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March 19, 1974

RECEIVED MAR 25 1974

United States Atomic Energy Commission
Washington, D. C. 20545

Attention: Mr. R. B. Chitwood, Chief,
Technical Support Branch
Directorate of Licensing

Gentlemen:

DOCKETED USAEC APR 04 1974 REGULATORY MAIL SECTION DOCKET CLERK

Response to
Review Questions on
Environmental Report
Moab Mill
For Atlas Minerals Division
Atlas Corporation

INTRODUCTION

Following a recent telephone conversation with your Mr. LeRoy Person, this discussion is presented in response to your letter of January 23, 1974 regarding review questions raised on the Atlas Minerals Division Environmental Report submitted on August 31, 1973.

It was our opinion, and the opinion of Mr. Person, that some additional data would be required to fully answer the review questions. However, to aid in the licensing time requirement our discussion is presented at this time based on existing data to be supplemented by additional data prior to beginning of the mill operation.

0786

QUESTION NO. 1 - APPENDIX A

This question concerns starter dikes, test data and stability analyses.

In our evaluation of the starter dikes of the existing facility, we found that the original construction was denser and probably had been placed to an engineering standard. However, succeeding starter dikes had likely been placed and compacted by construction equipment without density control. Nevertheless, for the following reasons we have concluded that all of the starter dikes are satisfactory for the proposed tailings pond operation:

1. The mechanically placed fill materials in the starter dikes, even if placed without density control, have higher strength characteristics than the hydraulically placed tailings.
2. The existing pond has operated satisfactorily to the present maximum height of approximately 75 feet.
3. The critical failure circle would not intersect the starter dam materials except immediately following construction.
4. The pond operation will be such that ponded water will remain a minimum of 250 feet away from any new starter dike section.

The test results presented in our report were selected to evaluate characteristics of materials within the zones of embankment failure potentials.

To present strength and density test results we are including, as Attachment 1, a stability analyses data sheet for our Section BB showing the typical friction angles and cohesion used for different portions of the slope. Attachment 2 shows a typical summary sheet for one of the triaxial tests with a photograph showing the method of failure of the sample.

In our evaluation of slope stability we picked the highest slopes, steepest slopes, and critical slopes within individual embankments. The highest slope was at Section CC shown in our report and the steepest and most critical overall section was Section BB. A computer printout of the ultimate section taken at Section BB is shown on Attachment 1. As our evaluations indicate, a static factor of safety is in excess of 1.9 for the overall slope, the need for more evaluations were not considered necessary.

QUESTION 2, SECTION 3.3.4, TABLE 3.10

This question concerns the rate of particulate emission from the yellow cake dryer and the throughput at the time this rate was measured.

The table lists an emission rate of 3.0 pounds of U_3O_8 per day. Since the yellow cake material being dried is 96 percent U_3O_8, the particulate emission rate would be 3.125 pounds per day. This emission rate was arrived at as an average of a number of measurements. However, one particular measurement taken on March 3, 1973 showed a 3.0 pounds U_3O_8 per day emission with a dryer throughput rate of 319 pounds of U_3O_8 per hour.

QUESTION 3, SECTION 3.3.4, TABLE 3.10

This question concerns the rate of particulate emission from the crushing plant west dust collector and the throughput rate when this rate was measured.

The crushing plant west dust collector was inoperative at the time that these samples were taken. This collector is designed for the same duty as the north dust collector and cleans air from the same areas. Thus it can be logically estimated that the emissions from the west collector will be very close to those from the north dust collector. Table 3.11 shows a measured emission rate of 0.039 pounds U_3O_8 per day from the north collector. The grade of ore being crushed on that particular day (February 28, 1973) was .276 percent U_3O_8. Thus the particulate emission rate from the north (or west) collector would be 14.1 pounds per day. The crusher throughput rate on this day was 135 tons per hour.

QUESTION 4, SECTION 3.3.4, TABLE 3.10

This question concerns the rate of particulate emission from the fine ore storage bin dust collector, and the throughput when this rate was measured.

On February 28, 1973 we measured a U_3O_8 emission rate of .019 pounds per day from the fine ore storage dust collector. The grade of ore ground on that day was .187 percent U_3O_8. Thus the particulate emission rate would be 10.2 pounds per day. The grinding throughput rate on that day was 41 tons per hour.

QUESTION 5, SECTION 2.0, FIGURE 2.11

This question concerns terms and units reported in the report.

The radiation units reported in the soil sampling survey were erroneously listed as mrem/hr. They should have been milliroentgens/hour.

QUESTION 6, SECTION 3.0, FIGURE 3.1

This question concerns an up-to-date plot plan showing location of new systems.

The response to this question was provided in a letter to Mr. Rothflesh dated January 14, 1974 from Mr. Gary Boyer.

QUESTION 7, SECTION 3.3.4.2, TABLE 3.11

This question concerns sampling of the dust collectors on February 28, 1973 as to what was the throughput on that date.

The crushing rate on February 28, 1973 was 135 tons per hour, the grinding rate was 41 tons per hour and the U_3O_8 drying rate was 319 pounds per hour.

QUESTION 8, SECTION 3.2

This question concerns flow sheets of the proposed mill processes.

The response to this question was provided in a letter from Mr. Gary Boyer dated January 17, 1974 to Mr. LeRoy Person, plus Attachments 4, 5 and 6, which are the latest flow sheets.

QUESTION 9 - APPENDIX A

This question concerns construction methods, liquefaction, and relative density.

Tailings ponds have been built and operated utilizing the upstream method for a great number of years. In the past, problems have developed where the pond is not properly operated or where tailings materials are too fine to provide sufficient strength characteristics. In our opinion, the upstream method is satisfactory for this pond.

Tailings materials are normally susceptable to liquefaction under earthquake conditions. However, for the Colorado Plateau Area, which is one of the lowest seismic areas in the United States, a ground acceleration of .05g or less can be expected. Therefore, utilizing the SIMPLIFIED METHOD OF PREDICTING LIQUEFACTION, developed by Doctors, Seed and Idriss, we conclude that with a relative density of 56 percent the embankments would have a safety factor of 2.0 for the design earthquake. It is also our opinion that dynamic testing and more sophisticated liquefaction analyses are not justified for this embankment.

A relative density of 85 percent for the tailings material is a maximum control value for the placement of fill. This density could not be achieved by the hydraulic fill methods employed in the past construction or proposed for future construction. However, we feel that a rigid density control should not be a requirement for the overall embankment or for starter dikes.

QUESTION 10 - APPENDIX A

This question concerns the material used to cover the tailings embankment.

Basically, this embankment cover material is a weathered bedrock or slope wash deposits from the adjacent hillsides. The materials will weather to fine sandy silt, with some clays, but will, for a long period of time, continue to have a large percentage of broken rock pieces. The purpose of this natural soil cover is to provide an appearance similar to the natural hillsides and to reduce wind and rain erosion of the embankment slopes. The embankment cover material will not have high rock strength characteristics but will weather to a material similar to that found on the adjacent hill-sides and will greatly reduce the blowing of the tailings materials.

QUESTION 11 - APPENDIX A

This question concerns the amount of field investigation performed.

It is our opinion that we have obtained sufficient stratigraphy and representative samples of the tailings and natural soil materials from the seven locations investigated. We are, however, willing and have suggested additional locations that could be investigated. We do not, however, feel that additional investigation, testing, or analyses will greatly alter the safety factor or recommendations presented.

QUESTION 12 - APPENDIX A

This question calls for presentation of records to date concerning water levels and constituent analyses in monitor wells. Tabulations of these data are attached covering the period 12/8/72 through 10/25/73. Date and time of measurements are requested. Time of day was not recorded for these measurements.

Elevations at which assay samples were collected are also requested. The piezometers were slotted their full length and gravel packed to the ground surface. Therefore, they monitor the entire saturated section below the water table in each boring, without respect to discreet stratigraphic intervals.

QUESTION 13 - APPENDIX A

This question relates to the schedule of water level measurement and water sample collection for assay in the monitor wells. On page 6-4 of the Environmental Report, it is indicated that the monitor wells would be sampled and measured quarterly after 2/8/73.

QUESTION 14 - APPENDIX A

This question requests the location of the discharge line referred to on page 6.

There appears to be an error in the quotation presented on page 6 as to the extent of the existing discharge line. The actual extent of the present line is shown on Plate 2 in the text of our report and as shown in black on Attachment 3.

QUESTION 15 - APPENDIX A

This question concerns the proposed discharge and decant facilities and requests information on the basin area in the southern corner of the pond.

Essentially, the discharge system will consist of extending the existing system to completely encompass the pond area. Initial discharging will be from the west area in order to build up that area and force the ponded water back into the center of the tailings pond area. A sketch of the discharge system is shown in red on Attachment 3.

The existing decant system will be altered in order to decant water from approximately the center of the ponded area. The location of a proposed tower is shown in blue on Attachment 3. Should difficulty arise in installing or operating the new decant tower, a pumping barge will be used to decant water from the central portion of the pond area over the embankment.

The basin area which is shown on the south end of the pond was designed for use as an alternate tailings storage area. This area has not been used for tailings storage in the past and will not be used for this purpose in the future.

QUESTION 16 - APPENDIX A

This question concerns embankment erosion from the normal operation of the decant facilities and possible failure of the discharge line. It also requests information on maintenance and inspection of the siltstone embankment cover.

The existing decant system has functioned well over the life of the pond. The system has access to free water only at the decant tower area. Piping of tailings from the pond is not anticipated, even with collapse of a decant line. The future decant tower will be designed and constructed to provide an inlet for the decant water at approximately the location shown on Attachment 3. This should not affect the satisfactory operation of the system. However, if installation difficulties arise an alternate floating decant system is proposed.

The existing or future tailings embankment with the siltstone cover is not designed to resist erosion from a possible break in the discharge line. The protection from erosional damage to the embankment will be provided by placing the decant line on the inside of the upper embankment and by sloping the crest of the embankment to drain into the pond.

The siltstone cover is intended to be essentially maintenance free. Water falling directly on the embankment should result in only minor erosion channeling. However, in conjunction with operating inspections of the tailings pond system, any channeling of the embankment surface should be noted. Where channeling occurs, filling should be accomplished in conjunction with siltstone cover placement on additional dike increase sections.

QUESTION 17 - APPENDIX A

This question concerns expected chemical and radiological concentrations in the tailings pond, in the ground water discharge to the Colorado River and at the closest river intake, under the proposed recycling plan.

Data relative to future tailings pond chemistry are currently being evaluated. Analysis of future effects upon ground water and surface water will necessitate the collection of additional field data on the permeability of the subsurface soils and on the present ground water chemistry, in addition to an assessment of the available ion exchange capacities of the soils.

This question is closely related to Questions 21 and 22, and all three questions will be answered jointly.

QUESTION 18 - APPENDIX A

This question concerns the estimated seepage loss from the existing tailings pond and the suggested loss from the future operation. It is also requested that the source of our information be defined.

As stated in Appendix A, all data presented was provided from measurements conducted by Atlas Minerals Division. Based on cur knowledge of the area, it appears that the precipitation and evaporation rate quoted would be reasonable numbers. It is our understanding that the water quantities quoted reflect the quantity pumped into the tailings pond and the quantities leaving the tailings pond reflected by measurements at the purification pond. Therefore, the difference is the total losses from evaporation plus seepage.

Our calculations of existing seepage were as follows:

1. The average water loss for the 25 months of record was 194.56 gallons per minute.

2. The rate of evaporation (50.37 inches per year) is equal to 2.61 gallons per minute, per acre; or, 117.45 gallons per minute for the assumed 45 acres covered by water.

3. The total seepage loss was 194.56 gallons per minute less 117.45 gallons per minute; or, 77.11 gallons per minute. This number was then quoted as 75 gallons per minute total seepage loss.

The assumed reduction for the new tailings pond system was based on the following:

1. Sealing is expected to occur due to a change to an acid leach system.

2. The quantity of water being circulated to transport the tailings will be reduced.

3. The maximum 20 feet increase in pond height would not materially alter the gradient on the seepage water.

The quoted future loss (less than half of the calculated seepage loss in the present system) reflects our inability to define seepage parameters for the future operation.

QUESTION 19 - APPENDIX A

This question concerns the control of the effluent water position within the pond.

The control of water within the decant pond is accomplished by moving the position of the discharge point to the area where water is closest

to the dike. The use of a center decant tower or centered pumping decant barge will enable the pond water to be kept in a central location more readily. The control measure will consist of observing the overall pond and determining if the ponded area is essentially centered in the confining dikes of the pond. The actual 250 foot required minimum will be checked occasionally to confirm that this requirement is being met.

QUESTION 21 - GENERAL

This question concerns assay data on the ground water for constituents other than the radium and thorium determinations provided in Appendix A of the Environmental Report. Other assays were actually obtained, as tabulated in the attachment to Question 12, but only on a random basis. We will define a program as soon as possible to monitor regularly other key constituents appropriate to the composition of present and expected future effluents from the operation, as indicated by the analysis on page 3-28 of the Environmental Report.

QUESTION 22 - GENERAL

This question concerns ion exchange taking place in the soils at the present time and requests an analysis of the long-term concentration to be expected in the Colorado River or which may remain in the ground water.

The evaluation of these phenomena requires considerably more field data, analyses and data projection than is presently available. We have proposed a program to evaluate the ion exchange problem. However, several months will be required to develop our data and provide a response.

The program will be conducted in two phases. Initially we will assess the available data on the natural and emplaced soil characteristics and the assay values of the consituents in both the tailings pond and monitor wells. We will also obtain additional soil samples in the field for determination of laboratory permeabilities, and perhaps conduct field permeability tests. In addition, these samples will permit some estimation of ion exchange capabilities. From this information we will make approximate estimates of expected trends in the ground water constituents under the anticipated changes in the tailings pond concentrations.

If, based on the use of very conservative values for these various parameters, it becomes evident that no concentrations of significance in the ground water or Colorado River will occur during or subsequent to the operation, we will present these findings to the AEC for approval.

If, on the other hand, the results of the foregoing studies are insufficiently conclusive as to the negligible impact of liquid effluents from the operation, we will proceed to the second phase, involving the utilization of an appropriate dispersion model, to predict concentrations. Also as part of this second phase, we would perform additional assays on the chemistry and the radium-to-uranium ratios in the soils and ground water.

QUESTION 23 - GENERAL

This question concerns floods from Moab Canyon Wash or the Colorado River that could threaten the tailings pond area. Included is a request for probable maximum flood quantity, channel and flood plain configurations, and velocities of flood waters that could reach the tailings dikes.

To respond to this question in more detail than was presented in the original report will require additional data collection, analyses, and several weeks to complete. Therefore, this response will be deferred until additional information is obtained. However, from our observations there appears little chance of flood water reaching the tailings pond embankment from either the Colorado River or Moab Wash. Moab Wash, adjacent to the purification ponds, is approximately 15 feet wide at the bottom, 10 feet deep, and has sandstone boulders placed as riprap on the bank next to the ponds.

QUESTION 24 - GENERAL

This question concerns effluent level control in the tailings pond.

The water level in the tailings pond will be controlled by the proposed decant tower. This tower will have openings that will control the upper level of the effluent pond. This level can be increased only by adding plugs to the openings in the tower. Therefore, quite accurate control of the water level surface can be maintained.

Should the alternate floating decant barge be employed this system will have an electric pump and an automatic control switch which will govern the amount of ponded water building up above the slimes. Therefore, an accurate control on pond size can be maintained with a pumping system.

With either decant system the ultimate pond area will be based on the liquid effluent produced divided by the amount evaporated per acre.

Should the mill effluent rate exceed the evaporation area available in the tailings pond the mill operation will be curtailed and/or an alternate evaporation pond constructed.

QUESTION 25, SECTION 2.9.3, TABLE 2.4

This question concerns the increase in uranium dust concentration for the years 1968-1972 and requests the average operating tons per day and the average grade of ore during this period.

The response to this question was provided in part by Mr. Gary Boyer's letter of January 17, 1974 to Mr. LeRoy Person. In addition, the following tabulation of operating tonnages and grades are provided:

Year	Average TPD	Ore Grade In Percent U_3O_8
1968	879	.247
1969	1076	.214
1970	1145	.231
1971	1269	.185
1972	1044	.168
1973	913	.160

QUESTION 26, SECTION 2.9.3, TABLE 2.4

This question concerns the operating tonnage for the proposed acid leach circuit.

The acid circuit operation tonnage will be 400-500 TPD through 1977. Thereafter the tonnage will be 600 TPD. If ore is available, an additional alkaline circuit tonnage of up to 400 TPD will be processed.

QUESTION 27 - COST BENEFIT SECTION

This question concerns the inadequacy of the Cost-Benefit section of the Environmental Report.

An expanded, more quantitative discussion of costs and benefits will be provided at a later date, using as models the AEC Regulatory Guide For The Preparation of Environmental Reports for Uranium Mills and specific examples of cost-benefit analyses judged adequate by the AEC.

oOo

On behalf of the Atlas Minerals Division, we are continuing to develop data and will supplement this response where required.

Yours very truly,

DAMES & MOORE

George C. Toland

George C. Toland

Partner

GCT/WEM/pc

cc: Mr. R. F. Hollis

Mr. W. P. Badger

Enclosures: 7 Tables

6 Attachments

MISCELLANEOUS TABULATION

(ppm)

Monitor Well	Cl 12/18/72	Cl 10/25/73	Na 12/18/72	Na 2/8/73	As 10/25/73	Ca 10/25/73
B1	879	-	-	640	-	-
B2	213	1,115	1,100	590	.03	492
B3	-	-	-	2,070	-	-
B4	1,021	880	1,920	1,890	.05	280
B5	128	1,086	1,230	1,070	-	432
B6	454	-	590	2,110	-	-
B7	113	-	320	-	-	-
TP1	1,121	1,264	2,320	1,620	.006	492
TP2	1,106	1,640	1,820	2,630	.01	652
TP3	2,865	5,559	2,520	4,000	.03	520
TP4	1,574	1,767	2,720	1,660	.003	660
TP5	3,021	3,197	4,300	2,710	.03	560
TP6	-	-	-	-	-	-
TP7	-	589	-	-	.01	520
TP8	-	11,440	-	-	.006	724

SO_4 (ppm) TABULATION

Monitor Well	12/8/72	2/8/73
B1	-	-
B2	1,100	4,155
B3	-	-
B4	1,920	3,240
B5	1,230	4,732
B6	590	-
B7	320	-
TP1	2,320	9,997
TP2	1,820	3,859
TP3	2,520	8,760
TP4	2,720	4,377
TP5	4,300	5,611
TP6	-	-
TP7	-	229
TP8	-	4,529

WATER LEVEL TABULATION

Monitor Well	Ground Elevation	Well Depth (ft.)	Water Depth (feet-inches) 12/7/72	2/8/73	3/6/73	5/15/73	7/19/73	10/25/73	Water Elevations 10/25/73
B1	502.4	81.5	36-6	36-6	36-6	36-6	36-6	36-6	465.9
B2	458.0	39.0	32-6	32-6	32-6	32-6	32-6	32-6	425.5
B3	497.5	71.5	11-0	11-0	11-0	11-0	11-0	11-0	586.5
B4	502.6	66.5	33-10	33-10	33-10	33-10	33-10	33-10	468.8
B5	464.0	41.5	37-11	37-11	37-11	37-11	37-11	37-11	426.1
B6	503.3	56.5	25-10	25-10	25-10	25-10	25-10	25-10	477.5
B7	501.0	31.5	24-0	24-0	24-0	24-0	24-0	24-0	477.0
TP1	433.8	10.5	8-3	8-3	8-3	8-3	8-3	8-3	425.5
TP2	431.4	11.0	7-0	7-0	7-0	7-0	7-0	7-0	424.4
TP3	434.3	13.5	8-8	8-8	8-8	8-8	8-8	8-8	425.6
TP4	433.6	10.5	7-2	7-2	7-2	7-2	7-2	7-2	426.4
TP5	425.4	10.5	7-0	7-0	7-0	7-0	7-0	7-0	418.4
TP6	451.0	14.0	Dry	Dry	Dry	Dry	Dry	Dry	-
TP7	431.4	-	-	-	6-6	6-6	6-6	6-6	424.9
TP8	431.4	-	-	-	5-6	5-6	5-6	5-6	425.9

RADIUM (Ra^{226} uc/ml x 10^{-8}) TABULATION

Monitor Well	12/8/72	2/8/73	3/6/73	5/15/73	7/19/73	10/25/73
B1	-	5.24	1.75	6.91	2.84	No Data
B2	2.18	1.63	1.41	.99	2.49	
B3	-	5.75	3.20	3.50	2.92	
B4	5.00	4.77	4.90	2.82	-	
B5	1.33	1.64	.85	.42	.49	
B6	2.61	2.14	3.92	-	2.49	
B7	1.48	-	-	-	.78	
TP1	.53	.23	.21	.37	.54	
TP2	.037	.004	.61	.41	1.09	
TP3	1.25	.82	.70	.84	.17	
TP4	.10	.13	.21	1.82	.74	
TP5	2.57	1.79	1.30	.27	.40	
TP6	-	-	-	-	-	
TP7	-	-	.047	.19	.86	
TP8	-	-	.26	.15	-	

THORIUM (Th^{230} uc/ml x 10^{-6}) TABULATION

Monitor Well	12/18/72	2/8/73	3/6/73	5/15/73	7/19/73	10/25/73
B1	-	.079	.004	.037	-	-
B2	.030	.042	.005	.007	.002	.011
B3	-	.053	.005	.053	.003	-
B4	.018	.063	.005	.011	-	.004
B5	.005	.006	.014	.005	.003	-
B6	.003	.015	.017	-	.004	-
B7	.006	-	-	-	.002	-
TP1	.010	.008	.005	.005	.002	.003
TP2	.008	.004	.004	.008	.002	.006
TP3	.004	.006	.006	.002	.003	.002
TP4	.014	.008	.003	.003	.002	.004
TP5	.005	.033	.008	.006	.002	.007
TP6	-	-	-	-	-	-
TP7	-	-	.002	.002	.002	.005
TP8	-	-	.002	.002	-	.006

TDS AND pH TABULATION

Monitor Well	TDS (ppm) 12/8/72	TDS (ppm) 2/8/73	TDS (ppm) 10/25/73	pH 12/8/72	pH 2/8/73	pH 10/25/73
B1	-	2,534	-	8.5	8.10	-
B2	3,374	4,315	9,076	8.2	8.00	7.05
B3	-	7,774	-	-	8.10	-
B4	7,984	7,697	7,576	7.7	8.15	7.45
B5	1,743	5,415	8,500	6.6	8.10	7.8
B6	4,756	9,344	-	7.2	8.15	-
B7	3,943	-	-	7.5	-	-
TP1	9,320	8,391	15,000	8.0	8.00	6.7
TP2	10,422	16,347	10,546	7.5	8.00	7.5
TP3	12,585	18,775	22,910	8.1	8.05	7.5
TP4	10,005	9,911	10,500	7.7	7.95	7.0
TP5	11,564	14,095	13,248	8.1	8.10	7.7
TP6	-	-	-	-	-	-
TP7	-	-	2,914	-	-	7.8
TP8	-	-	24,162	-	-	7.3

MISCELLANEOUS TABULATION

12/8/72

Monitor Well	Po^{210} uc/ml X 10^{-7}	U_3O_8 ppm	V_2O_5 ppm	NO_3 ppm	K ppm	Cu ppm	Fe ppm	Total Hardness ppm	MHOS Specific Conductance
B1	--	--	NL	331	--	--	--	174	--
B2	.031	9	NL	29	13	NL	23	1780	3600
B3	--	--	--	--	--	--	--	--	--
B4	.15	12	NL	66	41	NL	3	1480	6800
B5	.027	.9	NL	46	70	NL	3	820	2400
B6	.030	7	.4	120	18	NL	NL	1340	4500
B7	.013	2	.4	29	11	NL	3	1660	2800
TP1	.008	20	.4	973	42	NL	.07	2820	7800
TP2	.008	13	.4	1325	51	NL	.05	3900	8500
TP3	.016	8	.4	824	70	NL	10	3760	9000+
TP4	.005	7	NL	662	72	NL	7	3680	9000+
TP5	.013	12	4.0	364	40	NL	12	3820	9000+
TP6	--	--	--	--	--	--	--	--	--

DAMES AND MOORE ECP-5 SLOPE STABILITY ANALYSIS

JOB NO 5467-002-06 JOB NAME ATLAS MINERALS SECTION 2 C1 (OVERALL SECTION) SECTION BB

TOTAL NUMBER OF SOIL LINES = 21

DATA INPUT MODE = 1

SLOPE GEOMETRY DATA

LINE NO	LEFT-X	LEFT-Y	RIGHT-X	RIGHT-Y	SOIL DATA WT BELOW LINE-PCF	FRICT ANGLE-DEGS ABOVE	FRICT ANGLE-DEGS BELOW	COHESION-PSF ABOVE	COHESION-PSF BELOW
1	.00	120.00	124.00	124.00	120.0	.0	37.0	0.	0.
2	124.00	124.00	134.00	130.00	120.0	.0	37.0	0.	0.
3	134.00	130.00	138.00	130.00	120.0	.0	37.0	0.	0.
4	138.00	130.00	146.00	122.00	120.0	.0	37.0	0.	0.
5	146.00	122.00	163.00	122.00	120.0	.0	37.0	0.	0.
6	163.00	122.00	200.00	104.00	120.0	.0	37.0	0.	0.
7	200.00	104.00	224.00	97.00	120.0	.0	37.0	0.	0.
8	224.00	97.00	238.00	95.00	120.0	.0	38.0	0.	50.
9	238.00	95.00	260.00	73.00	120.0	.0	38.0	0.	50.
10	194.00	73.00	205.00	81.00	-120.0	37.0	38.0	0.	50.
11	205.00	81.00	224.00	97.00	120.0	37.0	38.0	0.	50.
12	.00	73.00	194.00	73.00	-125.0	37.0	38.0	0.	50.
13	194.00	73.00	237.00	73.00	-125.0	38.0	38.0	50.	50.
14	237.00	73.00	260.00	73.00	125.0	38.0	38.0	50.	50.
15	260.00	73.00	350.00	71.00	125.0	.0	38.0	0.	50.
16	.00	103.00	138.00	96.00	-120.0	37.0	37.0	0.	0.
17	138.00	96.00	200.00	83.00	-120.0	37.0	37.0	0.	0.
18	200.00	83.00	205.00	81.00	-120.0	37.0	37.0	0.	0.
19	205.00	81.00	237.00	73.00	-120.0	38.0	38.0	50.	50.
20	237.00	73.00	255.00	67.00	-125.0	38.	38.0	50.	50.
21	255.00	67.00	350.00	65.00	-125.0	38.0	38.0	50.	50.

UNIT WEIGHT OF WATER = 62.40 NUMBER OF COLUMN LOADS = 0 EARTHQUAKE COEFF = .00

MODE OF PROGRAM OPERATION = 4 SEARCH START AT X= 240.00 Y= 180.00

MAX NO OF TRIALS= 30 TOLERANCE= .05

SEARCH STEPS XDC= 5.00 YDC= 5.00

RADIUS TANGENTS MAX= 53.00 MIN= 73.00 INCR= 5.00

ATTACHMENT 1

RESULTS

CNTR NO	RAD NO	CENTER COORDINATES X	Y	CIRCLE RADIUS	FACTOR OF SAFETY	COH	FRIC	DRVG	ARC	XR	XL	NN
1	1	240.00	180.00	127.00	1.932	7127.	358123.	189016.	212.83	306.76	125.56	4
1	2	240.00	180.00	122.00	1.901	6027.	305099.	163636.	196.78	297.08	129.86	4
1	3	240.00	180.00	117.00	1.909	4800.	254747.	135987.	179.40	286.00	134.22	4
1	4	240.00	180.00	112.00	1.964	3773.	206778.	107223.	152.55	272.20	141.73	5
1	5	240.00	180.00	107.00	2.052	2511.	164952.	81775.	125.27	258.41	150.08	4

MINIMUM FS FOR THIS CENTER
1 2 240.00 180.00 122.00 1.901

CNTR NO	RAD NO	CENTER COORDINATES X	Y	CIRCLE RADIUS	FACTOR OF SAFETY	COH	FRIC	DRVG	ARC	XR	XL	NN
2	1	245.00	185.00	132.00	1.926	7249.	352486.	186824.	217.33	312.93	127.02	4
2	2	245.00	185.00	127.00	1.899	6132.	298421.	160416.	201.10	303.05	131.32	4
2	3	245.00	185.00	122.00	1.911	4973.	246911.	131783.	182.51	291.71	136.10	5
2	4	245.00	185.00	117.00	1.947	3974.	197752.	103627.	150.21	277.52	146.41	5
2	5	245.00	185.00	112.00	2.014	2782.	154471.	78093.	123.17	259.11	152.4[illegible]	4

MINIMUM FS FOR THIS CENTER
2 2 245.00 185.00 127.00 1.899

CNTR NO	RAD NO	CENTER COORDINATES X	Y	CIRCLE RADIUS	FACTOR OF SAFETY	COH	FRIC	DRVG	ARC	XR	XL	NN
3	1	250.00	190.00	137.00	1.935	7368.	346554.	182941.	221.79	319.07	128.50	4
3	2	250.00	190.00	132.00	1.913	6234.	291147.	155487.	205.39	308.98	132.80	4
3	3	250.00	190.00	127.00	1.932	5139.	23[illegible]543.	126132.	185.39	297.38	138.14	5
3	4	250.00	190.00	122.00	1.940	4173.	188645.	99414.	152.72	282.80	148.71	[illegible]
3	5	250.00	190.00	117.00	1.978	2747.	142647.	73489.	120.84	259.61	154.7[illegible]	4

MINIMUM FS FOR THIS CENTER
3 2 [illegible] 190.[illegible] 1[illegible]. 1.91[illegible]

CNTR NO	RAD NO	CENTER COORDINATES X	Y	CIRCLE RADIUS	FACTOR OF SAFETY	COH	FRIC	DRVG	ARC	XR	XL	NN
4	1	250.00	180.00	127.00	1.917	7106.	323117.	172255.	217.60	316.41	133.41	4
4	2	[illegible]	180.00	122.00	1.918	6004.	269414.	143573.	197.61	306.67	139.32	4
4	3	[illegible]	180.00	117.00	1.913	5064.	220711.	118026.	169.83	295.50	148.39	5
4	4	[illegible]	180.00	112.00	1.913	4078.	173352.	927[illegible].	146.90	281.50	154.19	5
4	5	250.00	180.00	107.00	1.966	2720.	128886.	66937.	116.36	259.57	160.08	4

MINIMUM FS FOR THIS CENTER

	4	[illegible]0.00	180.0[illegible]	112.00	1.91[illegible]

[illegible] CENTER HAS BEEN ANALYZED BEFORE - IT IS SIMPLY RENUMBERED

[illegible]	4	240.00	180.00	122.00	1.901

CNTR NO	RAD NO	CENTER COORDINATES X	Y	CIRCLE RADIUS	FACTOR OF SAFETY	COH	FRIC	DRVG	ARC	XR	XL	NN
[illegible]	[illegible]	[illegible]	190.[illegible]	137.00	1.981	7389.	380756.	195939.	219.01	309.44	120.02	4
[illegible]	[illegible]	[illegible]	19[illegible]	132.00	1.93[illegible]	6258.	325378.	171674.	200.7[illegible]	299.41	125.25	4
[illegible]	3	[illegible]40.00	190.00	127.00	1.924	4993.	274448.	145240.	183.06	287.90	129.54	4
[illegible]	4	[illegible]40.00	190.00	122.00	1.953	3864.	224073.	116712.	162.76	273.53	133.83	5
[illegible]	5	240.00	190.00	117.00	2.080	2839.	178743.	87286.	134.47	258.52	142.16	4

[illegible] FOR THIS CENTER

	3	240.00	190.0[illegible]	[illegible]27.00	1.924

[illegible] SAFETY HAS BEEN FOU[illegible]
X= 24[illegible].00 Y= 1[illegible] R= 127.00 FACTOR OF SAFETY= 1.899

TRIAXIAL COMPRESSION TEST DATA SHEET

JOB # 542-002-06

OWNER Atlas Minerals LOCATION Utah BORING # 3

SOIL TYPE DEPTH 50.5

lt. brn. clayey silt SAMPLE # 10

SAMPLED DJP 6.30 72 SET UP TESTED 12 27 72 SF OFFICE

SATURATED TEST [X] FIELD MOISTURE TEST [ ] TEST LATERAL PRESSURE 2500 PSF

TYPE OF TEST Tx/UU 1st

	Before	After
Weight soil & dish no E	792.3	485.8
Dry weight soil & dish	572.4	371.3
Net loss of moisture	219.9	114.5
Weight of dish only		109.2
Net weight of dry soil		262.1
Moisture, % of dry weight	38.4	43.7
Wt. solids + moisture W_t	792.3	822.6 gms.
W_o ÷ 454 W_o		lbs.
Weight solids W_s		gms.
Wet density W_o ÷ V_o	113.3	pcf
Dry density	81.9	pcf

Net diameter D_o 2.42 in.

Area $(0.785\ D_o^2)$ A_o 4.60 sq. in.

Height H_o 5.53 in.

Volume $(A_o H_o) \div 1728$ V_o cu. ft.

Volume $(A_o H_c) \times 16.4$ V cc

Specific gravity of solids (Assumed) G_s 2.70

Volume of solids $W_s \div G_s$ V_s cc

$(V_o - V_s) \div V_s$ e_i

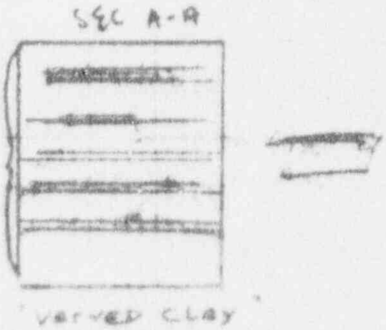
Initial burette reading cc

Burette reading under pressure cc

$(V_p - V_s) \div V_s$ e_p

(Dr = .012

NOTES



~~ε = 7.03%~~

~~σd = 4650 PSF~~

~~τ = 2325 PSF~~

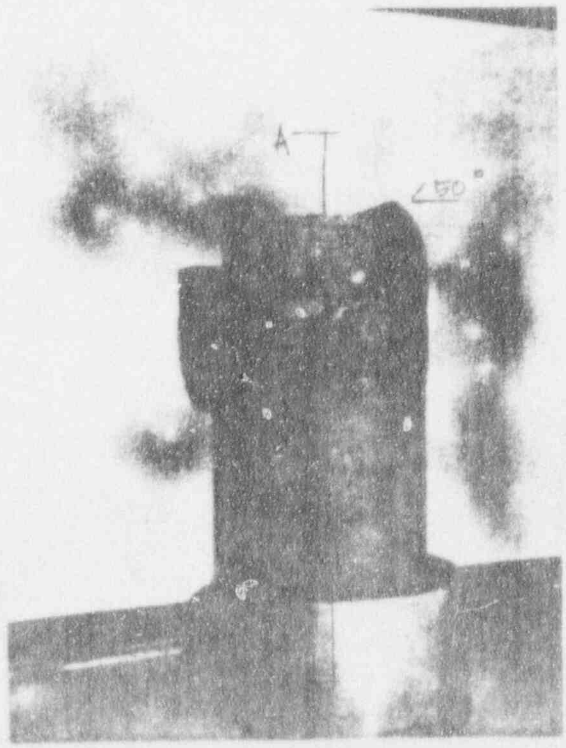
ε = 7.72 %

σd = 4672 PSF

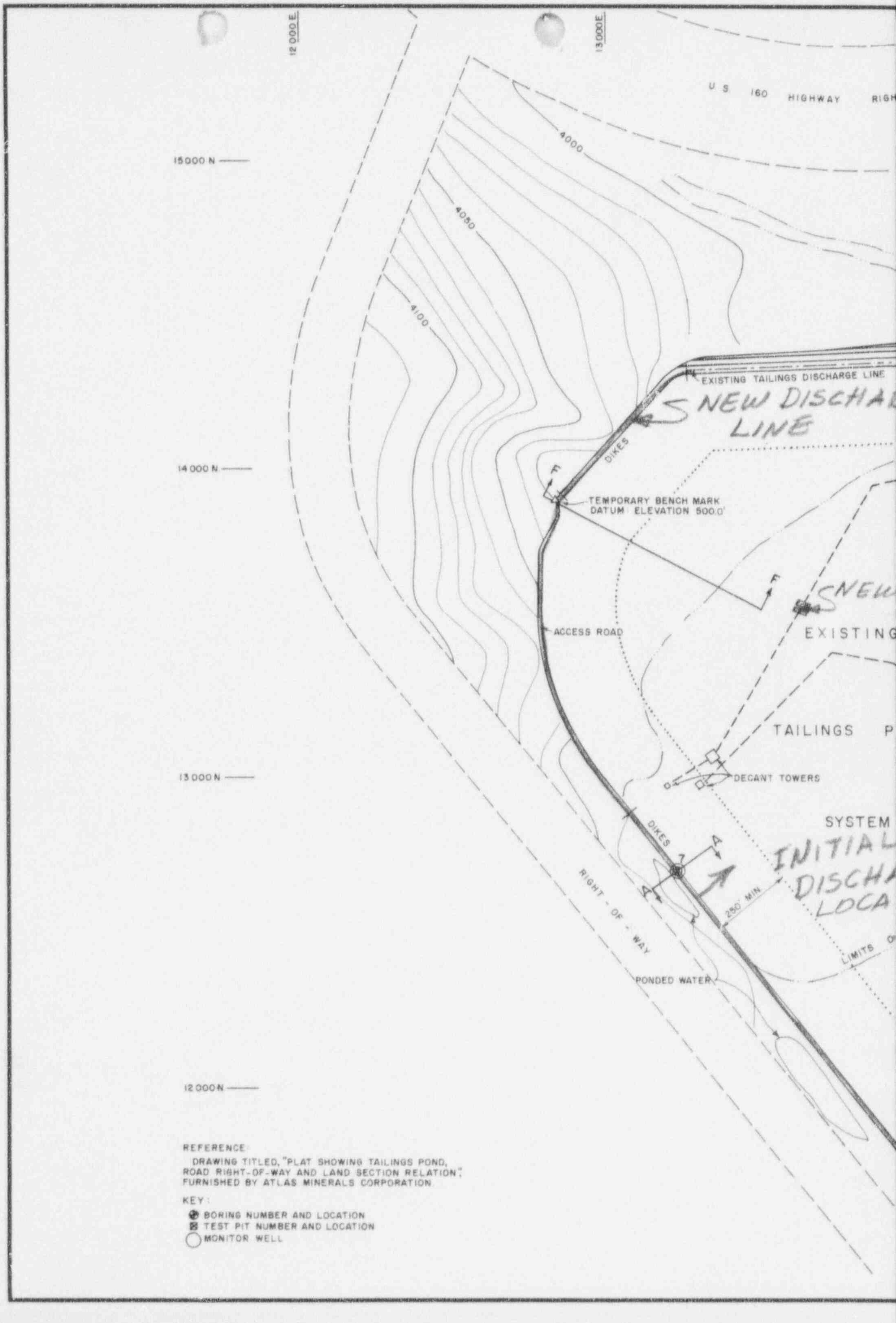
τ = 2336

γd = (437.82 / 447.1) × 81.9

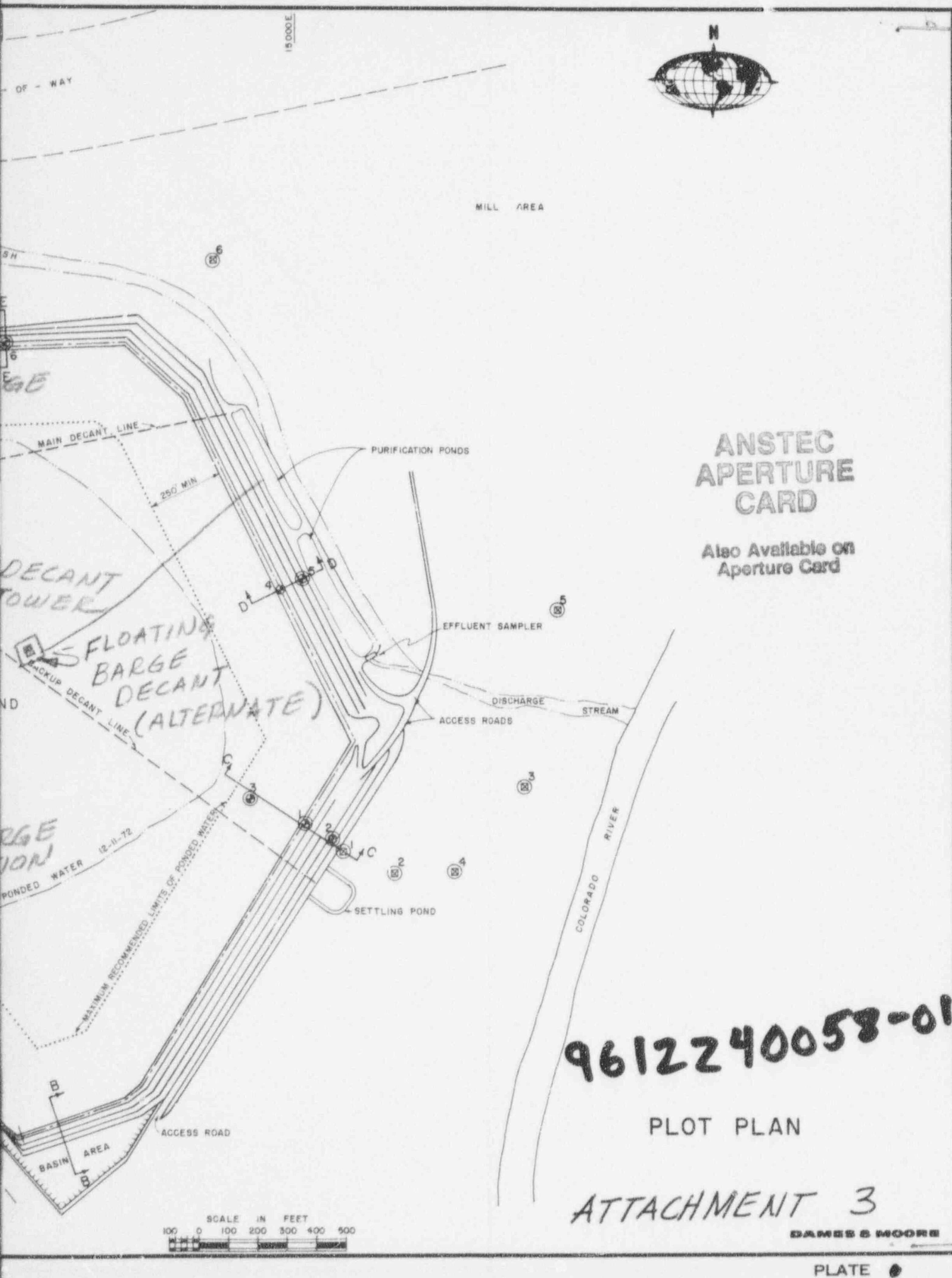
80.2 pcf ✓



ATTACHMENT 2



12 000 E
13 000 E
U S 160 HIGHWAY RIGH
15000 N
14 000 N
13 000 N
12 000 N
4000
4050
4100
EXISTING TAILINGS DISCHARGE LINE
NEW DISCHA
LINE
DIKES
TEMPORARY BENCH MARK
DATUM ELEVATION 500.0'
F
NEW
EXISTING
ACCESS ROAD
TAILINGS P
DECANT TOWERS
SYSTEM
INITIAL
DISCHA
LOCA
A
250' MIN
RIGHT - OF - WAY
LIMITS O
PONDED WATER
REFERENCE:
DRAWING TITLED, "PLAT SHOWING TAILINGS POND, ROAD RIGHT-OF-WAY AND LAND SECTION RELATION", FURNISHED BY ATLAS MINERALS CORPORATION.
KEY:
BORING NUMBER AND LOCATION
TEST PIT NUMBER AND LOCATION
MONITOR WELL



9612240058-01

PLOT PLAN

ATTACHMENT 3

DAMES & MOORE

PLATE