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To: Lee Mining

From: Bart Hartford

Re: Test of Tennessee Dump Chloride, Arizona

Introduction & Summary

Thursday, September 2, approximately 23 tons of dump material was shipped from Chloride, Arizona to the mill @ Sphuler Mountain. The mill,(figure II see flow sheet) which is a conventional floatation plant, is capable of operating at eleven tons an hour. However, for this test it was operated at a considerable reduced tonnage to accomodate the Tennessee dump sample. The purpose of the test was to determine under normal milling conditions:

1) Whether a saleable concentrate could be made?

2) What recovery of each metal might be expected?

3) Could a coarse fraction of the dump be rejected, while upgrading a finer fraction?

4) Whether the value of the test lot is sufficient to justify a profitable milling operation?

The 23 ton sample was screened ahead of crushing on a 3/4" screen. The coarse +3/4 fraction was crushed in the normal fashion and it was loaded into the ore bin. The finer -3/4" fraction was loaded into the ore bin after the crushed +3/4 to 2" material had passed through the mill. A head sample taken continuosly from the belt of each site fraction is given below in table I

Table I- Head Samples from Mill Test

Material Size	Wt %	Gold oz/ton	Silver oz/ton	Lead %	Analysis Copper &	Zinc %
+3/4"	56	.0135	.588	.51	.03	.48
-3/4"	44	.0305	.840	.88	.03	.95
Calculated Head	100	.021	.729	.67	.03	.69
Truckload Grab*	100	.029	.500			

Plus 1" Material Excluded

From the screen test of the feed (table I) it appears that 56% of the dump can be rejected. However, the above head analysis suggest that a seperation be made at some coarser size, perhaps 2". Belt pickers could easily remove valuable minerals in the coarser sizes.
This ore was run through the mill and the following concentrates were made.
They appear in Table II.

Table II-Concentrates from Mill Test

Material Size	Gold oz/ton	Silver oz/ton	Lead %	Copper %	Zinc %
+3/4"	.994	8.60	11.9	.71	4.76
-3/4"	1.025	10.40	9.61	.54	8.74

A saleable concentrate was produced. It is believed that it could be upgraded further through grinding the rougher concentrate. Because of the equipment available to the company, I recommend that a bulk concentrate be made and that it be treated by roasting. The calcine would be leached with Sulfuric acid to remove Copper, Iron, and Zinc. The leach residue would then be enriched in Lead, Silver & Gold. A rough analysis of the process appears in appendix A. The tails were assayed. The coarse +3/4" test tailing was assayed by size. Unfortunately, the volume of tailing sample taken in the -3/4" test did not permit this type of analysis. The recoveries from the tests are shown in Table III.

Table III- Recoveries from Mill Test

Material Size	% Recovery Gold	Silver	Lead	Copper	Zinc
+3/4	70.8	44.0	73.4	34.3	27.0
-3/4	67.3	72.4	62.5	67.9	30.8

No lab tests were done ahead of the mill test, so it is likely, that the results represent somewhat less than optimum. Respectable recoveries were obtained, except for Zinc. This could be due to incomplete activation of Sphalerite by Copper Sulfate or the Zinc minerals could be occuring as Hydro-Zincite, and Smithsonite. Gravity concentration using a jig in the grinding circuit would undoubtedly, increase the above recoveries. Overall, the test lots responded well to floatation. A combination of floatation and gravity would undoubtedly produce better recoveries than those obtained in the test. Acceptable concentrates were produced. The size of the sample together with additional samples taken at the Tennessee dump, indicate that the 23 ton sample selected for the mill test might be typical of the entire dump. If this were the case,

each ton of the -3/4 inch dump material would have a net smelter value of $18.98, assuming a 100% recovery of all metals under present market conditions. A projected milling cost of around twenty dollars per ton for processing the Tennessee dump through grinding and flotation does not appear attractive. Because of the size distribution of precious metals in the feed, a lower cost gravity method should be investigated.

Sample

The sample for the mill test was taken from the top of the dump at drill hole locations. Four buckets were taken at hole 23 and 2 buckets were selected at holes 15 & 27. As the truck was loaded, grab samples were taken from the loader bucket; +1" material was not included in the sample. The samples are shown in Table IV.

Table IV- Grab Samples of Test Lot

Grab No.	Gold oz/ton	Silver oz/ton
1206	.000	0.2
1207	.058	0.3
1208	.000	0.0
1209	.032	0.8
1210	.070	0.8
1211	.060	1.5
1212	.000	0.4
1213	.050	0.6
1214	.000	0.2
1221*	.000	0.2
Average	.027	0.5

*Sample taken from truckload

The 23 ton sample was trucked to Sphuler Mountain and 134.5 lbs. of sample was taken for screen analysis and assay by size. The results are given in Table V

TABLE V
Screen Analysis & Assay By
Size Of The Whole Sample

Product	WT %	Cumulative Wt% Retained	Cumulative Wt% Passing	Analysis Gold oz/ton	Analysis Silver oz/ton	Distribution Gold %	Distribution Silver %
+5"	8.9	8.9	91.1	.000	.000		
-5"x+4"	16.4	25.3	74.7	.000	.100		2.8
-4"x+3"	10.4	35.7	64.3	.000	.800		13.9
-3"x+2"	7.4	43.1	56.9	.022	.800	19.0	9.9
-2"x+1"	7.4	50.5	49.5	.000	.300		3.7
-1"x+4 Mesh	25.3	75.8	24.2	.020	.700	58.9	29.7
-4x+20"	11.9	87.7	12.3	.000	1.000		19.4
-20x35"	2.0	89.7	10.3	.000	1.100		3.7
-35x+100"	5.8	95.5	4.5	.030	1.000	20.2	9.7
-100x+200	2.0	97.5	2.5	.000	.800		2.7
-200x+325	1.2	98.7	1.3	.000	1.000		2.0
-325	1.3			.012	.900	1.9	2.0
Calculated total Head				.008	.597	100.0	100.0
Truck Grab Head (+1" Excluded)				.027	.500		
Calculated Head +1"				.003	.358	19.2	30.3
Assay Head -1/4" Fraction				.028	1.000		
Calc Head -1/4" Fraction				.008	.986	22.1	40.0
Calc Head -1/4" From Table				.035	.870		
Assay Head -3/4" Inch				.033	.820		
Calc Head -1" From Table				.008	.84	80.8	69.7

A graphical representation of the size distribution is shown in Fig I. Even though the size of the sample was large, 134.5 lbs, it failed to show the gold content observed in the other samples. However, the silver content agreed closely with the average grab sample in Table IV. Very little mineralization was observed in the rocks larger than one inch. This test showed 19.2% of the gold and 30.3% silver would be lost by screening out 3/4". I believe that these losses could be kept to a minimum by removing valuable minerals from a picking belt.

The 23 ton sample was screened ahead of crushing on 3/4 inch to observe the effect. The +3/4 inch fraction was run through the Mill and then the -3/4 inch fraction was shoveled onto the belt and charged into the ore bin. A screen analysis of the two flotation feed samples taken continuously from the belt is shown in Table VI.

TABLE VI
Screen Analysis of +3/4 & -3/4 Flotation Feeds
And Assay By Size

Mesh Product	Wt %	Cumulative Wt % Retained	Cumulative Wt % Passing	Analysis Gold oz/ton	Analysis Silver oz/ton	Distribution Gold %	Distribution Silver %
+3/4"							
+4	28.6	28.6	71.4	.000	0.8		24.4
-4x+20	37.6	66.2	33.8	.000	1.0		40.2
-20x+35	9.1	75.3	24.7	.020	1.0	13.8	9.7
-35x+100	16.0	91.3	8.7	.052	0.9	63.0	15.4
-100x+200	5.3	96.6	3.4	.030	1.1	12.1	6.2
-200x+325	1.8	98.4	1.6	.046	0.9	6.2	1.8
-325	1.6			.040	1.3	4.9	2.3
Total	100.0			.013	.935	100.0	100.0
-3/4							
+4	19.9	19.9	80.1	.000	0.4		9.2
-4x+20	38.4	58.3	41.7	.024	1.0	33.3	44.4
-20x+35	5.8	64.1	35.9	.016	0.7	3.4	6.0
-35x+100	20.0	84.1	15.9	.066	0.8	47.6	18.5
-100x+200	7.5	91.6	8.4	.038	1.2	10.3	10.4
-200x+325	3.7	95.3	4.7	.040	0.9	5.4	3.8
-325	4.7			.000	1.4		7.7
F&M Assayers							
Assay head	-3/4 inch fraction			.033	0.82	100.0	100.0
Lee Assayers							
Calc Head	-3/4 inch fraction			.028	0.86	100.0	100.0
Calc Head	-1/4 inch fraction			.034	0.87	100.0	90.8

It is uncommon to find no gold in the -325 mesh fraction. The table illustrates that if the plus 4 mesh were crushed nearly all of the gold and silver would be concentrated in the -4 mesh x 100 mesh size fraction. This indicates that the feed is idealy suited for gravity concentration.

Table VII- Calculated Head of 23 ton Test Sample

Product	Wt.* %	Analysis Gold oz/ton	Silver oz/ton	Lead %	Copper %	Zinc %	Distribution Gold %	Silver %	Lead %	Copper %	Zinc %
+3/4"	56	.0135	.588	.51	.03	.48	36.0	45.1	42.5	50.0	39.1
-3/4"	44	.0305	.840	.88	.03	.95	64.0	54.9	57.5	50.0	60.9
Total	100	.021	.729	.67	.03	.69	100.0	100.0	100.0	100.0	100.0

* Wt % taken from screen analysis of feed and figure I

While the screen analysis in table V shows a screen separation could be made at 3/4 inch, this table suggests that the separation should be made at a larger size.

The summary of all head samples is shown in Table VIII

Table VIII- Summary of Mill Test Head Samples

Description	Analysis				
	Gold	Silver	Lead	Copper	Zinc
	oz/ton	oz/ton	%	%	%
+3/4 Inch					
Assay head mill test from continuous belt sample	.028	.900			
Calc head from assays of screen sizes from continuous belt sample	.013	.935			
Head from F&M chemist by atomic absorption	.013	.52	.51	.03	.48
Mill test 1st day 1st hr. continuous belt sample.	.000	.000			
Calc +1" material from mill test.	.003	.358			
Average	.0114	.5426	.51	.03	.48
-3/4 Inch					
Grab sample after screening	.134*	.80			
Mill test assay head from continuous sample fire assay by F&M chemist	.033	.82	.88	.03	.95
Calc head mill test of screen samples from continuous belt sample. Fire assay by Lee mining.	.028	.86			
Calc head -1 inch screen fractions from 134.5 pound sample	.008	.84			
Average	.023	.84	.88	.03	.95

*.134 Gold assay not included in average, if included average raises to .051 oz/ton Gold.

It appears that the grind was relatively coarse, 26.3% + 100 mesh. The table shows that some gold was lost in the -35x+80 mesh fraction which was probably the result of incomplete liberation.

Results:

The Assay results from the mill test are shown below in Table XI

	Analysis		Average	
Product	Gold oz/ton	Silver oz/ton	Gold oz/ton	Silver oz/ton
+3/4 inch				
Head	.014	.364		
	.018	.460	.0145	.586
	.013	.935		
Conc	.888	8.308		
	.936	9.704	.944	8.600
	1.008	7.636		
Tail*	.000	.428		
	.000	.168	.0043	.3375
	.000	.452		
-3/4 inch				
Head (F&M)	.033	.82	.033	.82
Tail (F&M)	.010	.23	.010	.23
	.010	.24		
Conc #1	1.060	10.6		
	.808	11.0	.886	10.7
	.792	11.1	F&M(.796)	F&M(6.8)
Conc #2	1.332	10.9		
	1.412	10.9	1.27	10.8
	1.068	10.7	F&M(.811)	F&M(8.83)
Conc #3	.820	9.4		
	1.064	9.4	.921	9.4
	.880	9.4	F&M(.477)	F&M(7.16)
All concentrates			1.025	10.4

F&M () Samples to F&M chemist not splits assayed by Lee Mining.

*See Table X screen anaylsis of tail

In the -3/4 inch test three individual concentrate samples and two individual tailing samples were taken as the test progressed. They showed fairly good consistancy.

The Head, Concentrates and Tails for the two tests are summarized in the table below.

Table XII - Summary Analysis of Test Products

Product	Gold oz/ton	Silver oz/ton	Analysis Lead %	Copper %	Zinc %
+3/4					
Head	.0145	.586	.51	.03	.43
Conc	.994	8.60	11.9	.71	4.76
Tail	.0043	.338	.14	.02	.36
-3/4					
Head	.030*	.82	.88	.03	.95
Conc	1.025	10.4	9.61	0.54	8.74
Tail	.010	.24	.35	.01	.68

The corresponding recoveries obtained from each test in the Mill appear below.

Table XIII - Summary of Mill Test Recoveries

Mill Test	Gold %	Silver %	Recovery Lead %	Copper %	Zinc %
+3/4"	70.8	44.0	73.4	34.3	27.0
-3/4"	67.3	72.4	62.5	67.9	30.8

The recoveries obtained in the -3/4 inch test were satisfactory for the initial test, except for the Zinc recovery. Zinc minerals not recovered could have been in the form of Hydro-Zincite, and Smithsonite. Overall recovery would undoubtedly be improved by the use of a Jig in the grinding circuit.

APPENDIX A

Hypothetical Concentrates based on ratio of concentration using Gold and test results.

Smelter Schedule

Gold: Pay for 92.5% of the Gold Assay less .02 oz/ton at average monthly Gold prices

Silver: Pay for 95% of the Silver Assay less 1.0 oz/ton at average monthly Silver prices

Lead: Pay for 95% of the Wet Assay less 1.5 units at average monthly Lead Prices

Copper: Pay for 90% of Wet Assay less 1 unit less .12 per pound at average monthly Copper prices

Base treating charge for process of above metals = $130/ton

Zinc: Pay for 82% of Wet Assay if 40% or over. If under 40% deduct 8 units per ton and pay for at market price less .02 per ton. base charge = $180/ton

Case 1) Assume +3/4 inch fraction removed and Mill recoveries from actual test are used to calculate the concentrate. The bulk concentrate is roasted and then leached. The Lead, Gold and Silver residue is shipped to a Lead Smelter. The Copper Cement is shipped to a Copper Smelter and the Zinc precipitate shipped to a Zinc plant.

a) Gold Analysis of -3/4" Head = .03oz/ton

b) Ratio of Concentration* = 50.75
* RG = c-t/h-t = 1.015/.02 = 50.75

Then: Concentrate Assay is as follows:

Gold oz/ton	Silver oz/ton	Lead oz/ton	Copper oz/ton	Zinc oz/ton
1.0	29.96	27.91	1.0	14.85

c) After roasting and leaching a 50% weight loss is expected. The ratio of concentration of the residue is now increased to 101.5

Then: The assay of the Leach residue is:

Gold oz/ton	Silver oz/ton	Lead oz/ton	Copper oz/ton	Zinc oz/ton
2.0	60.0	55.8	0.1	0.5

Net Smelter
Value of Leach Residues

Gold	Value	:	(20-.002)*.925*400	= $732.60
Silver	Value	:	(60-1.0)*.95*8.00	= $448.40
Lead	Value	:	(55.8—1.5)*.95*20*.26	= $286.24

Total Value $1,449.24

Less:
Base Treating 130.00
Freight 60.00

$190.00
Net Smelter Value of concentrate $1259.25

Net value of Ore in dump
Value/Ton in place = $1259/101.5 = $12.40

Value of Zinc and Copper precipitates

d) Using the 50.75 ratio of concentration and a production rate of 400 tons per day then : roughly eight tons of concentrate would be produced. Assume 90% of the Copper and Zinc are leached out.

Zinc leached per day
14.85% *.90 *.20 *8 tons/day = 2,134 #'s Zinc
(1.067tons)

Copper leached per day
1% *.90 *.20 x8 tons/day = 144 #'s Copper
(.072 tons)

Net Smelter Value of Zinc

Assume: Zinc precipitates = 50% Zinc

Schedule: 50% * .82 * 20 * (.36 - .02) = $278.80

Less:

Base Treating	$160.00
Freight	$60.00
	$220.00

Net Smelter Value of Zinc Precip. $58.80

Net Smelter Value based on Conc. produced $58.80 * 1,067 $62.74

Net Smelter Value per ton in place for Zinc
Value/ton in place $62.74/400 = $0.16

Net Smelter Value of Copper

Assume: Copper Cement = 82% Copper

Schedule: (82% - 1%) * .90 * 20 * (.71-.12)= $860.22

Less:

Base Treating	130.00
Transportation	60.00
	$190.00

Net Smelter Value of Copper Precip. $670.22

Net Smelter value based on Conc Produced $670.22 * .072 tons/day = $48.75

Net Smelter value per ton in place for Copper
Value/ton in place $48.25/400 = $.12

Net smelter values contributed by each metal produced in concentrate

Metal	$/ton in place	%	cum %
Gold	6.27	49.51	
Silver	3.84	30.3	79.8
Lead	2.29	18.1	97.9
Copper	0.12	1.0	98.9
Zinc	0.16	1.1	100.0
Total	$12.68		

Case 2) Same as Case 1 except 100% recoveries on all metals are made.

a) Gold analysis of -3/4" Head = .03 oz/ton

b) Ratio of concentration = 34.16
* RG = c-t/h-t = 1.025/.03 = 34.16

Then : Concentrate assay is as follows:

Gold oz/ton	Silver oz/ton	Lead %	Copper %	Zinc %
1.0	28.01	30.1	1.0	32.5

c) After roasting and leaching a 50% weight loss is expected. the ratio of Concentration of the residue is now increased to 68.32.

Then: The assay leach residue is:

Gold oz/ton	Silver oz/ton	Lead %	Copper %	Zinc %
2.0	56.0	60.2	0.1	3.25

Net Smelter Value of Leach Residue

Gold Value	(2.0-.02)*.925x400=	$ 732.60
Silver Value	(56.0-1.0)*.95x8.00=	$ 418.00
Lead Value	(60.2-1.5)*.95x.26x20=	$ 289.97
	Total Value	$ 1440.57

Less:

Base Treating	130.00
Freight	60.00

$ 190.00

Net smelter value of concentrate $ 1250.58

Net value of ore in dump
Value/ton in place = $1250..57/68.32 = $18.30

Value of Zinc and Copper Precipitates

f) Using the 34.16 ratio of concentration and a production rate of 400 tons per day then: Roughly 11.7 tons of concentrate would be produced. Assume 90% of the Copper and Zinc are leached out

Zinc leached per day

32.5% * 20 * 11.7 tons/day * .90 = 6,844.5#'s (3.42 tons)

Copper leached per day

1% * .90 * 20 * 11.7 tons/day = 210.6#'s (.1053 tons)

Net Smelter Value of Zinc
Assume: Zinc precipitate = 50% Zinc

Schedule: 50% * .82 * 20 * (.36-.02) = $278.80
Less
Base Treating 160.00
Freight 60.00
$220.00
Net Smelter Value of Zinc Precipitate $58.80

Net Smelter Value Based on Conc Produced
$58.80 * 3.42 = $201.09

Net Smelter Value Per Ton in Place for Zinc
Value/Ton in Place $201.09/400 = $0.50

Net Smelter Value of Copper
Assume: Copper Cement = 82% Copper
Schedule: (82%-1.0%) * .90 * 20 * (.71 - .12) = $860.22
Less:
Base Treating 130.00
Freight 60.00
$190.00
Net Smelter Value of Copper Precip $670.22

Net Smelter Value Based on Conc Produced
670.22 * .1053 tons/day = $70.57

Net Smelter Value per Ton in Place for Copper
Value/Ton in Place 70.57/400 = $0.18

Net Smelter values contributed by each metal produced in concentrate

Metal	$/ton in Place	%	cum %
Gold	9.31	49.1	
Silver	5.31	28.0	77.1
Lead	3.68	19.4	96.5
Copper	.18	1.0	97.5
Zinc	.50	2.5	100.0
Total	18.98		

Conservative Estimates of Milling Cost @ 400 TPD
Operating only

Golconda

Net Smelter Return w/$60 Transportation of Concentrates			$12.68
Less:			
Trucking Raw Ore @ $2/ton			$10.68
Mill labor (2 men/shift 3 shift/day) $1.68/T			$9.00
Crushing and Screening @ $1.50/ton			$7.50
Lab and Supplies @ $1.00/ton			$6.50
1-Mill Superintendent $0.50/ton			$6.00
General Manager $0.48/ton			$5.52
Reagents			
Zanthate 317			
NaOH			
NaS102			
CuS04			
Promoter 25		$2.34	
			$3.18
Power	$1.94/ton		$1.24
Grinding Media	$.66/ton		$0.58
Lab Materials @	$1200/mo.	$.10/ton	$0.48
Maintenance @	$.30/ton		+$0.18

For Tennessee

$0.60/ton Trucking	+$1.78

Edward A. Nurse, P.E.
President

F & M Chemists

839 Front Street, Helena, Montana 59601
Phone 406/442-0880

September 23, 1982

CLIENT: Lee Mining

PROJECT NO.:

CERTIFICATE OF ANALYSIS

CLIENT SAMPLE NO.	F & M LAB NO.	OZ/T Au	OZ/T Ag					
1051	291	.010	.23	TAILS				
1052	292	.010	.24					
1053	293	.796	6.79	CONC.				
1054	294	.811	8.83					
1055	295	.477	7.61	CONTINUOUS BELT SAMPLE				
1056	296	.033	.82					

Michael K. Curtis, Chemist

Edward A. Nurse, P.E.
President

F & M Chemists

839 Front Street, Helena, Montana 59601
Phone 406/442-0880

September 13, 1982

CLIENT: Lee Mining Corp.
Box 467
Sheridan, MT 59749

PROJECT NO.:

CERTIFICATE OF ANALYSIS
A.A. GOLD & SILVER

CLIENT SAMPLE NO.	F & M LAB NO.	OZ/T Au	OZ/T Ag	% Cu	% Pb	% Zn		
1202 split a	288	.375	7.26	.71	11.9	4.76		
1203 Split a	289	.012	.53	.03	.51	.48		
1204 Split a	290	.013	.52	.02	.14	.36		

Michael K. Curtis, Chemist

FIGURE 1 - SCREEN ANALYSIS OF FEED

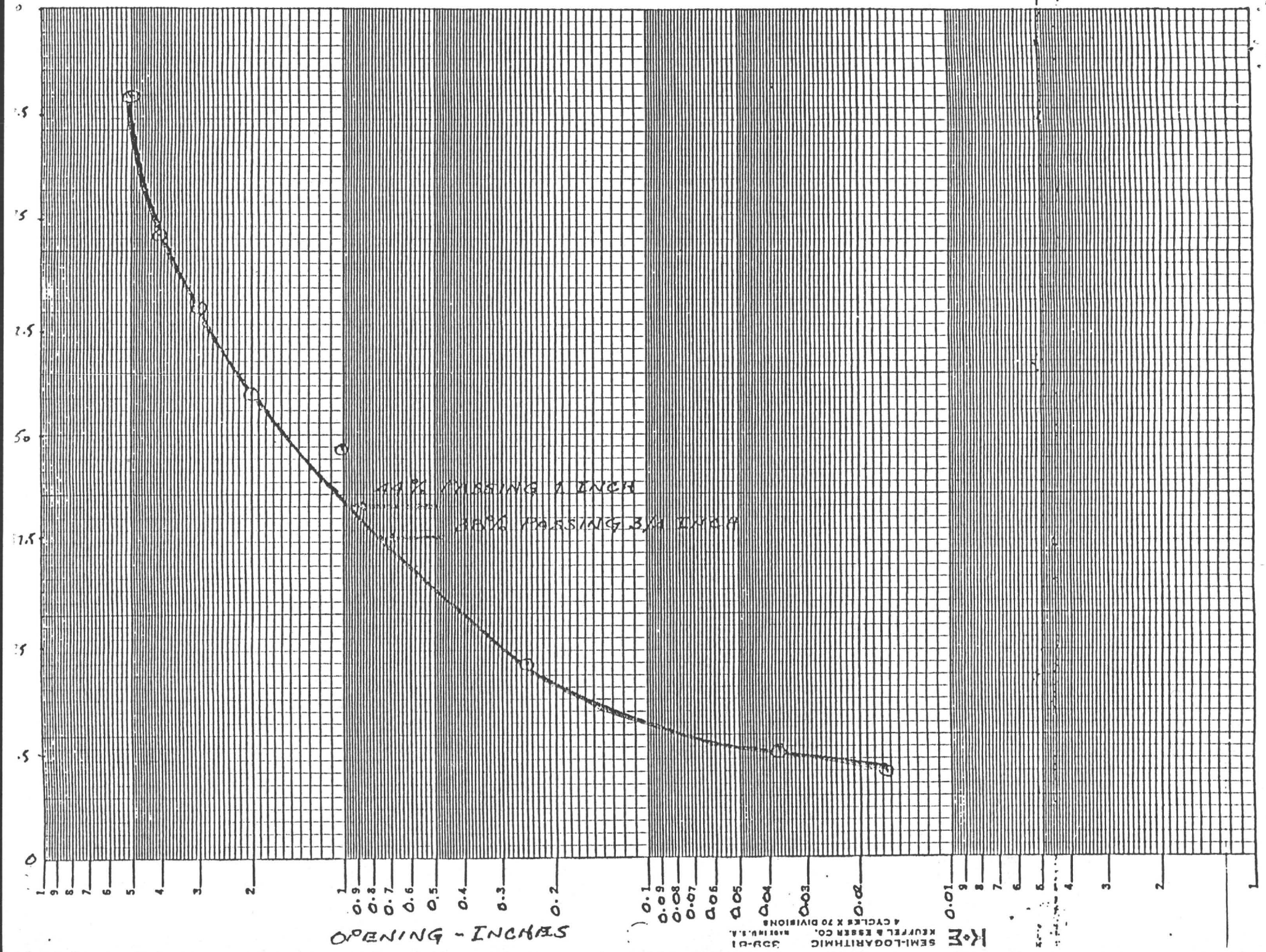
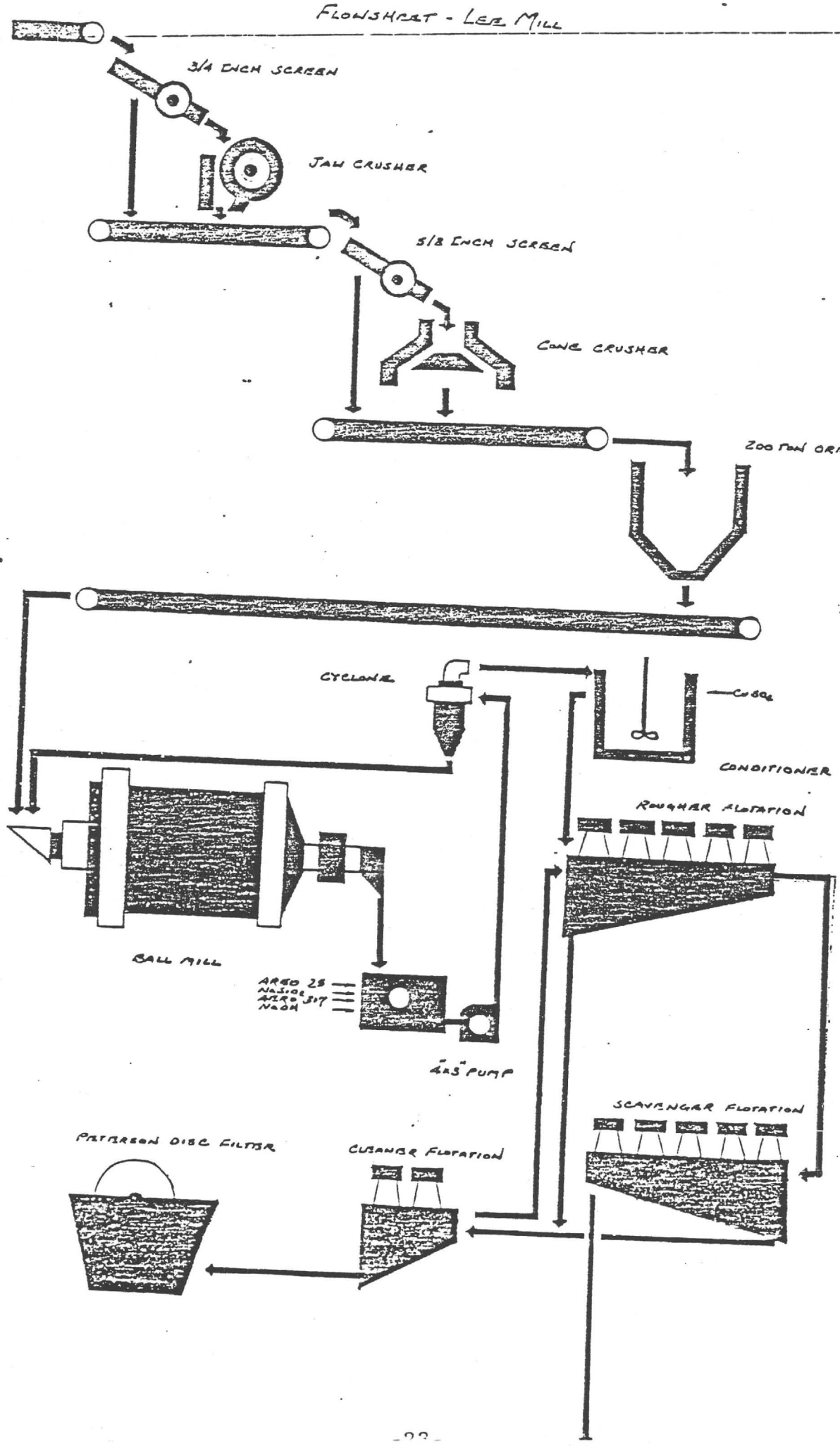


FIGURE II

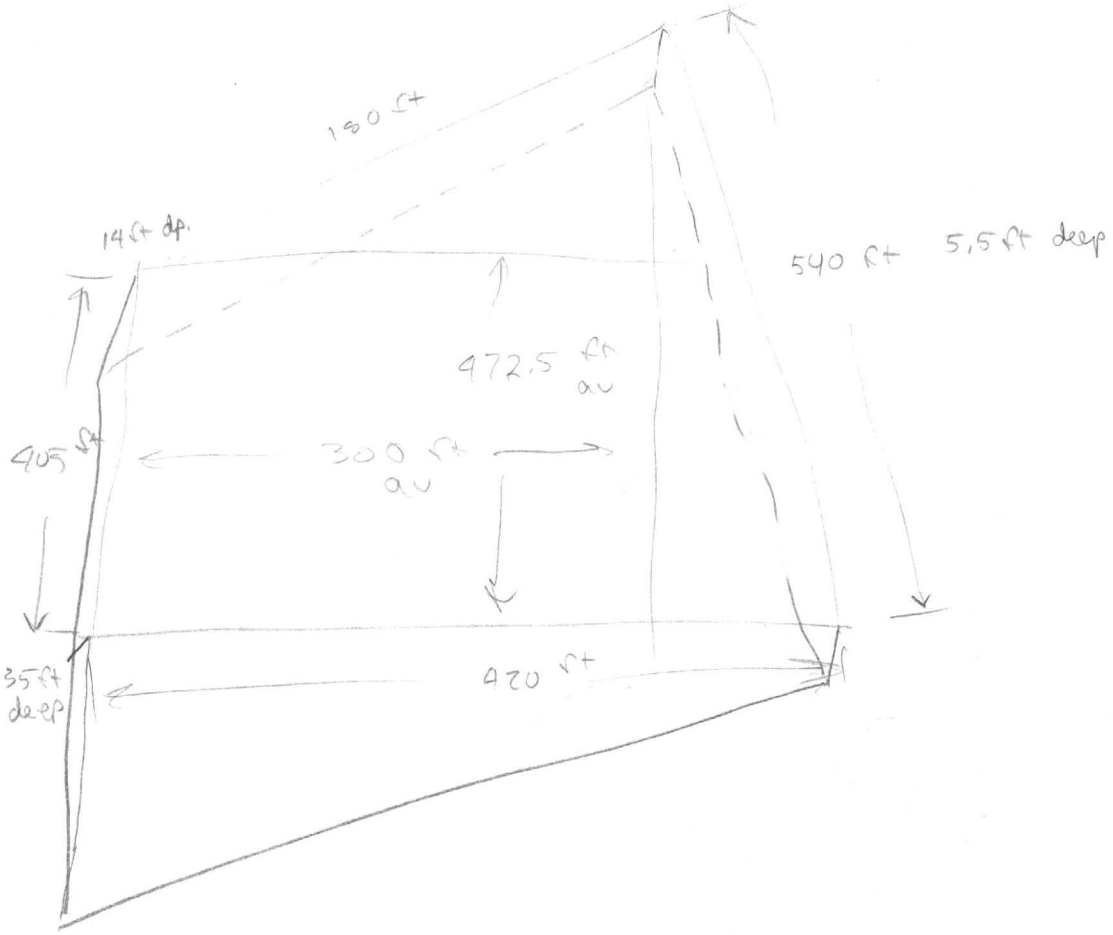
FLOWSHEET - LEE MILL

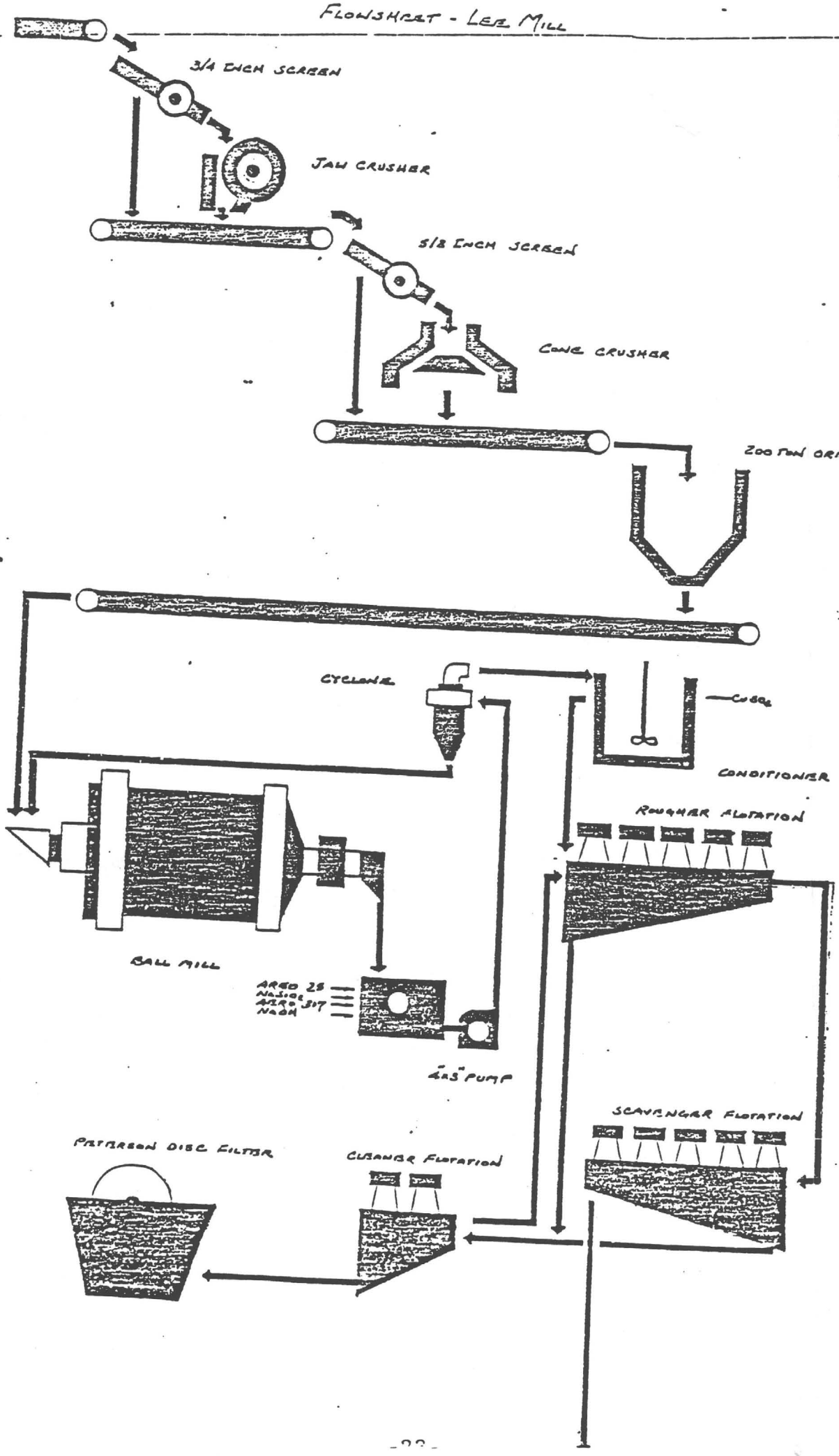


60
9

540 ft x 5.5 ft deep

~~X~~ 420 ft x 35 ft deep



24.5 ft deep av $\simeq 2.13 \cdot 10^6$ ft^3

FLOWSHEET - LEE MILL