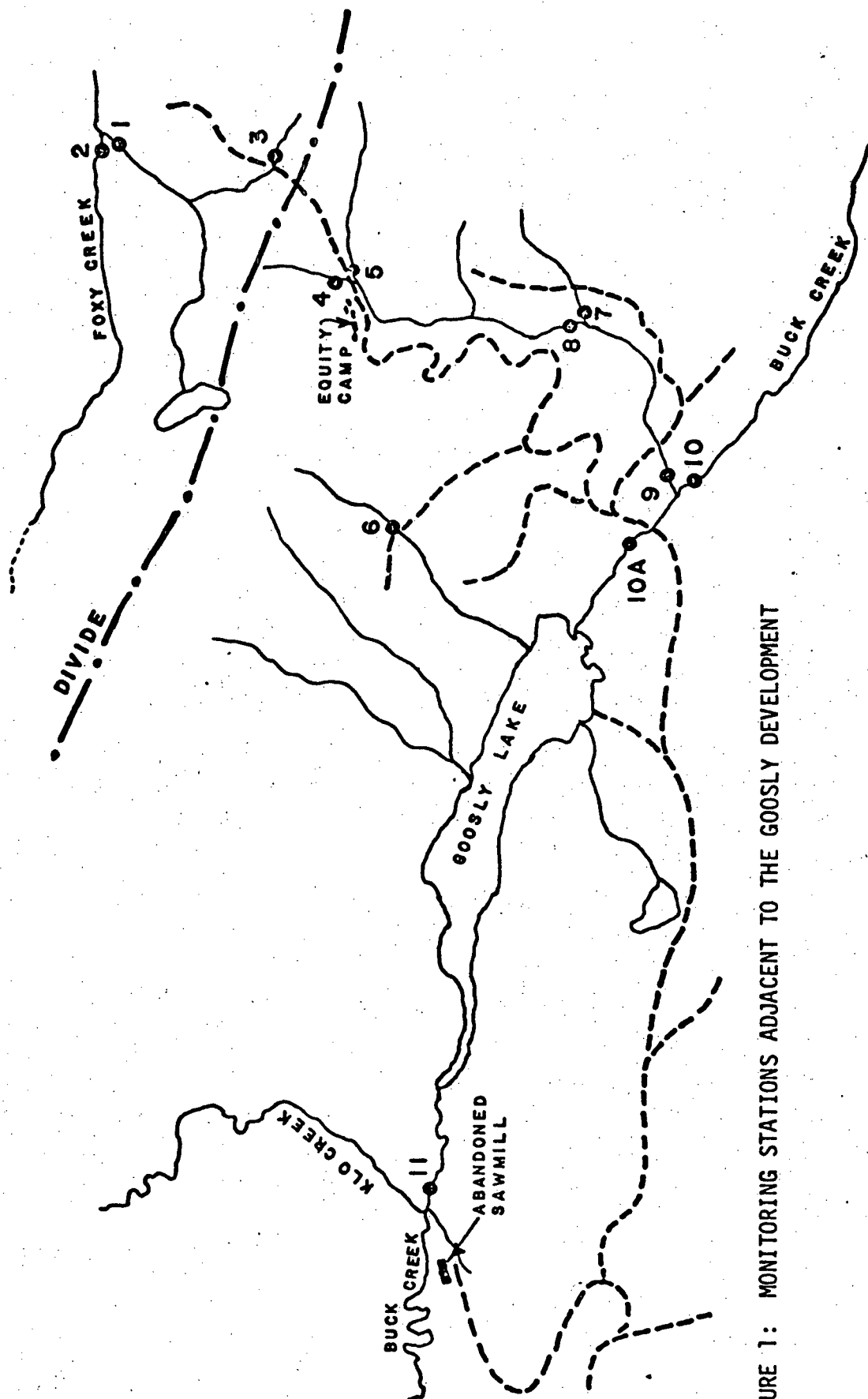


FIGURE 1: MONITORING STATIONS ADJACENT TO THE GOOSLY DEVELOPMENT

The fourth sample, which was also kept cool but otherwise untreated, was obtained for total filterable and non-filterable residues. Environment Canada defines the above residue fractions as follows (Davidson et al, 1972; APHA, 1971):

- (a) Total Residues - that material remaining in a vessel after evaporation of the sample in a muffle furnace at 103°C for two hours;
- (b) Filterable Residues - that portion of the total residues that pass through a Whatman GF/C filter paper and remain after evaporation of 103°C for two hours;
- (c) Non-Filterable Residues - that portion of the total residues that are retained by a Whatman GF/C filter paper and evaporated to dryness at 103°C for one hour.

Except for turbidity and conductivity which were measured from the fourth sample within six hours of collection using a Hach 1860A Turbidimeter and a Seilbod LTB Conductivity Meter, all analyses were performed at the Environment Canada Water Chemistry Laboratory in West Vancouver.

## 2.2 Bioassay Procedures

The supernatant of two tailings samples, (flocculated and unflocculated) representing the theoretical mine effluent from the thickener overflow, were supplied by Equity Mining Capital Ltd. from bench-scale metallurgical studies for bioanalyses. It was assumed that both were acutely toxic and 96 hour LC<sub>50</sub>'s (1) were performed to assess the median lethal concentration of each.

Bioassays were performed at concentrations of 100%

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(1) 96 hour LC<sub>50</sub> - This term refers to Median Lethal Concentration or that level of a measurable lethal agent required to kill the 50th percentile in a group of test organisms, over the time period of 96 hours. The 50th percentile is meant to represent the average organism.

and 56% on both samples under static, aerated and without replacement conditions for 96 hours with dilution water (pH = 6.4; hardness = 7.5 ppm  $\text{CaCO}_3$ ) obtained from the North Vancouver Capilano Reservoir. Five coho under-yearlings (Oncorhynchus kisutch) per 30 kilo test sample ( $\bar{x}$  loaded density = 1.10 gm/l) were used as test species. Full bioassay details are appended. Observations of cumulative mortality were made at 24,48,72 and 96 hours.

A subsample of each supernatant was forwarded to the Water Chemistry Laboratory for determinations of dissolved metals and non-filterable residue content. Procedures outlined in Section 2.1 were employed in the analyses.

### 3 RESULTS AND DISCUSSION

#### 3.1 Water Quality

3.1.1 Physical. Turbidity, conductivity and residue values are presented in Table 1. In all but one case, filterable residues accounted for almost all the residues present. Bridge repair just above Station 5 was probably responsible for the small fraction of non-filterable residues at that point.

The unusually high volume of residue at Station 4 was attributed to various activities in and around the camp area. This was reflected by the turbidity measurements of 15.0 FTU's (slightly translucent to the naked eye), and the degree of impedance to the flow of electricity as indicated by the low conductivity value of 55  $\mu\text{mho/cm}$ .

Conductivity is a measure of the water's ability to conduct an electrical current and is primarily due to the available motile ionic constituents. An approximate correlation exists between the amount of filterable residues present and the conductance [conductivity ( $\mu\text{mho/cm}$ )  $\times .6$  to  $.7 \approx$  filterable residues (ppm)]. This relationship appears to hold true in these waters except at Station 4, the camp drainage, which would indicate that an abnormal amount of non-ionized organics or non-ionized colloidal inorganics was present. Most natural waters in the northwest sector of British Columbia register conductances of between 50 and 150  $\mu\text{mho/cm}$ .

3.1.2 Heavy Metals. Total and dissolved metal levels summarized in Table 2 were found to be equivalent to those recorded in the summer of 1973 (Hallam and Kussat, 1974; Beak, 1973). The dissolved fractions in all cases were low and usually below the detection limit.

As in most cold northern streams these waters are

TABLE 1 TURBIDITY, CONDUCTIVITY AND RESIDUE CONTENT OF THE WATERSHED  
ADJACENT TO THE GOOSLY DEVELOPMENT - JULY 26, 1974

Station Number	Turbidity F.T.U.'s	Conduct $\mu$ mho/cm	Total Res. mg/l $\pm 2.5$	Filterable Res. mg/l $\pm 2.5$	Non-Filter- able Res.* mg/l $\pm 2.5$
1	2.6	160	109	109	<2.5
2	2.5	73	42	42	<2.5
3	4.4	280	168	168	<2.5
4	15.0	55	481	481	<2.5
5	2.2	280	188	183	5.0
6	3.4	88	66	66	<2.5
7	1.8	110	63	63	<2.5
8	9.1	200	135	135	<2.5
9	9.5	170	121	121	<2.5
10	4.2	130	95	95	<2.5
11	3.5	82	69	69	<2.5

\* Obtained by subtraction-detection limit = 2.5 mg/l

< Indicates less than the detection limit

TABLE 2 TOTAL AND DISSOLVED METAL ANALYSES - JULY 26, 1974

Station Number		Cd ppm +0.01	Cr ppm +0.02	Cu ppm +0.01	Fe ppm +0.03	Mo ppm +0.1	Pb ppm +0.02	Zn ppm +0.01
1	Total	<0.01		0.01	0.34		0.02	0.05
	Dissolved	<0.01	<.02	<0.01	0.15	<0.3	<0.02	<0.01
2	Total	<0.01		0.02	0.20		0.02	0.03
	Dissolved	<0.01	<.02	<0.01	0.09	<0.3	<0.02	<0.01
3	Total	<0.01		0.05	0.18		<0.02	0.04
	Dissolved	<0.01	<.02	0.01	<0.03	<0.3	<0.02	<0.01
4	Total	<0.01		0.08	0.31		0.02	0.07
	Dissolved	<0.01	<.02	<0.01	0.14	<0.3	<0.02	<0.01
5	Total	<0.01		0.04	1.6		0.02	0.08
	Dissolved	<0.01	<.02	0.01	0.43	<0.3	<0.02	0.03
6	Total	<0.01		0.03	0.23		0.02	0.02
	Dissolved	<0.01	<.02	<0.01	<0.03	<0.3	<0.02	<0.01
7	Total	<0.01		0.03	1.3		0.04	0.01
	Dissolved	<0.01	<.02	0.02	0.37	<0.3	<0.02	<0.01
8	Total	<0.01		0.07	0.76		<0.02	0.05
	Dissolved	0.02	<.02	0.02	0.05	<0.3	<0.02	<0.01
9	Total	<0.01		0.02	0.80		<0.02	0.02
	Dissolved	<0.01	<.02	<0.01	0.16	<0.3	<0.02	<0.01
10	Total	<0.01		0.03	0.87		0.03	0.04
	Dissolved	<0.01	<.02	0.01	0.44	<0.3	<0.02	<0.01
11	Total	<0.01		0.02	0.50		0.02	0.02
	Dissolved	<0.01	<.02	<0.01	0.17	<0.3	<0.02	<0.01

< Denotes less than the dection limit



relatively soft [ $\approx 60$  ppm  $\text{CaCO}_3$  equivalents, calculated (APHA, 1971) from Hallam and Kussat (1974)]. This tends to increase the toxicity of heavy metals to fish several fold. For example, cadmium, which itself acts synergistically with such metals as zinc (McKee and Wolf, 1973) to increase toxic effects, is considered only "safe" below 0.03 ppm in hard waters and below 0.004 ppm in soft waters (E.P.A., 1973).

3.1.3 Bionutrients. Several processes in the dressing of ore use reagents that contain bases or bi-products of  $\text{PO}_4$ ,  $\text{NO}_2$ ,  $\text{NO}_3$ , and  $\text{SO}_4$ . These could constitute, if in large enough quantities, a threat to the biota of Goosly Lake and Buck Creek.

Sulfates, for example, that could originate from the microbial leaching of mineral deposits and the antimony leaching facilities, are known to be lethal to shiners (an abundant species at Goosly Lake) at concentrations of 100 mg/l over a period of 120 hours (McKee and Wolfe, 1963). Phosphates and nitrates originating from domestic sewage or frothing and promoting agents can result in algae blooms that are ultimately responsible for degrading water quality.

The levels of bionutrients in the watershed adjacent to the development are presented in Table 3.

Nitrates and Nitrites were below the detectable limits in all the analyses and phosphates were well below the Provincial "A" level objectives (2.0 mg/l) specified for "The Mining, Mine-milling, and Smelting Industries of British Columbia" (1973). Sulfate levels, on the other hand, varied from above the "A" level standards (50 mg/l) at Stations 3 and 8 to undetectable at others. No explanation can be provided for these erratic and anomolous readings.

TABLE 3     BIONUTRIENT CONTENT OF THE WATERSHED ADJACENT TO THE GOOSLY  
DEVELOPMENT - JULY 26, 1974

Station Number	TP <sub>04</sub> mgP/l ±.005	NO <sub>3</sub> mgN/l ±.005	NO <sub>2</sub> mgN/l ±.005	SO <sub>4</sub> mg/l ±.005
1	.023	<.01	<.005	-
2	.019	<.01	<.005	<5
3	.013	<.01	<.005	91
4	.015	<.01	<.005	<5
5	.052	<.01	<.005	10
6	.015	<.01	<.005	<5
7	.029	<.01	<.005	13
8	.020	<.01	<.005	52
9	.017	<.01	<.005	43
10	.027	<.01	<.005	10
11	<.01	<.01	<.005	<5

< Indicates less than the detection limit

### 3.2 Tailings Chemistry and Bioassay Results

The two tailings samples (flocculated and unflocculated) supplied from bench-scale studies were found non-toxic at 100% concentration over a 96-hour period. Results of the bioassays are summarized in Table 4 and full details are appended. These bioassays were, however, performed on the clear supernatant of the settled tailings and, therefore, sublethal factors such as abrasion to fish gills from the tailings sands could not be considered. Nor could a proper assessment be made at this time of other influencing factors, such as the effect of leaching circuit effluent if it is to be combined with the tailings and the toxicity build-up associated with 50% recycle.

TABLE 4 BIOASSAY RESULTS ON FLOCCULATED AND UNFLOCCULATED SIMULATED TAILINGS

Sample Origin	Concentration %	Cumulative Mortality at time (hrs.)				Assessment
		24	48	72	96	
Tailings from thickner unflocculated	100%	0/5	0/5	0/5	0/5	Non-toxic
	56%	0/5	0/5	0/5	0/5	Non-toxic
Tailings from thickner flocculated	100%	0/5	0/5	0/5	0/5	Non-toxic
	56%	0/5	0/5	0/5	0/5	Non-toxic

Provided the tailings samples supplied from the bench-scale studies are a reasonable indication of the tailings' quality with respect to the pulp settleability, then turbidity and suspended solids are not expected to present a problem. Environment Canada maintains that suspended solids in effluent discharges should not exceed 25 mg/l or background levels, whichever is the greater.

Fish have an avoidance reaction towards turbid water and trout and salmon are primarily sight feeders. Concentrations of suspended solids exceeding 25 mg/l cause difficulties in the feeding habits of such fish. Further increases in the levels of suspended solids cause a reduction in growth and disease resistance as well as physically eroding and clogging the gill membranes (Hynes, 1966; Lantz, 1971).

The effects of settled suspended materials on the stream environment are also well documented. Blanketing of the stream bottom causes a reduction of flow through the bottom gravel often the segment of the stream that is affected becomes unsuitable for fish egg development. Silting may also drastically change the population of bottom-dwelling invertebrates, impede fry emergence and cause high mortality and poor fry quality at emergence (Gammon, 1970).

Chemical analyses of the unflocculated tailings revealed that the sample contained potentially toxic levels of lead and zinc (see Table 5). These appear to be significantly reduced by the addition of a flocculent indicating that the non-filterable (non-settleable) particles of greater than  $0.45\mu$  in size contributed significantly to lead and zinc contamination. Even with the use of a flocculent, zinc levels exceeded concentrations that were toxic to flathead minnows and elicited an avoidance reaction from rainbow trout (E.P.A., 1973).

TABLE 5 TAILINGS CHEMISTRY

Sample Origin	Non-Filterable Residues ppm $\pm 2.5$	Cd ppm $\pm 0.01$	Cu ppm $\pm 0.01$	Fe ppm $\pm 0.03$	Pb ppm $\pm 0.02$	Zn ppm $\pm 0.01$
Tailings from thickner unflocculated	6	<.03	<.01	.02	.21	1.5
Tailings from thickner flocculated	<3	<.03	<.01	<.02	<.01	.06

#### 4 GOOSLY LAKE

It is expected that demands on the watershed will increase tremendously because of its easy access to the Houston-Smithers area and proposed developments. To stress the relative importance of Goosly Lake as both a fisheries resource and a recreational area in relationship to its size, the British Columbia Fish and Wildlife Branch has supplied the following information.

##### 4.1 Dimensions of Goosly Lake

Area	597 acres
Perimeter	39,500 feet
Mean depth	33.7 feet
Maximum depth	66 feet
Volume	20,160 acre-feet
Elevation	2,700 feet

##### 4.2 Water Parameters Measured on August 16, 1968

Seechi Disc	6 feet
Total dissolved solids	63 ppm

##### 4.3 Fisheries Resource

Resident fish distribution from a gill net sample,  
August 17, 1968

74 red-sided shiners	(Richardsonius balteatus)
49 pea mouth chub	(Mylocheilus caurinum)
22 longnose suckers	(Catastomus calostomus)
12 rainbow trout	(Salmo gairdneri)
8 large-scale suckers	(Catostomus macrocheilus)
7 mountain whitefish	(Prosopium williamsoni)
1 kokanee	(Oncorhynchus nerka)

Anadromous species (Fisheries and Marine Services files)

Coho	(Oncorhynchus kisutch)
Pink	(Oncorhynchus gorbuscha)
Chinook	(Oncorhynchus tshawytsch)
Sockeye	(Oncorhynchus nerka)
Chum	(Oncorhynchus keta)
Steelhead Trout	(Salmo gairdneri)

5 EQUITY MINING WATER-USE PROGRAM

Equity Mining Capital Ltd. has proposed a 50% recycle program for its tailings supernatant. Process make-up water (approximately 1,600,000 IGPD) is to be drawn over a 1,000 foot head from Goosly Lake. The balance of the tailings supernatant is to be decanted from the tailings pond to Goosly Lake. This decant should not affect the lake level because it is of the same order of magnitude as the process make-up water.

Retention of the tailings slurry facilitates only settling of the sands but to date there has been no indication that any other treatment facilities will be incorporated to remove dissolved constituents. To assume that 50% recycling reduces the quantity of dissolved toxicants to the environment by 50% is incorrect. In reality, 100% of the dissolved and suspended matter are discharged at twice the concentration in half the volume. 50% recycling by nature is advantageous only to the mill. In the case of Equity Mining Capital Ltd., it reduces the volume of process water required and the size of the tailings facilities needed.

The following function predicts the concentration of any contaminant in the tailings during any given cycle:

$$x + x \sum_{a=1}^N \left(\frac{1}{2}\right)^a$$

where  $x$  = concentration of contaminant produced from a single cycle

$N$  = number of cycles

$$\lim_{N \rightarrow \infty} x + x \sum_{a=1}^N \left(\frac{1}{2}\right)^a = 2x$$

These contaminants increase in concentration asymptotically until they reach a theoretical equilibrium of twice the original concentration. This approach is 100% valid in the case of the accumulation of a physical substance in the effluent. For chemical substances, the approach is still valid; nevertheless, chemical equilibria should be taken into consideration. Since each mining effluent is unique, we do not attempt to predict the actual slope of the curve for Equity Mining Capital Ltd. It is a known fact that accumulation does occur in any recycling system.

Figure 2 illustrates this mode of accumulation for a constant mill additive of 50 mg/l. This could represent a mill reagent, dissolved metal or suspended solid.

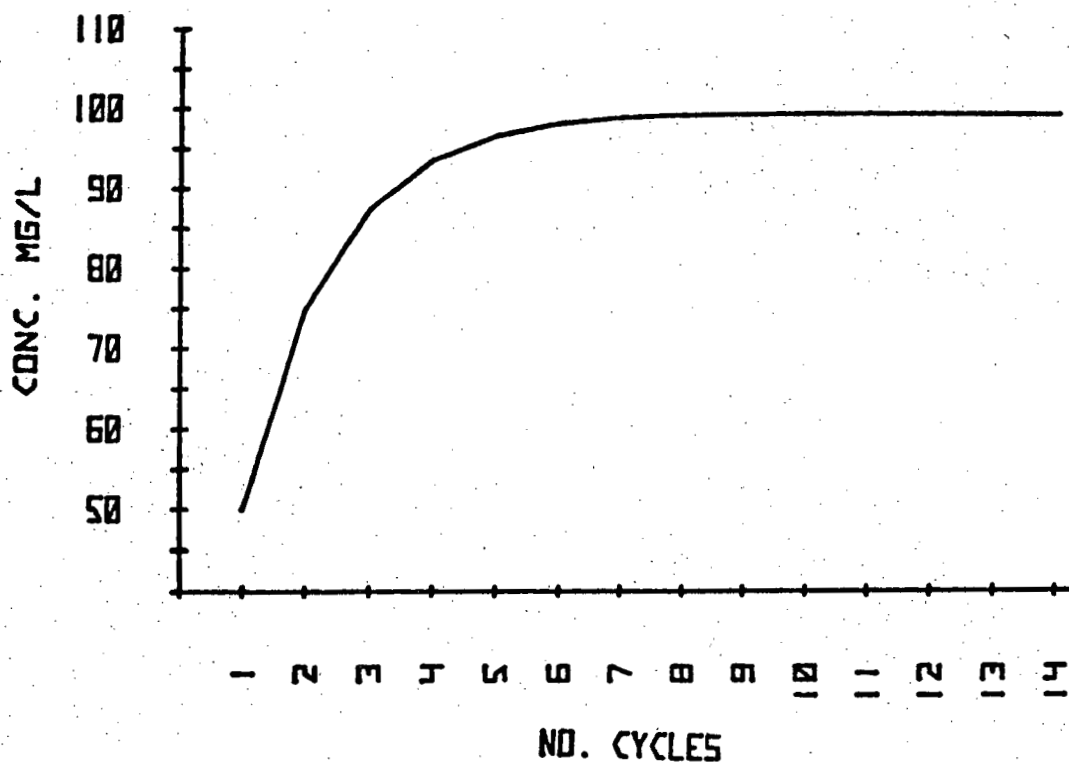


FIGURE 2: THE ACCUMULATION OF SUSPENDED SOLIDS IN THE TAILINGS AT 50% RECYCLE FOR A CONSTANT ADDITIVE OF 50 MG/L

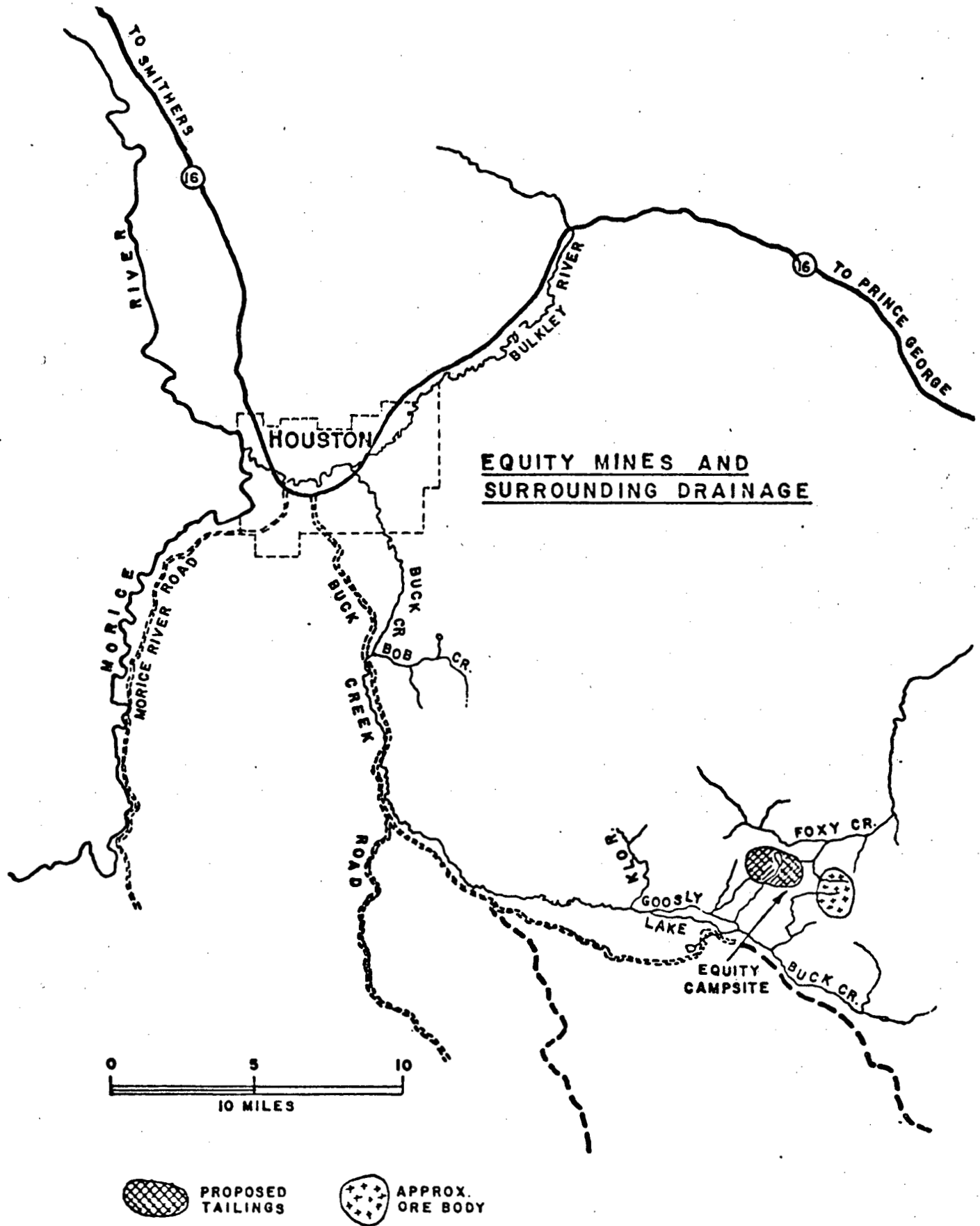


FIGURE 3: EQUITY MINES AND SURROUNDING DRAINAGE



Equilibrium is essentially reached after only 14 cycles at which point both the tailings recycle and mill effluent contain identical quantities of dissolved contaminants. The volume of discharge from the tailings impoundments, when full, equals one-half the process requirements and contains twice the concentration of solutes as an equivalent non-recycle system. Consequently, there would be no ecological advantage. Goosly Lake would be the recipient of all the dissolved constituents discharged from the mill.

The Buck Creek system (see Figure 3) which includes the discharge of Goosly Lake, Kloo Creek and Bob Creek, drains approximately 210 square miles. Bob Creek and Kloo Creek contribute between 1/2 and 2/3 the total flow of Buck Creek at Houston. Fisheries and Marine Service personnel at Smithers report that during August of each year the only recorded flows originate from Bob and Kloo Creeks and that the Goosly Lake outlet is sometimes a dry creek bed. This, in effect, would create a closed system for at least a portion of the year between Goosly Lake and the Equity Mill.

Table 6 provides a summary of unpublished data\* for the flow rates measured by an automatic water gauge situated at the mouth of Buck Creek. Data was supplied by the Water Survey of Canada, Vancouver, B.C.

\* Subject to revision

TABLE 6 BUCK CREEK FLOW AT MOUTH - 1973

Month	Mean cfs	Acre-feet (total)	Maximum cfs	Minimum cfs
January (Ice conditions)	16.5	1,010	16.8	14.4
February (Ice conditions)	11.4	633	13.9	11.0
March (Ice conditions)	21.0	1,290	33.5	11.6
April	127.0	7,580	311.0	36.5
May	1,010.0	62,100	2,560.0	389.0
June	537.0	32,000	804.0	239.0
July	84.0	5,160	224.0	22.2
August	20.8	1,280	36.2	8.9
September	27.0	1,610	61.5	20.4
October	56.4	3,470	66.3	46.5
November (Ice conditions)	20.3	1,210	50.1	12.1
December (Ice conditions)	9.8	600	11.9	8.0
YEAR SUMMARY	163.0	118,000	2,560.0	8.0

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#### ACKNOWLEDGEMENTS

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APPENDIX

B.



BIOASSAY RECORD - RELEVÉ D'ESSAIS BIOLOGIQUES

SAMPLE NO. / Échantillon n° 3268-1		COMPANY / Société Equity Mine - Goosly Project		ATTENTION / À l'attention de R. Hoos	
SAMPLE DESCRIPTION, AMOUNT AND CONTAINER / Description de l'échantillon, quantité et récipient Water from thickener U-3 effluent without flocculant					
COLLECTED BY / Prélevé par Company		DATE Approx. 1st wk. in Dec.		TIME / Heure	
ANALYSIS REQUIRED / Analyse demandée 96 hr. LC <sub>50</sub>		DILUTION WATER (Check one) Eau de dilution (Cocher selon le cas) <input type="checkbox"/> Salt Water Eau saline <input checked="" type="checkbox"/> Fresh Water Eau fraîche		SAMPLE HANDLING (Check one) Manipulation de l'échantillon (Cocher selon le cas) <input type="checkbox"/> Legal Légale <input checked="" type="checkbox"/> Routine Courante	

FOR LAB USE ONLY - RÉSERVÉ AU LABORATOIRE

RECEIVED IN LABORATORY BY / Reçu au laboratoire par R. Watts		DATE 19/12/74		TIME / Heure 1600	
ORIGINAL SAMPLE / Échantillon initial pH 7.30		DILUTION WATER / Eau de dilution pH 6.4		DILUTIONS MEASURED BY Dilutions mesurées d'après <input checked="" type="checkbox"/> Weight Le poids <input type="checkbox"/> Volume Le volume	
FISH SPECIES / Espèce de poisson Coho		BIOASSAY TEMPERATURE Température lors de l'essai 9.5 ± 1 °C		FISH SIZE / Taille du poisson <input checked="" type="checkbox"/> Weekly Average Moyenne Hebdomadaire <input type="checkbox"/> Actual Actuelle	
FORK LENGTH (avg.) Longueur de la fourchette (app.) 8.37 cm		RANGE / Portée 6.80 TO 9.45 cm		WEIGHT (avg.) / Poids (app.) 6.60 gm/g	
				FISH LOADING DENSITY Densité de la charge de poissons 1.10 gm/l/g/l	
				RANGE / Variation 2.89 gm/g TO 8.94 gm/g	

Concen- tration	Test Vol. Vol de l'échant.	Start Date Essai commencé le	Start Initial		CUMULATIVE MORTALITY AT TIME (hr) Mortalité cumulative												FINAL	
			pH	D.O. O.D.		.25	.5	1	2	4	8	16	24	48	72	96	pH	D.O. O.D.
100%	30k110	20/12/74	7.20	6.7									0/5	0/5	0/5	0/5	7.31	10.5
56%	30k110	20/12/74	7.20	10.1									0/5	0/5	0/5	0/5	7.22	10.7

ANALYSIS RESULTS / Résultats de l'analyse

This sample is non toxic at 100% concentration in a 96 hr. LC<sub>50</sub>.

Linda Patterson

ANALYST / Analyste

Dec. 24/74

DATE

Man. min. 150



Environment Canada  
Environmental Protection

Environnement Canada  
Protection de l'Environnement

### BIOASSAY RECORD - RELEVÉ D'ESSAIS BIOLOGIQUES

SAMPLE NO. / Échantillon n° <b>3268-2</b>		COMPANY / Société <b>Equity Mine - Coosly Project</b>		ATTENTION / À l'attention de <b>R. Hoos</b>	
SAMPLE DESCRIPTION, AMOUNT AND CONTAINER / Description de l'échantillon, quantité et récipient <b>Water from thickner U-3 effluent with flocculant</b>					
COLLECTED BY / Prélevé par <b>Company</b>		DATE <b>Approx. 1st wk. in Dec.</b>		TIME / Heure	
ANALYSIS REQUIRED / Analyse demandée <b>96 hr. LC<sub>50</sub></b>		DILUTION WATER (Check one) Eau de dilution (Cocher selon le cas) <input type="checkbox"/> Salt Water Eau saline <input checked="" type="checkbox"/> Fresh Water Eau fraîche		SAMPLE HANDLING (Check one) Manipulation de l'échantillon (Cocher selon le cas) <input type="checkbox"/> Legal Légale <input checked="" type="checkbox"/> Routine Routinaire	

#### FOR LAB USE ONLY - RÉSERVE AU LABORATOIRE

RECEIVED IN LABORATORY BY / Reçu au laboratoire par <b>R. Watts</b>		DATE <b>19/12/74</b>		TIME / Heure <b>1600</b>		WITNESS / Témoin	
ORIGINAL SAMPLE / Échantillon initial pH <b>7.71</b>		SALINITY / Teneur en sel ‰ <b>6.4</b>		DILUTION WATER / Eau de dilution HARDNESS (ppm) <b>7.5 CaCO<sub>3</sub></b>		SALINITY / Teneur en sel ‰ <b>6.4</b>	
FISH SPECIES / Espèce de poisson <b>Coho</b>		BIOASSAY TEMPERATURE Température lors de l'essai <b>9.5 ± 1 °C</b>		FISH SIZE / Taille du poisson <input checked="" type="checkbox"/> Weekly Average Moyenne Hebdomadaire <input type="checkbox"/> Actual Actuelle		DILUTIONS MEASURED BY Dilutions mesurées d'après <input checked="" type="checkbox"/> Weight Le poids <input type="checkbox"/> Volume Le volume	
FORK LENGTH (avg.) Longueur de la fourchette (app.) <b>8.37 cm</b>		RANGE / Portée <b>6.80 cm TO 9.45 cm</b>		WEIGHT (avg.) / Poids (app.) <b>6.60 gm/g</b>		RANGE / Variation <b>2.89 gm/g TO 8.94 gm/g</b>	

Concentration	Test Vol. Vol de l'échant.	Start Date Essai commencé le	Start Initial		CUMULATIVE MORTALITY AT TIME (hr) Mortalité cumulative												FINAL	
			pH	D.O. O.D.	.25	.5	1	2	4	8	16	24	48	72	96	pH	D.O. O.D.	
100%	30kilo	20/12/74	7.67	8.6								0/5	0/5	0/5	0/5	7.35	9.7	
56%	30kilo	20/12/74	7.42	10.1								0/5	0/5	0/5	0/5	7.44	10.6	
Control Contrôle	30kilo	17/12/74	6.36	11.5					0/5			0/5	0/5	0/5	0/5	6.66	9.2	

ANALYSIS RESULTS / Résultats de l'analyse

This sample is non toxic at 100% concentration in a 96 hr. LC<sub>50</sub>.

Linda Patterson

ANALYST / Analyste

Dec. 24/74

DATE

150

Man. min.