UNITED NUCLEAR
CORPORATION

MINING AND MILLING DIVISION
WYOMING OPERATIONS
P.O. BOX 2996
CASPER, WYOMING 82602
(307) 265-6447

December 12, 1978

40-8602

U. S. Nuclear Regulatory Commission
Fuel Processing and Fabrication Branch
Division of Fuel Cycle and Material Safety
Washington, D. C. 20555

Attention: L. W. Rossbach

Gentlemen:

Relative to your letter dated September 18, 1978, requesting additional data and analysis of the effluent embankment foundation, attached hereto are ten (10) copies of the response. This information becomes Addendum III to the Dames and Moore Report of Investigation and Design as amended.

In addition to the data and analysis presented herewith, detailed plans and specifications for the foundation excavation and construction of the full height embankment are being prepared and will be submitted upon completion.

Please advise if further information is desired.

Very truly yours,

UNITED NUCLEAR CORPORATION
Mining and Milling Division

C. E. Wolff
Plant Superintendent
Wyoming Operations

CEW/mdd
cc: A. W. Woods
A. W. Shafer
C. H. Likins
R. O. Hiscox
L. Zussman (5)
F. Munson

C

ADDENDUM III

DAMES & MOORE
CONSULTANTS IN THE ENVIRONMENTAL AND APPLIED EARTH SCIENCES

SUITE 200, 250 EAST BROADWAY · SALT LAKE CITY, UTAH 84111 · (801) 521-9255
CABLE: DAMEMORE TWX: 910-925-5692

December 6, 1978

United Nuclear Corporation
P. O. Box 2996
Casper, Wyoming 82602

Attention: Mr. C. E. Wolff,
Plant Superintendent

Gentlemen:

Enclosed are 35 copies of our response to NRC Question No. 1.

If you have any questions or require additional information, please contact us.

Yours very truly,

DAMES & MOORE

Larry T. Murdock
Associate

LTM/GWC/nb

Enclosures

QUESTION NO. 1

Submit to NRC additional data and analyses to show that the loose sands in the embankment foundation are clearly safe against liquefaction for a 1,000-year return interval earthquake or submit for approval a plan for remedial work to ensure safety against liquefaction. In either case, documents to be submitted to NRC should include additional boring logs with standard penetration tests to show the extent of the loose material in the embankment foundation and Atterberg limit tests for material classification.

RESPONSE TO QUESTION NO. 1

ADDITIONAL BORING LOGS AND LABORATORY TESTS

Logs of seven additional borings drilled in the valley alluvium are presented on Plates 1A and 1B. The locations of the borings are shown on Plate 2, Plot Plan.

The borings were drilled utilizing hollow-stem auger equipment. Standard penetration tests were conducted at close intervals in the borings. The holes were advanced with the augers, the augers were filled with water, and the SPT sampler was driven 18 inches. The blows per foot of penetration for the last 12 inches are reported on the left side of the boring logs on Plates 1A and 1B.

The soils have been classified in accordance with the Unified Soil Classification System. Field classifications were supplemented by subsequent inspection and testing in the laboratory. Sieve and Atterberg limits tests were conducted on selected samples. The results of these tests are provided on Table 1.

Subsurface conditions in the alluviated valley are shown by a total of 12 borings. The alluvium consists of silty clay (CL) to sandy clay (CL-SC) which is soft to medium stiff where saturated and stiff to hard where dry. A sandy stratum, mostly consisting

of loose to medium dense, clayey, fine to medium sand (SC-CL to SC), generally occurs from depths of 20 to 30 feet. The sand is plastic, having a plasticity index ranging from 5 to 20 (Table 1). Two pockets of loose, silty, fine to coarse sand were encountered in Boring 5A at a depth of 22.0 to 26.5 feet and Boring 21 at a depth of 25.0 to 26.5 feet.

Ground water levels lie at about 20 feet in depth.

DESIGN EARTHQUAKE ACCELERATION

As discussed in the response to Question No. 4 of the Q-2 Questions*, the 1,000-year return period maximum ground acceleration for the site is estimated to be 0.06g.

LIQUEFACTION POTENTIAL

An evaluation of the liquefaction potential was performed for a Magnitude 6 event with a ground acceleration of 0.06g as discussed previously.

The following evaluation of the liquefaction potential of the subsurface soils utilizes the emperical method developed by Seed**. The method involves the determination of a critical cyclic stress ratio through the comparison of standard penetration test data at sites where liquefaction did or did not occur during previous earthquakes with standard penetration results recorded for the actual site conditions. To calculate the cyclic stress ratio induced by the postulated earthquake, the simplified Seed and Idriss*** procedure was used. It should be

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* United Nuclear Corporation, Letter to U. S. Nuclear Regulatory Commission, Attention: Mr. R. A. Scarano, Dated June 13, 1978.

** Seed, H. B., 1976, Evaluation of Soil Liquefaction Effects of Level Ground During Earthquakes, ASCE National Convention on Liquefaction Problems in Geotechnical Engineering, September.

*** Seed, H. B., and Idriss, I. M., 1971, Simplified Procedures for Measuring Soil Liquefaction Characteristics, Proceedings Journal of Soils Mechanics and Foundation Engineering Division, ASCE, Vol. 97, No. SM9, September.

noted that this is generally assumed to be a conservative approach for the determination of a factor of safety for the liquefaction potential of a soil deposit.

Plate 3, Liquefaction Criteria, shows the relationship of standard blow counts (SPT) obtained in the field to depths of the standard penetration tests in the field, for potential liquefaction under the future condition with the dam constructed. For the future condition, a ground water level at the ground or dam surface was assumed.

The liquefaction criteria shown on Plate 3 are very conservative for it does not account for any future gain in strength of the sand stratum resulting from consolidation upon placement of the dam fill. The curves also assume the future ground water level to be at the surface of the fill.

The results of the Atterberg limits tests show that most soils with low blow counts are plastic, silty clay or clayey sand. These plastic soils have plasticity indexes which range from 5 to 20 for the clayey sand soils and range from 10 to 34 for the silty clay soils. These plastic soils should have sufficient cohesion to resist grain movement which could result in the development of excess pore pressures. Three samples (samples at 22.5 and 25.5 feet in Boring 5A, and one sample at 25.0 feet in Boring 21) are non-plastic and have blow counts indicating a factor of safety of less than one against liquefaction. The non-plastic samples appear to indicate pockets of coarser-grained sediments which were deposited in the meander of the small stream which has occupied the valley bottom.

REMEDIAL ACTION

United Nuclear Corporation plans to remove the loose soils from beneath the embankment. The excavation plan is shown on Plate 2. The excavation will be inspected by a qualified engineer, and any remaining loose sands or unsuitable soils will be removed prior to the backfilling operation. Backfill will be placed and compacted in accordance with the contract specifications. The

core (Zone 1) will be extended and keyed into the foundation excavation, and Zone 4 and Zone 5 shell material will be used in the downstream and upstream portions of the excavation, respectively. The contract specifications and drawings will be modified to reflect these changes.

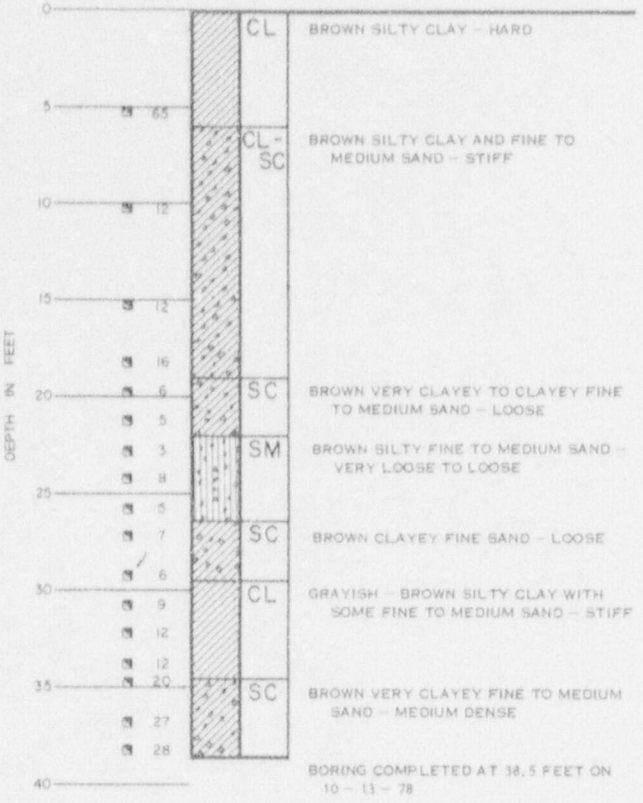
TABLE 1

SUMMARY OF INDEX TESTS

Boring Number	Depth In Feet	Percent Finer By Weight Sieve #40	Sieve #200	Liquid Limit	Plastic Limit	Plasticity Index	Unified Soil Classification
5A	19.5	--	--	28.2	18.3	9.9	SC
5A	21.0	--	--	33.0	20.1	12.9	SC
5A	22.5	64.1	24.5	- - - N O N - P L A S T I C - -			SM
5A	25.5	65.4	17.8	- - - N O N - P L A S T I C - -			SM
5A	29.0	--	--	36.2	22.0	14.2	SC
11A	20.0	--	--	55.1	26.5	28.6	CH
11A	21.5	99.3	94.0	58.8	24.8	34.0	CH
11A	26.0	93.6	48.7	36.2	16.9	19.3	SC-CL
11A	27.5	99.8	68.6	31.5	15.8	15.7	CL
11A	29.0	--	--	40.4	17.8	22.6	CL
11A	35.0	--	--	22.0	17.4	4.6	SC-CL
21	10.0	--	--	27.8	17.5	10.3	CL
21	11.5	91.0	38.3	24.7	16.4	8.3	SC-CL
21	17.5	99.0	42.0	31.9	18.9	13.0	SC-CL
21	19.0	--	--	29.8	17.3	12.5	SC-CL
21	20.5	--	--	33.7	17.2	16.5	SC-CL
21	22.0	--	--	29.1	17.6	11.5	SC-CL
21	25.0	28.4	15.4	- - - N O N - P L A S T I C - -			SM
21	28.0	--	--	32.9	18.2	14.7	CL
22	27.0	87.0	45.8	30.6	16.5	14.1	SC-CL
23	27.0	74.6	42.3	25.4	20.4	5.0	SC-CL
25	23.5	--	--	39.7	20.3	19.4	CL

BORING 5A

ELEVATION 5192.0 FEET



BROWN SILTY CLAY – HARD

BROWN SILTY CLAY AND FINE TO MEDIUM SAND – STIFF

BROWN VERY CLAYEY TO CLAYEY FINE TO MEDIUM SAND – LOOSE

BROWN SILTY FINE TO MEDIUM SAND – VERY LOOSE TO LOOSE

BROWN CLAYEY FINE SAND – LOOSE

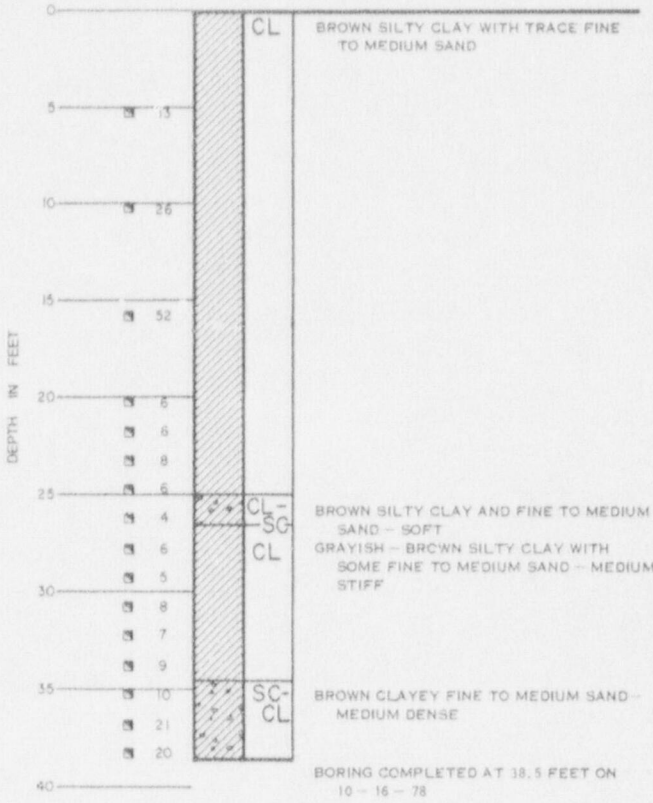
GRAYISH – BROWN SILTY CLAY WITH SOME FINE TO MEDIUM SAND – STIFF

BROWN VERY CLAYEY FINE TO MEDIUM SAND – MEDIUM DENSE

BORING COMPLETED AT 38.5 FEET ON 10 – 13 – 78

BORING 11A

ELEVATION 5184.6 FEET



BROWN SILTY CLAY WITH TRACE FINE TO MEDIUM SAND

BROWN SILTY CLAY AND FINE TO MEDIUM SAND – SOFT

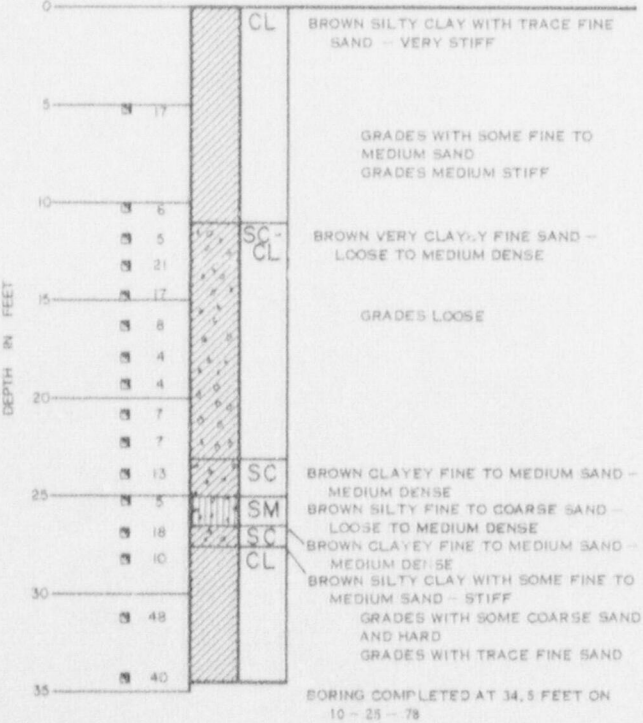
GRAYISH – BROWN SILTY CLAY WITH SOME FINE TO MEDIUM SAND – MEDIUM STIFF

BROWN CLAYEY FINE TO MEDIUM SAND – MEDIUM DENSE

BORING COMPLETED AT 38.5 FEET ON 10 – 16 – 78

BORING 21

ELEVATION 5193.7 FEET



BROWN SILTY CLAY WITH TRACE FINE SAND – VERY STIFF

GRADES WITH SOME FINE TO MEDIUM SAND
GRADES MEDIUM STIFF

BROWN VERY CLAYEY FINE SAND – LOOSE TO MEDIUM DENSE

GRADES LOOSE

BROWN CLAYEY FINE TO MEDIUM SAND – MEDIUM DENSE

BROWN SILTY FINE TO COARSE SAND – LOOSE TO MEDIUM DENSE

BROWN CLAYEY FINE TO MEDIUM SAND – MEDIUM DENSE

BROWN SILTY CLAY WITH SOME FINE TO MEDIUM SAND – STIFF
GRADES WITH SOME COARSE SAND AND HARD
GRADES WITH TRACE FINE SAND

BORING COMPLETED AT 34.5 FEET ON 10 – 25 – 78

KEY

A – ▣

A BLOWS PER FOOT OF PENETRATION WITH STANDARD SPLIT SPOON USING A 140 LB. HAMMER DROPPING 30 INCHES (SPT)

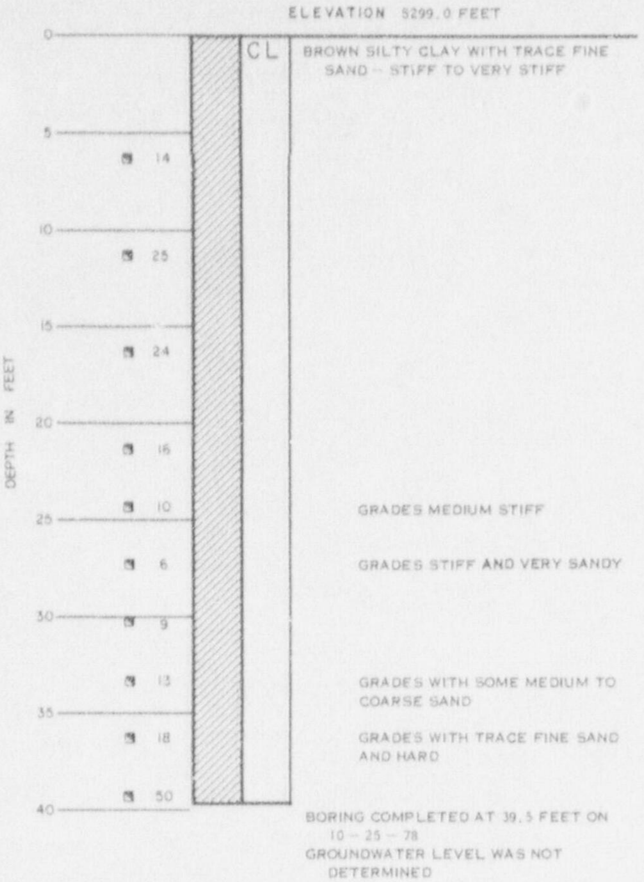
▣ DEPTH AT WHICH DISTURBED SAMPLE WAS EXTRACTED

LOG OF BORINGS

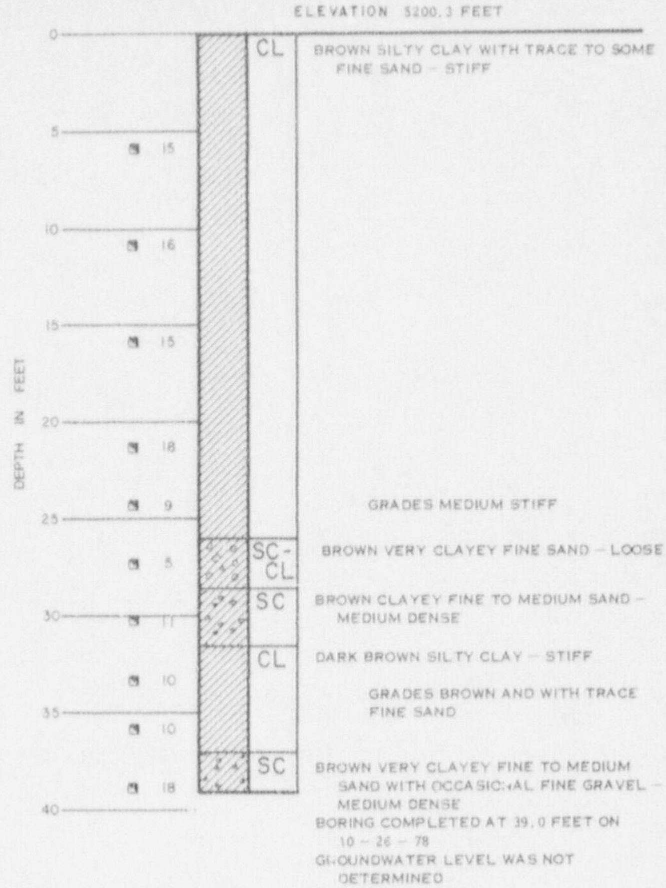
DAMES & MOORE

PLATE 1A

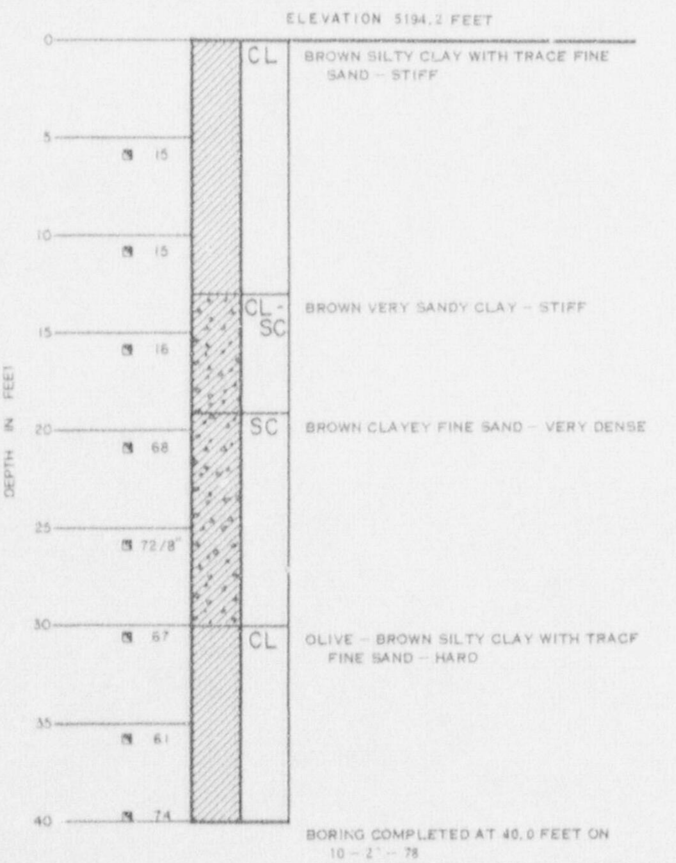
BORING 22



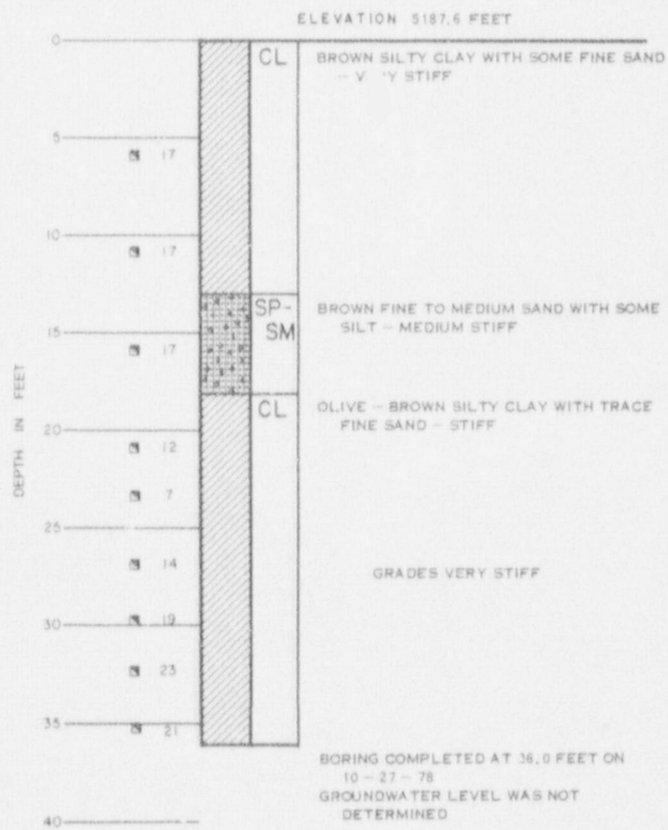
BORING 23



BORING 24



BORING 25



LOG OF BORINGS

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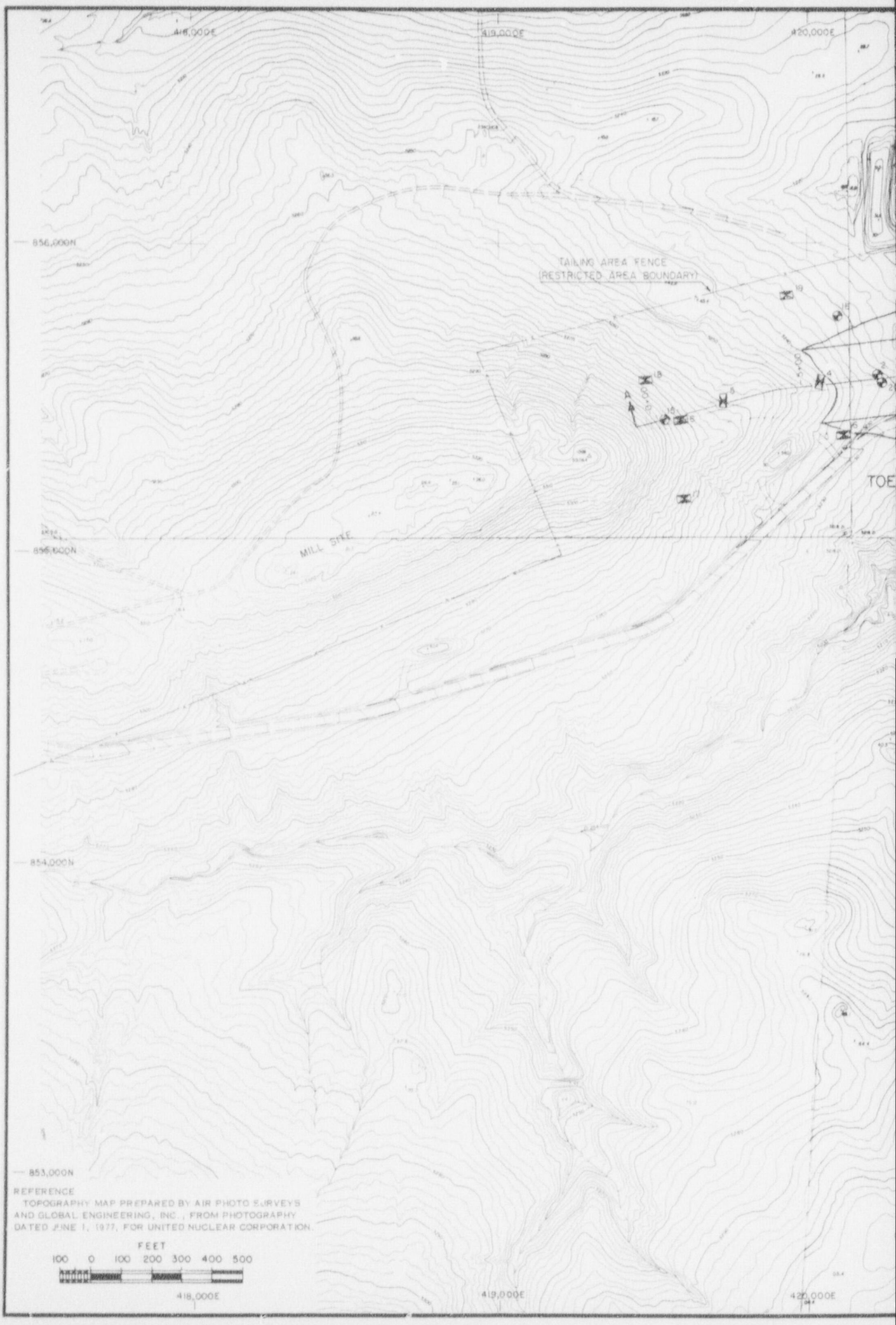
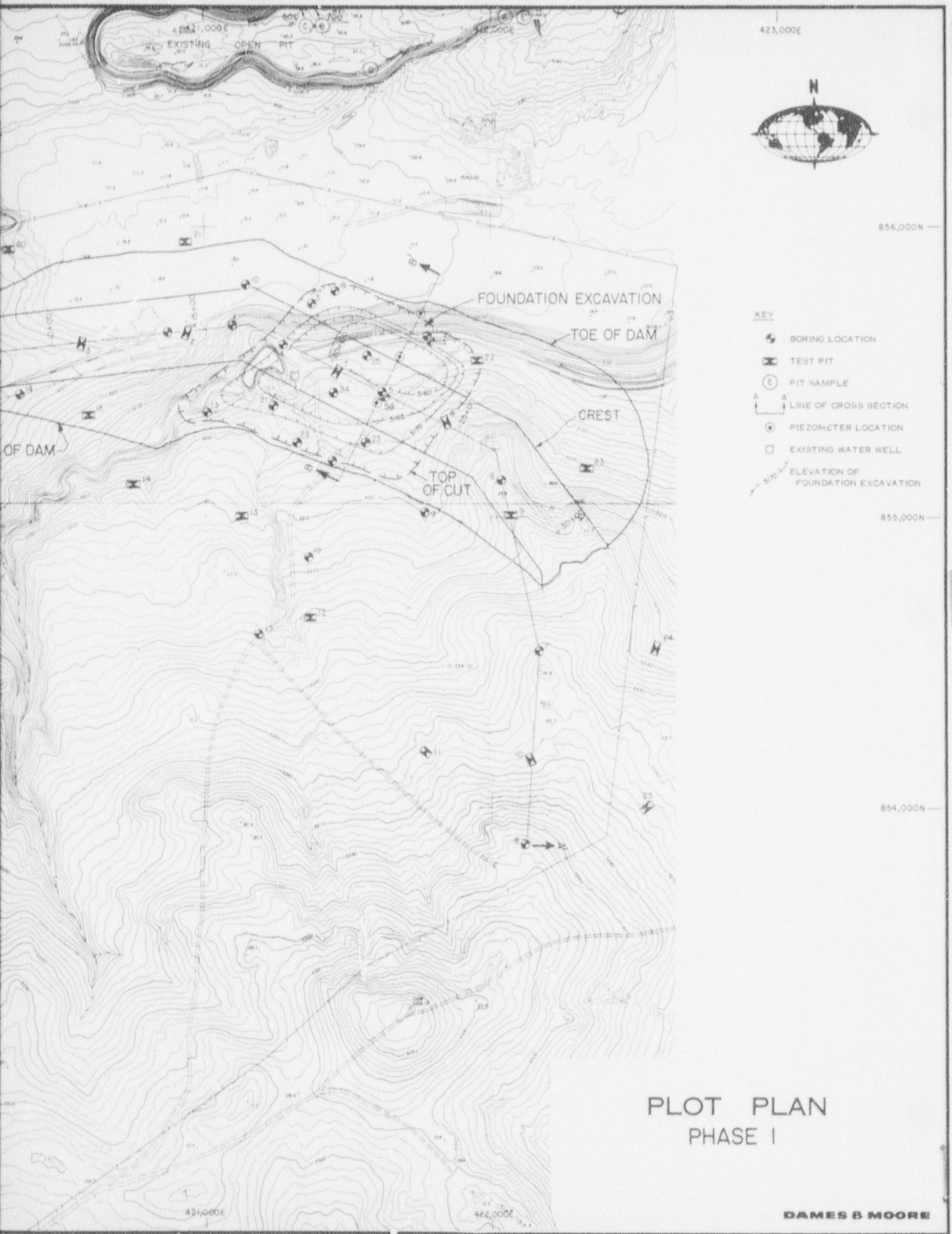
PLATE 1B


418,000E
419,000E
420,000E
856,000N
855,600N
854,000N
853,000N
TAILING AREA FENCE
(RESTRICTED AREA BOUNDARY)
MILL SITE
TOE
REFERENCE
TOPOGRAPHY MAP PREPARED BY AIR PHOTO SURVEYS
AND GLOBAL ENGINEERING, INC., FROM PHOTOGRAPHY
DATED JUNE 1, 1977, FOR UNITED NUCLEAR CORPORATION.
FEET
100 0 100 200 300 400 500



PLOT PLAN
PHASE I

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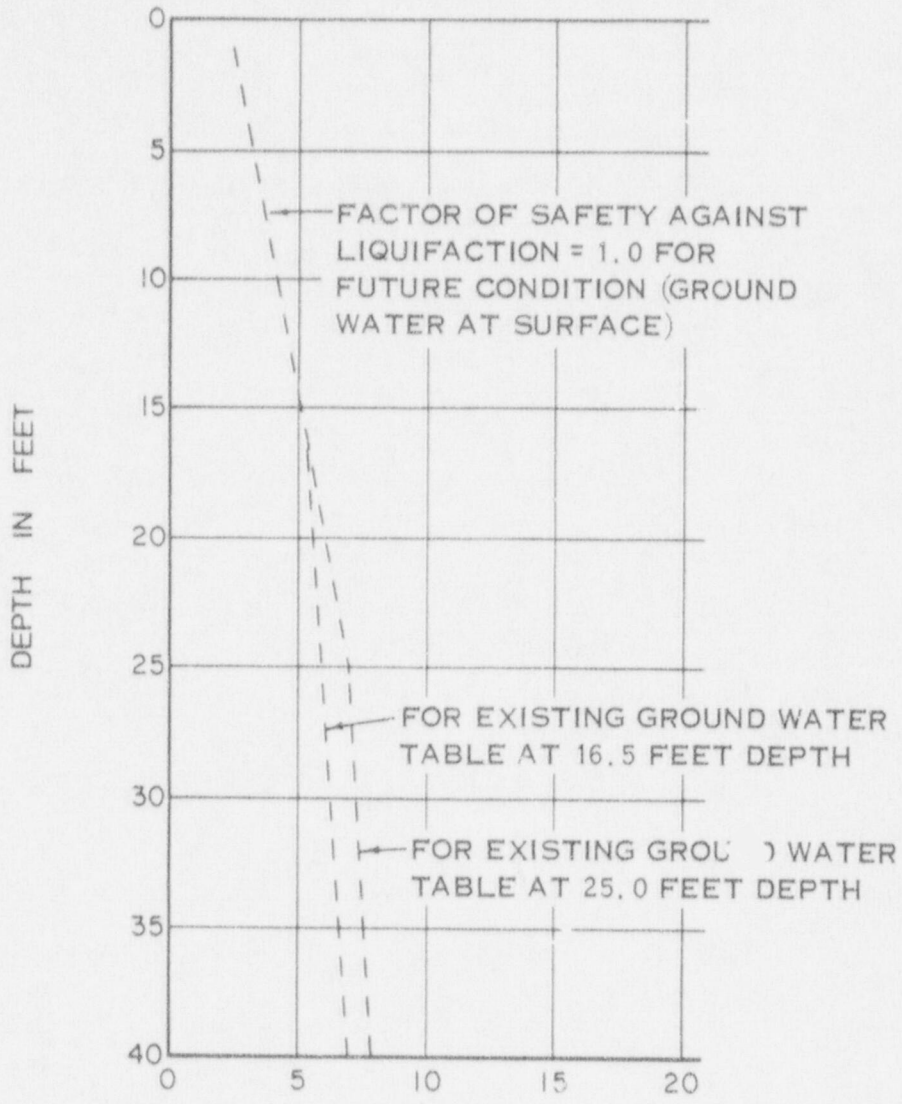
PLATE 2



STANDARD PENETRATION TEST BLOW COUNTS
(BLOWS PER FOOT)

LIQUIFACTION CRITERIA

DAMES & MOORE

PLATE 3

REVISIONS BY DATE

BY DATE

CHECKED BY

FILE 0266ZST

946.7 (REV. 6-61)