Environmental Pro tion
3rd Floor, Kapilano 100, Park Royal
West Vancouver, B.C. V7T 1A2

884686

Our file:
4780-1

April 6, 1989

B.C. AMD Prediction & Prevention Committee

Re: Kutcho Creek AMD Research

Please find attached a formal application by Sumac Mines Ltd. to conduct the subject research program.

I would appreciate any comments you may have by April 21, 1989.

Yours truly,

K.D. Ferguson
Head, Mining & Metallurgy Program

cc: J. Robertson - Tech Corp.

Attachment

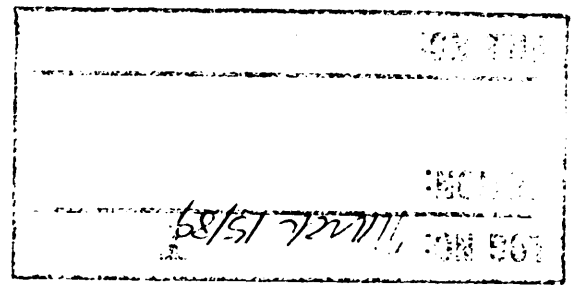
Sumac

SUMAC MINES LTD.

TELEPHONE
685-6735
FACSIMILE
(604) 685-3276

BOX 10150, PACIFIC CENTRE
602 - 700 WEST GEORGIA STREET
VANCOUVER, B.C. V7Y 1C6
CANADA

March 10, 1989



Ministry of Energy, Mines
and Petroleum Resources
Mineral Resources Division
Parliament Buildings
Victoria, B.C.
V8V 1X4

Attention: Mr. Greg McKillop, Manager
Canada/British Columbia Mineral Development Agreement

Dear Sir:

Re: Kutcho Creek Acid Mine Drainage Research

Please find enclosed an outline of the Kutcho Creek Phase II proposed studies on acid generation to be conducted in 1989-90.

Phase I of the study is now scheduled for completion in May 1989. An interim report highlighting the progress of the study was submitted to you on March 1, 1989. The results of the study to date are very informative and certainly relevant to the understanding of acid generation in cold climates and particularly the importance of rock texture in determining rate of acid release. Rate of reactions, i.e. acid or alkaline, appear to be more directly related to the texture of the rock than the acid generation potential as derived from acid base accounting. As an example, during the first phase of the study, it was demonstrated that highly schistosed rocks with low to medium sulphur (5-8%) generate acid at rates significantly higher than well indurated rocks with high sulphur (35-40%) content.

Also, during the first phase of the study a modified humidity cell was developed which could become an industry standard for the kinetic assessment of acid generation potential. These new findings are of general importance to the industry and relevant to other projects in British Columbia and Canada.

Last year's program was under the direction of Esso Minerals Canada while this year we will be directing the program. Rescan Environmental Services Ltd. will continue to supervise the program as outlined in our joint proposal with Esso Minerals Canada submitted to you in March 1988.

Phase II of the work involves the development of field test plots at Kutcho Creek and a detailed assessment of drill core to develop computerized control techniques for sequencing, segregating and blending of waste rock.

The information generated during this year's field program will be compared to the results of the bench scale kinetic testwork. Information on scaling up laboratory studies to field level applications will contribute significantly to the general understanding of acid generation.

The amount of money budgeted for this year is $140,000.00 for the development and instrumentation of the field test plots and drill core assessment. The budget is allocated as follows: $85,000 for field test plots and monitoring; and $55,000 for drill core assessment and a computer controlled waste rock sequencing system.

Accordingly, Sumac is applying for assistance from the Canada/British Columbia Mineral Development Agreement in order to conduct the 1989 field program. The attached proposal and documentation should serve as our application for funding.

If you require further information please do not hesitate to contact me.

Yours very truly,

SUMAC MINES LTD.
per:

Ichiro Abe,
Vice-President

IA:sas
Attachment

KUTCHO CREEK PROJECT

MDRP Meeting - Proposed Program - Acid Mine Drainage Concerns

10:00 a.m. - March 18, 1988

Hemlock Room, Parliament Buildings - Victoria, B.C.

BACKGROUND

Exploration in the Kutcho Creek area of northwestern B.C. (Figure 1) by Sumac Mines Ltd. and Esso Minerals Canada in the early 1970's led to the discovery of the Kutcho Creek massive sulphide deposits (Figure 2). Subsequent exploration and development work, primarily in the main ore zone, has delineated possible economic reserves of copper, zinc and silver mineralization.

In late 1984, a preliminary feasibility study was commissioned by Sumac and Esso with the objective being to realistically assess the project's viability and to identify information gaps in the existing data base in order to guide subsequent phases of development.

The results of the study (Attachment 1) showed that Kutcho Creek is submarginal at today's metal prices but that the project could be considered a candidate for development subject to improvements in metal markets. Supply and demand studies seem to indicate that a new copper supply will be needed by the early 1990's.

STRATEGY

Based on our experience to date (Attachment 2), both Sumac and Esso recognize that substantial lead time may be required prior to Stage II approval. We also recognize that acid mine drainage (AMD) has emerged as the key environmental issue throughout the province and that until that issue is resolved to the satisfaction of all concerned, the approval for Stage II will be withheld.

We are therefore proposing a jointly-funded test program on Kutcho Creek which has been designed, under the direction of Rescan Environmental Services Ltd., to provide definitive answers on the potential for AMD on the property. The program requires a commitment of at least three years.

KUTCHO CREEK PROJECT
DESCRIPTION OF HANGING WALL AND FOOTWALL ROCK TYPES

Hanging Wall

The hanging wall of the Kutcho sulphide lens is a variably altered quartz feldspar crystal tuff. Quartz and feldspar phenoclasts comprise from 20 to 50% of the rock volume and sit in a fine matrix of quartz, muscovite, carbonate, chlorite and epidote. Quartz grains range from 2 to 10mm in size and are visible even within the intensely altered rock. Gradational changes in both quartz abundance and size are related to bedding within the tuffs. Feldspar grains are euhedral to anhedral, range in size from 1 to 4mm and are commonly psuedomorphed by fine sericite and carbonate or epidote. Fine disseminated to rare, coarse porphyroblastic pyrite occurs within the hanging wall over a 20 to 30m thickness immediately adjacent to the massive sulphide lens. Pyrite concentration in this area is approximately 3%. Sericite-carbonate alteration is intense in the lower 10m of the hanging wall. Alteration effects are not visually observed at distances greater than 40m above the sulphide lens.

Tests to date indicate that the hanging wall rock is acid consuming.

Footwall

The footwall of the Kutcho Creek volcanogenic massive sulphide deposit consists of highly altered felsic lapilli tuffs and lithic ash tuffs. Textures are largely obliterated by alteration and penetrative foliation although flattened siliceous fragments are locally preserved. Mineralogy primarily consists of quartz, ferroan dolomite, muscovite and pyrite. Chlorite and epidote are minor and localized constituants. Pyrite occurs as thin, semi-massive to massive layers (2 -30cm) and as disseminations within the upper 20m of the footwall. Overall pyrite content in this interval is approximately 10%. Pyrite abundance decreases away from the ore zone to about 2% at 50m.

The footwall has the potential to generate acid mine drainage.

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PROPOSAL

Purpose: To conduct acid mine generation studies for the Kutcho Creek project in support of Stage II requirements.

Objective: To determine whether Kutcho Creek has the potential to generate acid mine drainage. The program will determine, through the use of mineralogical analysis, the reactive minerals contributing to the possible generation of acid as well as the requirement of using segregation or blending as a method of controlling potential acid mine drainage.

General Methodology: During the first year samples would be obtained from the various rock types which are representative of the Kutcho deposit. These samples would be subjected to various laboratory tests and upon completion, a baseline of information would be established for future work.

The second year of the program would result in the construction of test piles to determine the effectiveness of blending and/or segregation of rock in the waste dump. In addition, a test pile of only footwall material will be set up and monitored for potential acid generation. The material on site will limit the test piles to approximately 20 tonnes each.

The third year of the program would continue with ongoing monitoring of the test piles which would eventually lead to the preparation of an acid mine generation mine abandonment plan.

Details of Test Program:

Year 1

- obtain 20kg samples of material from each stockpile. (See Figure 3).
- obtain 100kg samples of hanging wall material by taking material from the waste dump, or scaling the back in the adit.
- material shipped to an environmental lab to coordinate testing.
- perform a mineralogical determination on samples by rock type on existing samples.
- set up humidity cells consisting of footwall, hanging wall, and some interstitial waste material as well as ore samples.
    - on a weekly basis measure leachate for pH, total acidity, alkalinity, sulphates, and iron.
    - every four weeks complete an ICP scan and acid-base accounting.
    - run humidity cells for a minimum of 10 weeks.
    - upon completion of the humidity cell tests, perform a mineralogical evaluation to determine the reactive sulphides.
- perform acid-base accounting tests on the above samples.
    - analyze for paste pH.
    - percent total sulphur or percent pyritic sulphur.
    - neutralization potential.
- determine if required, the minimum ratio of hanging wall to footwall rock to ensure neutralization of AMD.

Optional Program Year 1 or Year 2

- examine the drill core and select samples for acid-base accounting, by rock type. Particularly important are those holes which penetrate the footwall.

- the analytical work will test for:

    - paste pH
    - percent total sulphur or percent pyritic sulphur.
    - neutralization potential.

- once the results of the acid-base accounting are finalized, construct a computer model, based upon the present pit design, identifying quantities and locations of acid consuming and potential acid generating materials.

- determine a ratio of materials available for waste dump segregation or blending.

Year 2

- based upon the test results obtained from the Year 1 Program, possibly five testpiles will be constructed using material from the stockpiles, three of which are as follows.

    1-20 tonne testpile of footwall material.
    2-20 tonne testpiles consisting of a mixture of footwall and hanging wall material.

- each testpile will be contained by specially prepared test boxes.

- the leachate will be collected and sampled monthly by an automatic sampler.

Year 3 +

- ongoing monitoring of testpiles and submission of mine abandonment plan.

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KUTCHO CREEK AMD TEST PROGRAM
ESTIMATED PROGRAM COSTS

Year 1

Professional Fees:				
- Rescan	10	mandays @ $600		$ 6,000
- Esso Minerals	13.3	mandays @ $300		4,000
Drafting:				
	1	manday @ $320		$ 320
Word Processing				
	2.5	mandays @ $250		$ 625
Humidity Cells - Acid-Base Accounting:				
Acid-Base Accounting 15 samples @ $50/ea (paste pH, sulphur, acidity/alkalinity).			$ 750	
Humidity Cells:				
- Construction of Cells			$ 2,500	
- Misc. Supplies for testwork			500	
- Testwork 15 samples x 10 series @ $250 ($SO_4$, acidity/alkalinity, conductivity, pH, dissolved metals: Cu, Cd, Pb, As, Hg, Mn, Al, Zn, Fe).			37,500	
Mineralogy:				
Petrography 15 samples @ $60/ea (feldspar abundances and composition, and alteration assemblages).			$ 900	
- photography demonstrating alteration assemblages.			150	
		Subtotal		$42,300
Disbursements:				
Travel Expenses			$ 6,000	
Sampling Equipment and Supplies			500	
Computer Usage			1,000	
Misc. Office and Drafing Supplies			500	
Progress Report Preparation			1,000	
		Subtotal		$ 9,000
		Subtotal Year 1		62,245
		Contingency		9,285
		EMC Overhead		3,470
		Total Year 1		**$75,000**

Optional Program Year 1 or 2

Professional Fees:					
- Rescan	10	mandays	@ $600		$ 6,000
- Esso Minerals	30	mandays	@ $300		9,000
Drafting:					
	1	manday	@ $320		$ 320
Word Processing					
	2.5	mandays	@ $250		$ 625
Analytical Services:					
Acid-Base Accounting of Drill Core 350 samples @ $50/ea (paste pH, sulphur, acidity/ alkalinity).					$17,500
Disbursements:					
Travel Expenses				$ 6,000	
Sampling Equipment and Supplies				500	
Computer Usage				1,000	
Misc. Office and Drafing Supplies				500	
Progress Report Preparation				1,000	
Camp Cost				3,600	
Subtotal					$ 9,000
Subtotal Optional					46,045
Contingency					6,335
EMC Overhead					2,620
Total Optional Program					**$55,000**

Year 2

Professional Fees:			
- Rescan	4 mandays @ $600		$ 2,400
- Esso Minerals	10 mandays @ $300		3,000
Word Processing			
	4 mandays @ $250		$ 1,000
Analytical Services:			
Monitoring Testplots (August and October) 10 @ $300/ea ($SO_4$, acidity/alkalinity, conductivity, pH, microscope identification of micro-organisms, dissolved metals: Cu, Cd, Pb, As, Hg, Mn, Al, Zn, Fe).			$ 3,000
Test-Box Construction:			
Engineering Design		$ 2,000	
Labour 140 hours @ $25/hour Senior Carpenter and Labourer		3,500	
Construction Materials			
Lumber and Building Supplies		6,500	
Poly-Membrane Liner Material		1,500	
Insulation		500	
Piping		600	
Heat (external & internal) Sensors 20 @ $150/ea		3,000	
Temperature Recorder		10,000	
Sampling Receptacles 5 @ $250/ea		1,250	
Procurement of Materials 4 mandays @ $250/ea		1,000	
Transportation of Material		2,000	
Front-end Loader 4 days @ $800		3,200	
Vehicle 12 days @ 120		1,440	
Supervision Senior Environmental Engineer 10 mandays @ $600		6,000	
Labourers (2) 8 mandays @ $250		2,000	
	Subtotal		$44,490
Disbursements:			
Travel Expenses		$ 9,900	
Vehicle and Equipment at Site		1,200	
Sampling Equipment and Supplies		1,000	
Computer Usage		1,000	
Misc. Office and Drafing Supplies		1,000	
Progress Report Preparation		2,500	
	Subtotal		$16,600
	Subtotal Year 2		70,490
	Contingency		6,460
	EMC Overhead		4,050
	Total Year 2		**$85,000**

Year 3

Professional Fees:			
- Rescan	10 mandays @ $600		$ 6,000
- Esso Minerals	20 mandays @ $300		6,000
Drafting:			
	2 manday @ $320		$ 640
Word Processing			
	5 mandays @ $250		$ 1,250
Analytical Services:			
Monitoring Test-Boxes (monthly from May-October) 6 months x 5 boxes @ $300/box		$ 9,000	
	Subtotal		$ 9,000
Disbursements:			
Travel Expenses		$17,860	
Vehicle		1,800	
Sampling Equipment and Supplies		1,000	
Computer Usage		1,000	
Misc. Office and Drafing Supplies		1,000	
	Subtotal		$22,660
	Subtotal Year 3		45,550
	Contingency		6,830
	EMC Overhead		3,620
	Total Year 3		$55,000

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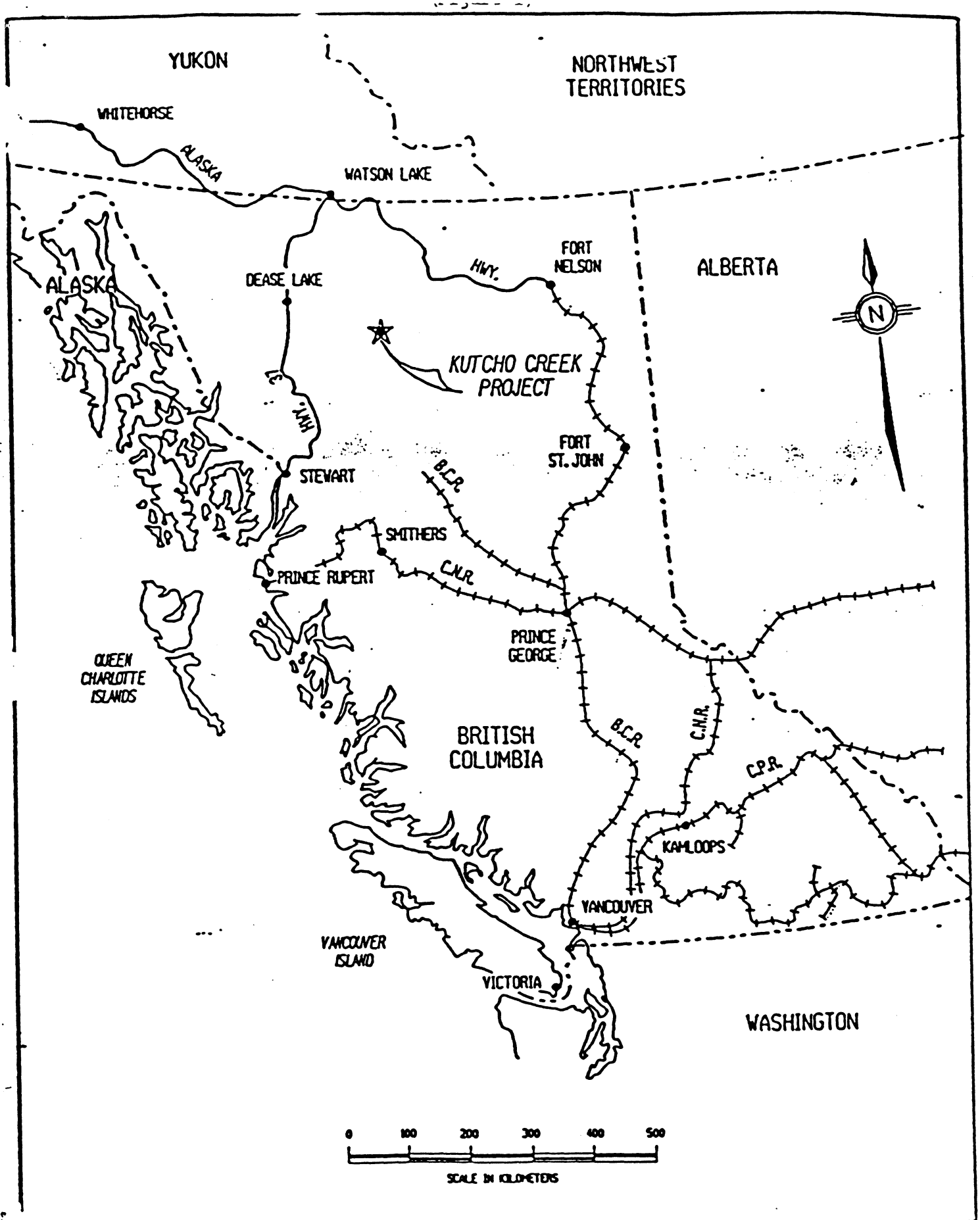
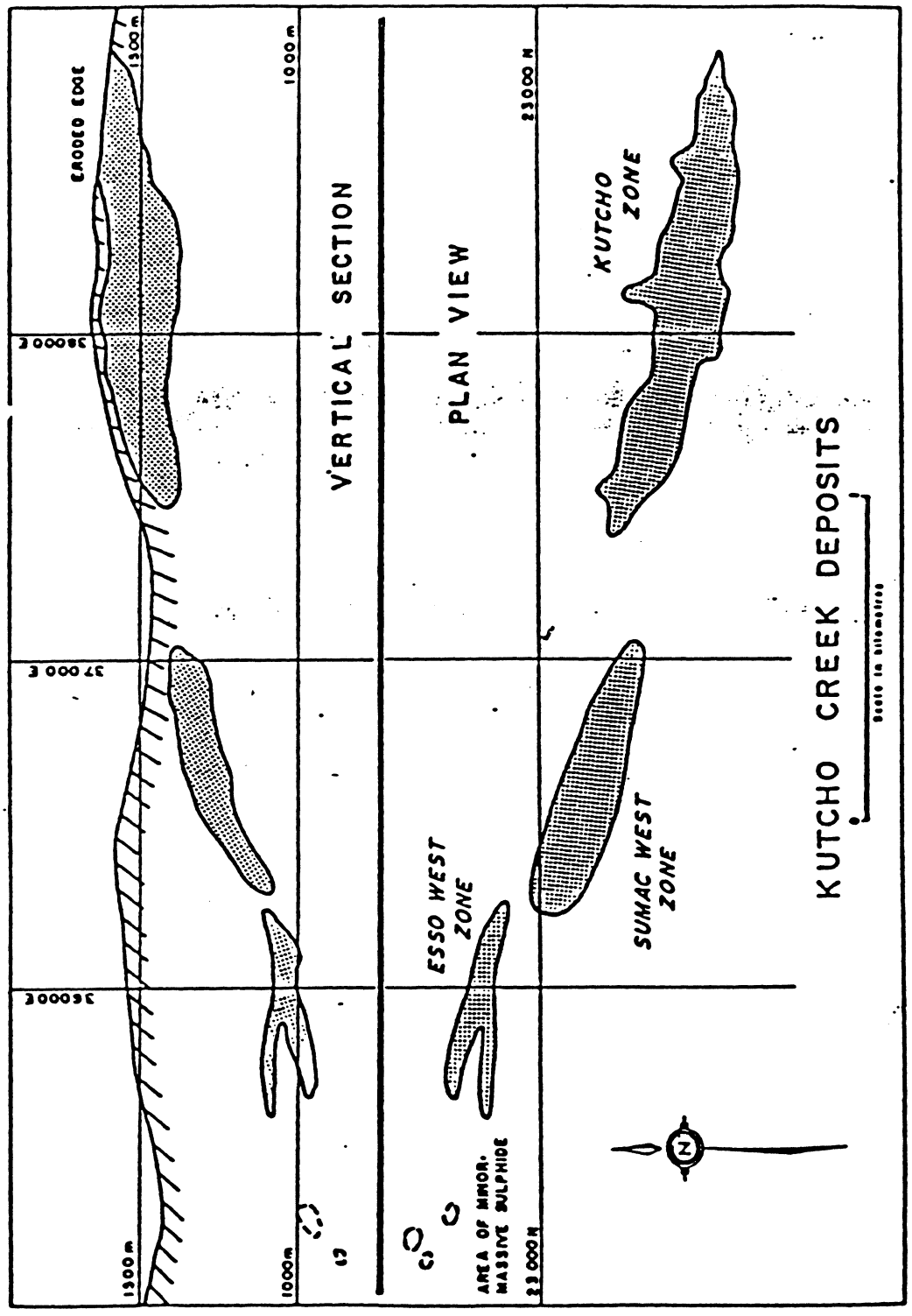


EMC/SUMAC KUTCHO CREEK		LOCATION MAP					
WRIGHT ENGINEERS LIMITED VANCOUVER CANADA	Drawn	GDT	Appr.	WDD	DRAWING NO		REV
	Check	HM	Appr. Date		A	1344 FIGURE 3-1	



ENC/SUMAC
KUTCHO CREEK

KUTCHO CREEK DEPOSITS

WRIGHT ENGINEERS LIMITED
VANCOUVER CANADA

Drawn	JB	Appr.	WDS	DRAWING NO.	REV
Check		Appr.		A 1344 FIGURE 4-1	

(Attachment 1)

KUTCHO CREEK PROJECT - FACT SHEET

Owners:	Esso Minerals Canada and Sumac Mines Ltd.
Location:	110 km east of Dease Lake, 390 km north of Smithers
Reserves:	13.9 million tonnes @ 1.75% Cu 2.47% Zn, 28.91 g/t Ag and 0.34 g/t An
Life of Mine:	10 years
Principle Economic Minerals:	Chalcopyrite, bornite and sphalerite
Strip Ratio:	6.6 to 1
Proposed Milling Process:	Conventional crushing-grinding flotation
Production Rate:	4000 tonnes of ore per day
Concentrate Produced:	Approximately 360 tonnes per day
Shipping Facility:	Deep water dock at Stewart - 530 km from Kutcho to Stewart
Road Access:	New road required to Highway 37 near Dease Lake
Employees:	Mine construction - 400 persons (max) Mine operation - 290 persons

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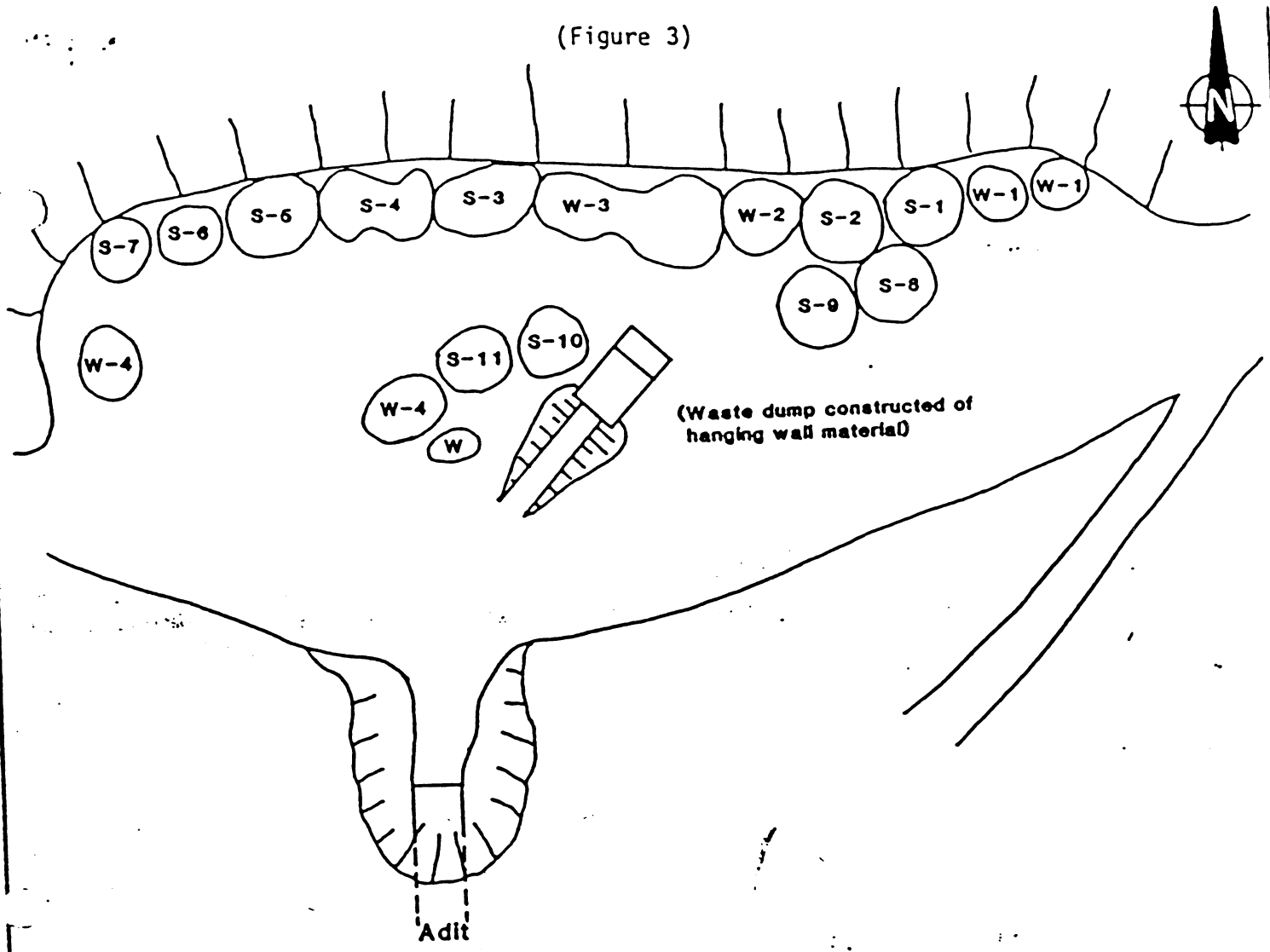
(Attachment 2)

Key Dates Concerning Kutcho Stage II Report

May, 1985	- Decision to proceed to Stage II
Mar. 8, 1986	- Draft submission made to Mine Development Steering Committee for pre-screening
May 6, 1986	- Draft submission accepted by Mine Development Steering Committee
May 29, 1986	- Formal submission of Stage II Report made to Mine Development Steering Committee (additional copies of Stage II report submitted with copies to local libraries and municipalities)
Sept. 17, 1986	- Meeting with review agencies to discuss AMD concerns - Request for further information
Oct. 6, 1986	- Follow-up meeting with review agencies to discuss AMD concerns - Request for further information
Dec. 18, 1986	- Supplementary Technical Letter - Stage II submitted
Feb. 4, 1987	- Additional information to Supplementary Technical Letter submitted
May 6, 1987	- Preparation for Cabinet Submission of Stage II study
June 24, 1987	- Government generic presentation to deputy ministers on AMD potential
Feb. 16, 1988	- Government generic presentation to Cabinet on AMD potential

(Figure 3)



ORE ASSAY ON EACH BLAST

NO.	LOCATION (m)	Cu %	Zn %	S %	Pb %	Au g/t	Ag g/t
S-1	174.1 - 176.1	1.08	0.77	6.08	0.029	0.22	43.7
S-2	176.1 - 178.3	1.46	0.81	25.6	0.029	0.40	60.7
S-3	187.6 - 189.6	2.39	4.00	23.4	0.14	0.31	39.8
S-4	189.6 - 191.0	2.19	2.41	15.9	0.099	0.29	29.1
S-5	191.0 - 192.8	1.22	0.71	17.2	0.058	0.22	21.4
S-6	192.8 - 194.7	2.07	1.19	34.7	0.053	0.31	36.0
S-7	194.7 - 196.5	2.01	2.35	34.4	0.059	0.31	31.2
S-8	196.5 - 197.7	1.29	3.22	39.3	0.033	0.19	16.3
S-9	197.7 - 199.3	2.46	3.21	38.6	0.025	0.21	19.7
S-10	199.3 - 201.1	2.24	2.27	35.1	0.026	0.43	28.4
S-11	201.1 - 202.9	0.76	0.55	19.1	0.012	0.12	8.1

WASTE ASSAY

NO.	LOCATION (m)	Cu %	Zn %	S %	Pb %	Au g/t	Ag g/t
W-1	172.0 - 174.1	0.46	0.34	5.85	0.025	0.20	25.2
W-2	178.3 - 180.1	0.07	0.13	N.A	N.A	N.A	N.A
W-3	185.1 - 187.6	1.62	2.25	N.A	0.064	N.A	N.A
W-4	202.9 - 204.4	0.18	0.24	17.3	0.006	0.08	4.1

ESSO MINERALS CANADA

KUTCHO CREEK PROPERTY

Location Map
Of
Ore & Waste Stockpiles

Project No. 122	Mining Div. Liard
NTS. 104I/1W	Drawn by:
Date: Mar.1988	Fig. No.