

0063

File Sunnyside
ACT/007/007 #2

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS



March 3, 1986

RECEIVED
MAR 03 1986

Kaiser Coal Corporation
P.O. Box D
Sunnyside, Utah 84539

**DIVISION OF
OIL, GAS & MINING**

Attention: Roger Coleman

Gentlemen:

This report summarizes the results of the investigations and stability computations which we have performed for the East Slurry Cell for the Kaiser Coal Mine near Sunnyside, Utah. The report is discussed under the following headings: (1) Investigations performed prior to March 30, 1984, (2) Investigations performed subsequent to March 30, 1984.

1. INVESTIGATIONS PERFORMED PRIOR TO MARCH 30, 1984

The results of this investigation is summarized in a report dated the 25 of March 1984. The Slurry Cell is presented in Figure No. 1 attached hereto. A stability analysis was performed for a section along line CC which is located in the southeasterly portion of the dike. In order to define the characteristics of the subsurface material along line CC, test hole No. 1 was drilled as shown in Figure No. 1. The log for this test hole is presented in Figure No. 2 attached hereto. It will be observed that the refuse material extended to a depth of 54 feet below the existing ground surface. The remainder of the soil profile consisted of a brown sandy silt underlain by silty sand with sandstone fragments.

The density characteristics of the refuse material were defined by standard penetration tests performed at five foot intervals throughout the soil profile. Typical in-place densities of the refuse material was determined by performing in-place density tests at three foot intervals in test pits. The

results of these tests indicated that the in-place density of the refuse material varied from about 70 pounds per cubic foot to 91 pounds per cubic foot. A consolidated drained triaxial shear test was performed on representative samples of the refuse material densified to an in-place unit weight of between 78 and 80 pounds per cubic foot. A stability analysis was performed using Spencers Method which is an acceptable method for solving limiting equilibrium problems. The results of the stability analysis is presented in Figure No. 3 attached hereto. The shear strength parameters along with the unit weights assumed for the various material throughout the soil profile are shown in Figure No. 3.

The factor of safety obtained assuming a friction angle of 35 degrees from the refuse material was 1.42, assuming a friction angle of 37 degrees for the refuse material a factor of safety of 1.5 was obtained.

Subsequent to the completion of the report, dated 30 of March 1984. Consideration was given to the seismic stability of the east side dike. The results of the stability consideration were outlined dated March 30, 1984. A copy of this letter is attached hereto. It was concluded that as a consequence of the low expected seismic acceleration at this site, and the in-place density of the existing materials, that no seismic stability problems existed for the east side dike.

2. INVESTIGATIONS PERFORMED SUBSEQUENT TO MARCH 1984.

A) The Slope Stability Conditions along line CC assuming that the refuse embankment was completely saturated.

On February the 18, 1985, we performed a stability analysis for a cross section along lines CC as outlined in Figure No.1 attached hereto. The shear strength parameters and the in-place unit weights used for the saturated cross section was the same as those used for the unsaturated cross section. The assumption that the entire cross section of the existing dike would be saturated along line CC was believed to be unrealistic assumption. In the latter part of 1985, piezometers were installed along a cross section several hundred feet west of line CC. The piezometers were installed at this location since some seepage appeared to be occurring through the existing slope.

B) A Stability Analysis Performed along the Piezometer Lines.

Kaiser Coal Corporation
March 3, 1986
Page 3

A profile through the cross section of the dike where the piezometers were located is shown in Figure No. 4. The boundary between the alluvial fill and the coarse refuse is shown in this profile, along with the location of the piezometers. It will be observed that the groundwater level is located approximately at the surface of the alluvial fill. It will also be observed that the side slopes for the profile through the piezometer line is 2.75 horizontal to one vertical. The shear strength parameters used in this analysis in this analysis are identical used for the profile along CC as outlined in the March 25 report. The shear strength parameters used in the analysis are presented in Figure No. 4.

A factor of safety of 2.2 was obtained for this slope and the location of the critical failure surface is presented in Figure No. 4. The computer print-out for this condition is also attached hereto. It is our opinion that the seismic stability considerations discussed for the profile along cc is valid for the cross section shown in Figure No. 4, and it is our belief that the likelihood of slope failure at this site under the contemplated seismic conditions is relatively low. If there is any questions relative to the information contained herein, please advise us.

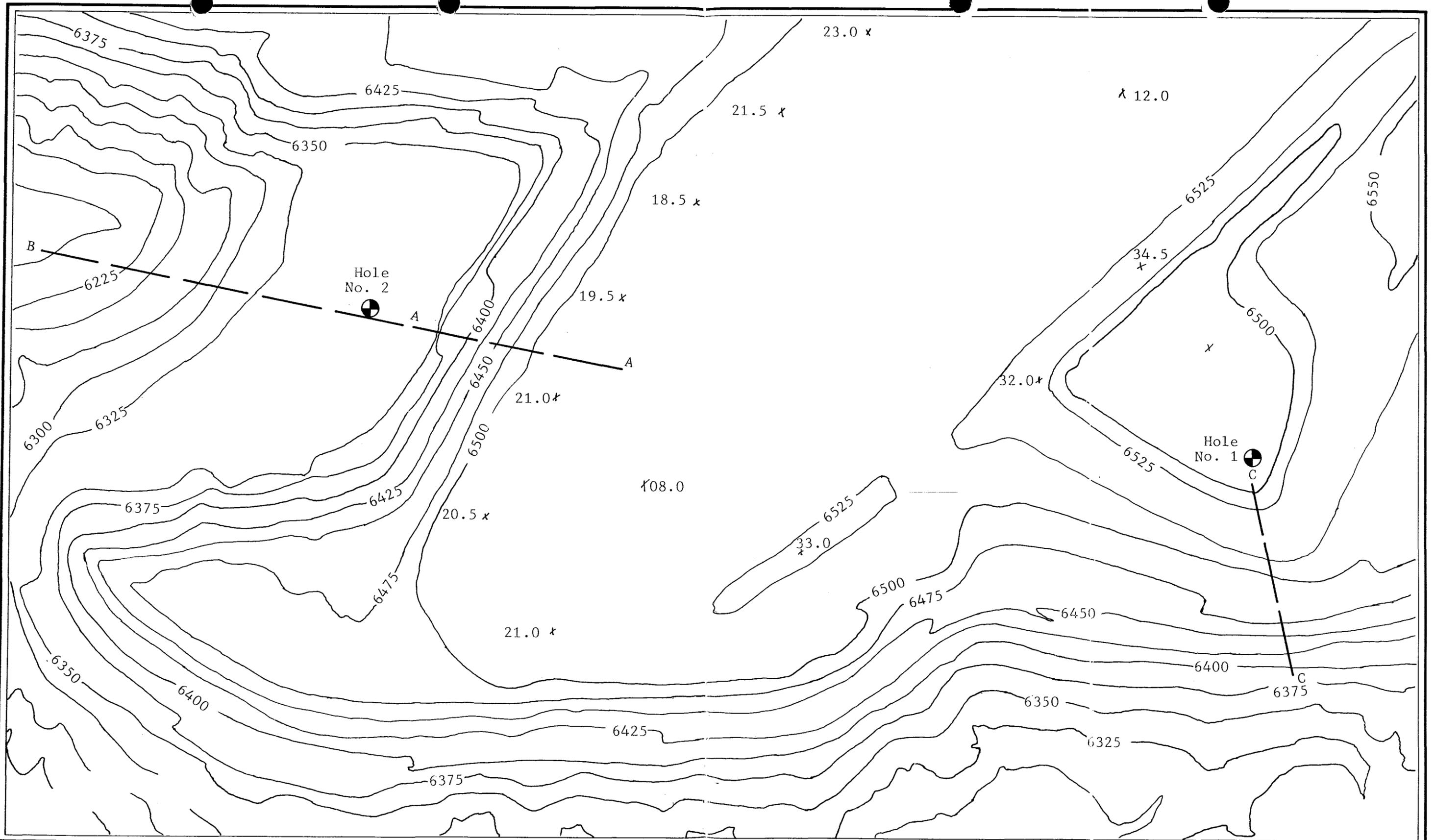
Yours Truly

~~ROLLINS, BROWN AND GUNNELL, INC.~~



Ralph L. Rollins

RLR/arb

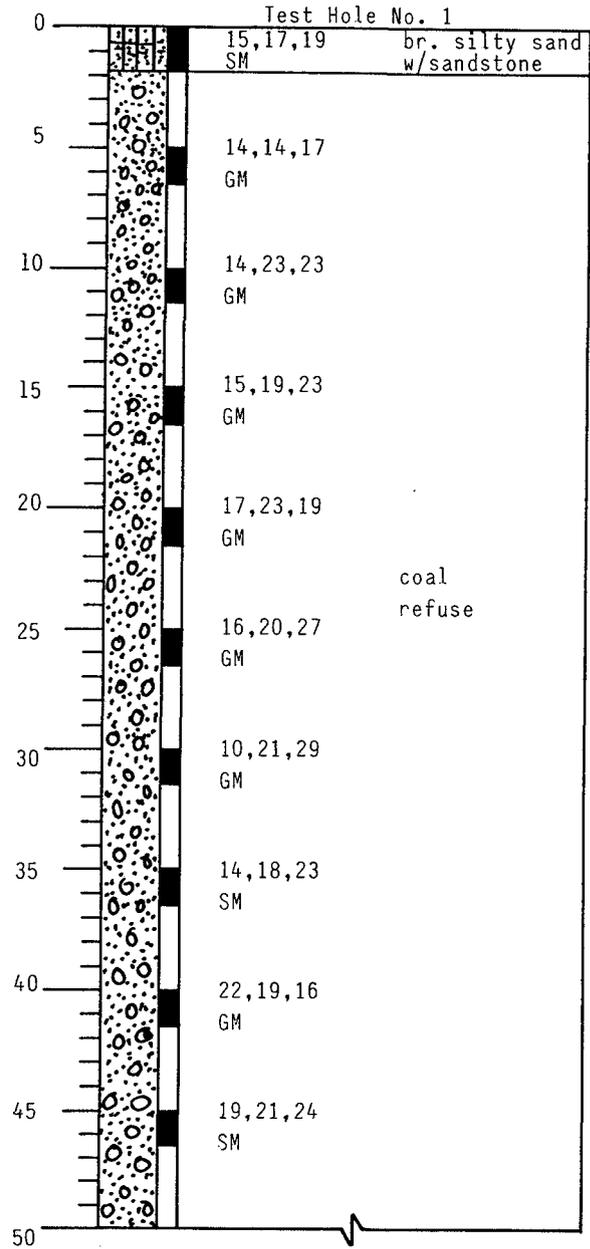


ROLLINS, BROWN AND GUNNELL, INC.
 PROFESSIONAL ENGINEERS

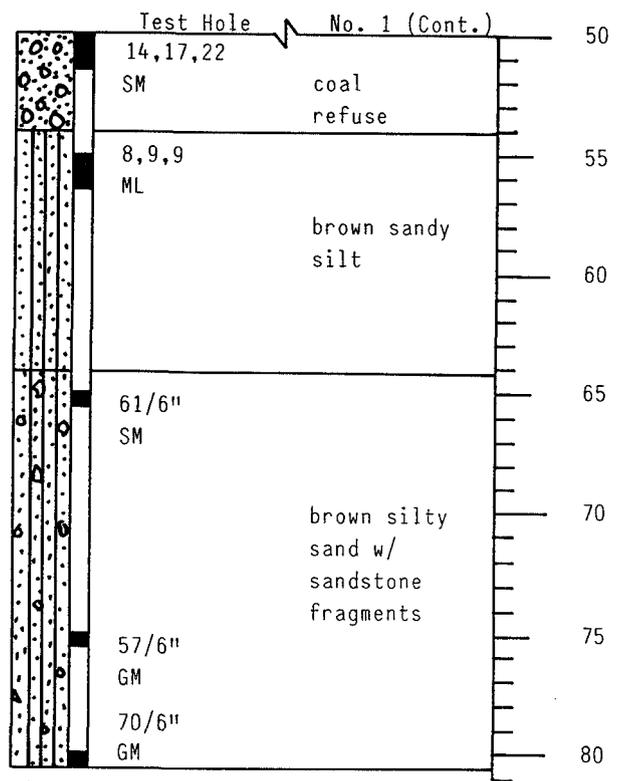
KAISER STEEL DIKE STABILITY
 Stability Analysis--Slope Location
 Sunnyside, Utah

FIGURE
 NO. 1

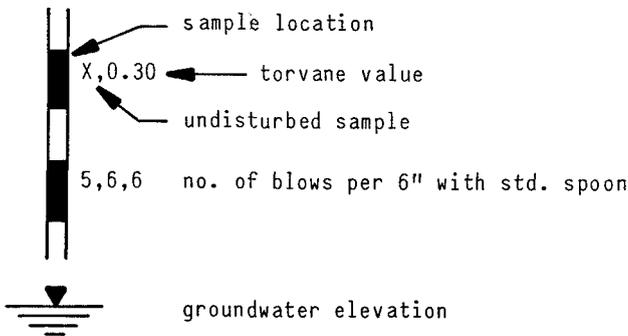
DEPTH



DEPTH



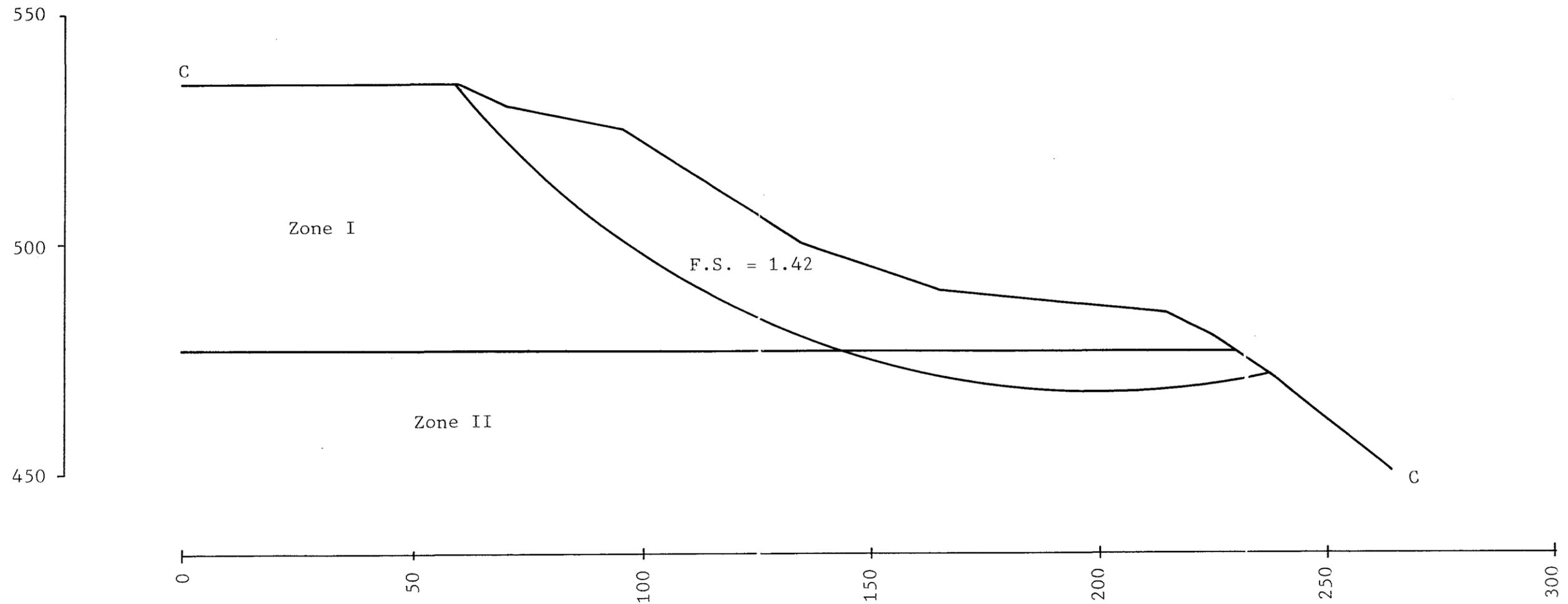
LEGEND



ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

Log of Borings for:
Kaiser Steel Dike Stability
Sunnyside, Utah

Figure No. 2



Zone	Material	c, psf	ϕ , deg	γ , pcf
I	Coal Refuse	0	35	80
II	Silty Sand, Sandy Silt	0	36	105

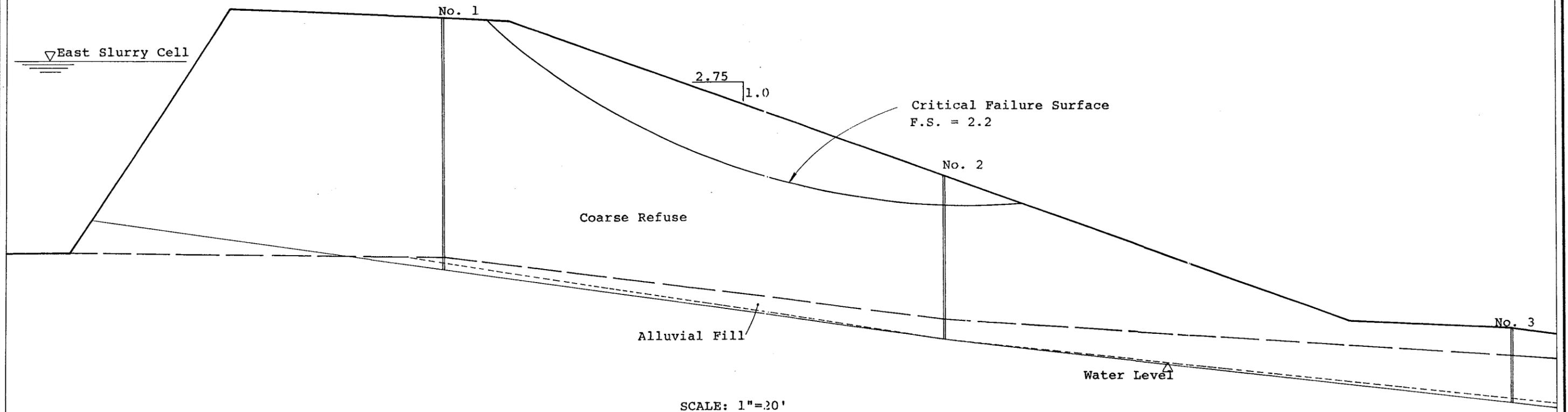


ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

KAISER STEEL DIKE STABILITY
Stability Analysis--East Slope
Sunnyside, Utah

FIGURE
NO. 3

ZONE	MATERIAL	C, psf	ϕ , degrees	γ , pcf
I	Coal Refuse	0	35	80
II	Silty Sand, Sandy Silt	0	30	105



ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

KAISER COAL COMPANY
Sunnyside, Utah

SOIL PROFILE ALONG THE PIEZOMETER LINE

FIGURE
NO. 4