Appendix 5-16

Storage Pad Stability Analysis

STORAGE PAD SLOPE STABILITY ANALYSIS AT THE CRANDALL CANYON MINE, EMERY COUNTY, UTAH

Prepared for

GENWAL COAL COMPANY
Crandall Canyon Mine
Huntington, Utah

Prepared by

EARTHFAX ENGINEERING, INC.
Midvale, Utah

November 9, 1990

REGISTERED PROFESSIONAL ENGINEER
11-9-90
No. 5576
KENNETH T.
KLEBBA
STATE OF UTAH

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STORAGE PAD SLOPE STABILITY ANALYSIS AT THE CRANDALL CANYON MINE, EMERY COUNTY, UTAH

1.0 INTRODUCTION

The Crandall Coal Mine, owned by Genwal Coal Company near Huntington, Utah (Figure 1-1), currently trucks approximately 1,000,000 tons of coal annually down Crandall Canyon. This stream-incised canyon provides only limited area for structures, storing equipment, and maneuvering vehicles (Figure 1-2).

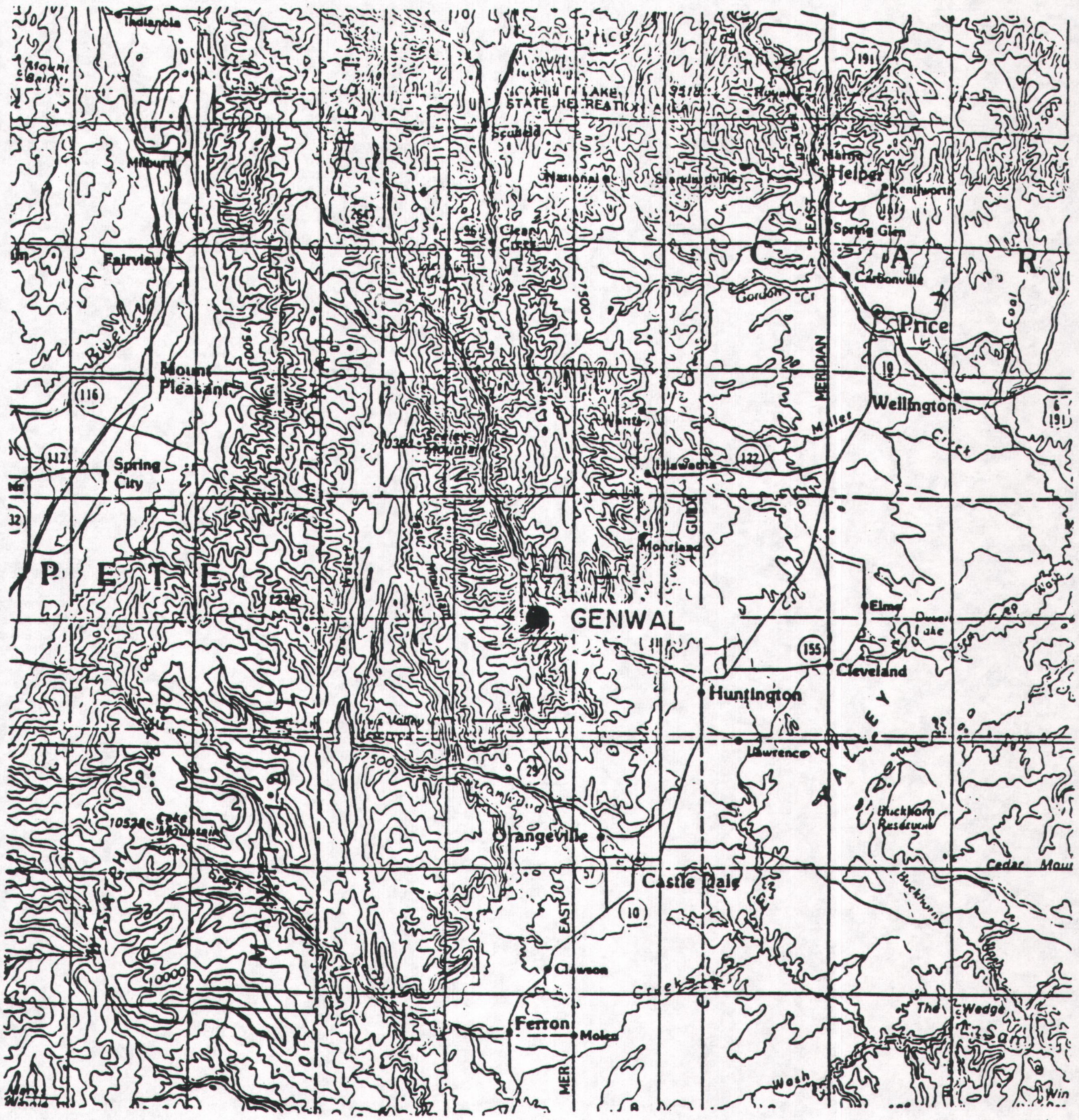
To provide additional surface area for equipment storage and vehicle maneuvering, Genwal has proposed extending their existing storage pad toward Crandall Creek. In addition, Genwal has proposed paving their haul road from the mouth of Crandall Canyon to the truck turnaround area, a distance of approximately 1.3 miles. The truck turnaround area is shown on Figure 1-2.

The purpose of this report is to determine the slope stability of the proposed storage pad. Slope stability analyses will be evaluated for the critical operating conditions and will include an allowance for seismic loading.

The work described in and associated with this report included field observations, surface soil sample collection, reviews of field and laboratory data, and geotechnical calculations.

This report presents an expression of professional opinions and recommendations based on the results of field observations, laboratory analyses, and professional judgement. A qualified engineer or geologist should be at the site during the storage pad construction to monitor field conditions and make field decisions as necessary.

This document is divided into six sections including this introduction. Background information related to the site is summarized in Section 2.0. Results



Scale 1:500 000

1 inch equals approximately 8 miles

10 0 10 20 30 40 Miles

10 0 10 20 30 40 50 Kilometers

N

Contour interval 500 feet

National Geodetic Vertical Datum of 1929

FIGURE I-I. SITE LOCATION MAP.

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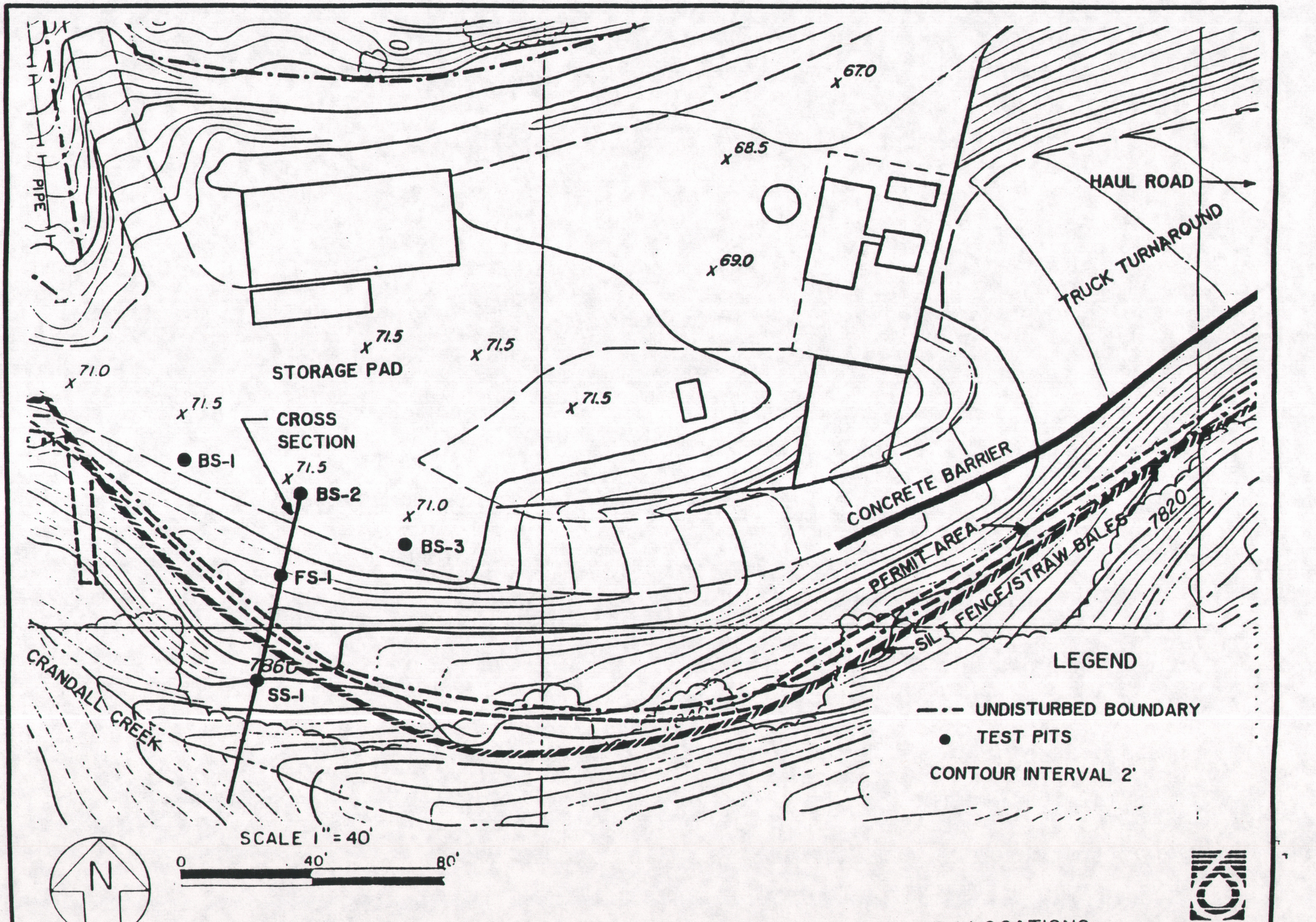

FIGURE 1-2. GENWAL SITE PLAN, SOIL SAMPLING AND CROSS SECTION LOCATIONS.

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of the near-surface soils investigation are presented in Section 3.0, followed by a slope stability analysis of the storage pad slope in Section 4.0. Conclusions and recommendations are presented in Section 5.0, followed by the cited references in Section 6.0.

2.0 BACKGROUND INFORMATION

2.1 Site Description

The surface storage pad for the Crandall Canyon Mine is located on the north slope of Crandall Canyon which is a tributary of Huntington Creek in Emery County, Utah. The geology of Crandall Canyon consists of the Mesaverde Group of upper Cretaceous sedimentary rocks. Genwal is currently mining the Hiawatha coal seam of the Blackhawk Formation.

The Blackhawk Formation, the middle member of the Mesaverde Group, consists of light to medium gray sandstone, light gray to black shale, light to medium gray siltstone, and coal (Davis and Doelling, 1977). The sandstones are mostly fine grained and form ledges and cliffs. The shales and siltstones are generally carbonaceous and underlie covered slopes. The sediments of the Blackhawk Formation are typically 400 to 1,100 feet thick.

Alluvial deposits are present in the bottom of Crandall Canyon and grade into colluvial deposits at short distances upslope from the canyon floor. Alluvial deposits in the vicinity of the surface storage pad are typically silty-sands with intermittent layers of sandy-gravel. Colluvial deposits contain poorly sorted, unstratified layers of large angular sandstone blocks in a gravelly sand matrix.

The north bank of the Crandall Creek stream channel downslope from the surface storage pad consists of nearly vertical stream cuts which are currently up to 8 feet high with a debris slope at the base of the cut. Alluvial deposits of cemented silty-sands and sandy-gravels are exposed in the steep bank cut.

The vegetation on the south slope of Crandall Canyon consists of dense stands of conifers and aspen. These trees are present in scattered stands on the north slope along with bushes, sagebrush, and grasses.

2.2 General Seismicity

Seismic activity in the vicinity of the Crandall Creek Mine has been historically low. Between 1850 and 1978, the largest seismic event to occur near the site was Magnitude 5.8 (Richter scale) at a hypocentral distance of approximately 26 miles west (Figure 2-1; Arabasz et al, 1979). According to worldwide earthquake data compiled by Seed (1982), this event corresponds to a peak horizontal acceleration in rock of about 0.07g, where g is gravitational acceleration. This peak horizontal acceleration will be used for the slope stability analyses.

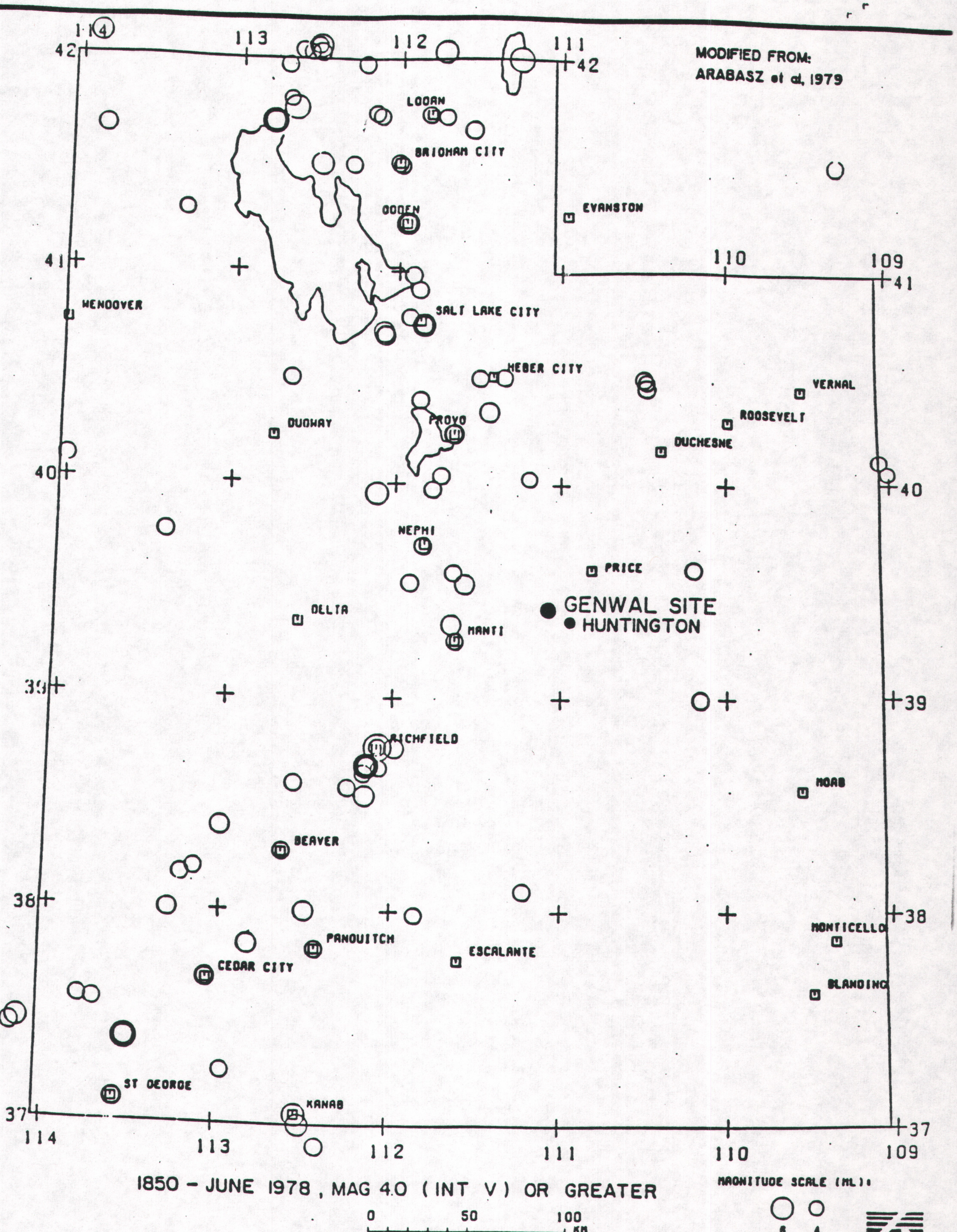

FIGURE 2-1. UTAH EARTHQUAKES OF MAGNITUDE 4.0 (RICHTER) OR GREATER - 1850 TO 1978.

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3.0 SOILS INFORMATION

3.1 General

Calcium carbonate from the parent rock has cemented the insitu alluvial and colluvial soils. This cementation, coupled with inherent slope stability provided by roots and capillarity (inter-particle moisture), enables steep slopes to form in Crandall Canyon. Depending on the relative influence of these factors and the localized geomorphic processes, the side slopes in Crandall Canyon range from the angle of repose at the ridge line to near vertical at locations along the creek. Upon saturation, apparent and bonded soil strength from capillarity and cementation decreases, leaving root structure and internal friction/cohesion to maintain the slope.

3.2 Subsurface Exploration

The site of the proposed storage pad extension was investigated by hand excavating five shallow test pits on September 20, 1990 at locations identified as BS-1 through BS-3, FS-1, and SS-1 in Figure 1-2. Bulk grab samples were collected from each location and submitted for physical analyses.

Samples BS-1 through BS-3 were collected from the existing surface storage pad. This storage pad is constructed of native fill material (silts through cobbles) underlying imported road base (silty gravelly sand). These soils are very hard due to repeated loading with truck traffic and to annual applications of magnesium chloride. Concrete was encountered at a depth of 4 inches at BS-1, thereby precluding deeper excavation. BS-2 and BS-3 were both excavated to a depth of about 18 inches. Based on these two pits, the base course material extends to a depth of approximately 8 inches. According to telephone conversations with Genwal, this thickness is typical for the haul road.

The sample from BS-1 consists of road base. Samples from BS-2 and BS-3 are composite samples of road base and native fill material.

Sample FS-1 was collected from the fill slope of the surface storage pad. This material is uncompacted silty gravelly sand and appears to be a composite of road base and native fill material.

Sample SS-1 was collected from native soil along the north bank of Crandall Creek. This material is a silty gravelly sand with calcium carbonate cementation.

3.3 Laboratory Analyses

Soil samples collected during the field investigation were submitted to Garco Testing Laboratory in Salt Lake City, Utah for physical analyses. Laboratory tests were performed in accordance with methods prescribed by the American Society of Testing and Materials.

Modified Proctor compaction tests were conducted on one composite sample from pits BS-1 through BS-3. Atterberg Limits and mechanical gradation tests were conducted on samples from SS-1 and a composite of BS-1 through BS-3. Garco submitted samples from SS-1 and FS-1 to Dames & Moore in Salt Lake City, Utah for unconsolidated, undrained direct shear tests to evaluate soil strength parameters. These laboratory results are presented in Appendix A.

Three California Bearing Ratio (CBR) tests were conducted on samples from BS-1 through BS-3 compacted to 95% of the modified Proctor dry density. These test results are presented in a haul road design report by EarthFax (1990).

3.4 Soil Data

Laboratory test results of the site soils are summarized in Table 3-1. According to these data, the soils are nonplastic silty gravelly sands and silty

TABLE 3-1

Summary of Laboratory Test Results

Sample	Unified Soil Class[a]	Plastic Index	Percent Passing #4 sieve	Percent Passing #200 Sieve	Internal Friction and Cohesion (°/ksf)	Modified Proctor Density/ Moisture
BS-1	SM	Nonplastic Combined Sample	56.4 Combined Sample	19.9 Combined Sample		132.8pcf 6.9% Combined Sample
BS-2	GM					
BS-3	GM					
FS-1	SM				55/1.6[b]	
SS-1	SM	Nonplastic	71.0	19.8	46/0.7[c]	

(a) All samples are coarse-grained with greater than 12% passing a #200 sieve, thereby rendering an SM or GM classification. BS-1, FS-1, and SS-1 are silty gravelly sands. BS-2 and BS-3 are silty sandy gravels.

(b) Sample compacted to 123.5 pcf and tested under unsaturated and undrained conditions.

(c) Sample compacted to 110 pcf and tested under unsaturated and undrained conditions.

sandy gravels. Typically, 19.8% of the soil is fine-grained (passing a #200 sieve). Since the samples are nonplastic, the fine-grained fraction is probably silt rather than clay. The modified Proctor density of the base course material is 132.8 pounds per cubic foot (pcf) at an optimum moisture content of 6.9%.

The angle of internal friction as determined by the direct shear test is 46 degrees for sample SS-1 and 55 degrees for sample FS-1. The internal cohesion is 700 pounds per square foot (psf) for sample SS-1 and 1600 psf for sample FS-1. These values are unusually high and, in the case of sample FS-1, may indicate that gravel-sized particles had a significant effect on the limited testing surface of the direct shear device. The high strength values for sample SS-1 may explain the prolonged stability of the near-vertical stream cut downslope of the storage pad on the north bank of Crandall Creek. The strength parameters from sample SS-1 will be used to conduct the slope stability analyses.

4.0 SLOPE STABILITY ANALYSES

4.1 General

Soil slope stability analyses were performed with the computer program GEOSLOPE which is based on the FORTRAN program STABL3, developed at Purdue University. GEOSLOPE utilizes the limit equilibrium procedure of slices to determine the safety factor of potential failure surfaces for circular (Simplified Bishop's method) and noncircular shapes (Jambu's method). Potential failure surfaces at the site were assumed to be circular for this report.

4.2 Assumptions

The following assumptions were made for the slope stability analyses:

1. Results from the direct shear test on sample SS-1 are representative soil strength parameters for the native soil. Therefore, angle of internal friction is 46 degrees and the internal cohesion is 700 psf.

2. The soils drain rapidly and excess pore pressures do not develop in response to strains and stress changes. Consequently, the pore pressure parameter in the stability analysis is 0.

3. The maximum horizontal acceleration at the site is 0.07g.

4.3 Soil Property Parameters

As indicated in Section 3.1, the shear strength of <u>insitu</u> soil deposits at Genwal is provided by internal friction and cohesion, root/soil interaction, calcium carbonate cementation, and inter-particle capillarity. The latter two components disappear upon saturation. The shear strength of <u>disturbed</u> native soil deposits is developed through internal friction and cohesion, capillarity and, to lesser degrees, cementation and root/soil interaction. Internal friction, cohesion, and capillarity act on imported soils.

Data for shear strength components provided by cementation, capillarity, and vegetation are not available. These strengths can be estimated, however, by conducting slope stability analyses on the existing slope and assuming a minimum safety factor under dry, static (no earthquake loading) conditions. In the interest of conservatism, however, these shear strength components will be neglected and the stability will be evaluated using only internal friction and cohesion.

4.4 Slope Stability Analysis

A cross-section of the Crandall Canyon and storage pad slope is presented in Figure 4-1. This cross-section was developed by surveying the slope using a hand-held eye level and a measuring tape. The proposed storage pad extension is also shown in Figure 4-1. Boulders will be placed at the toe of the extension slope to act as a makeshift retaining wall, thereby enabling additional fill soil to be placed.

The proposed slope in Figure 4-1 is stable with a critical safety factor of 1.58 under static conditions and 1.45 under dynamic conditions using a horizontal acceleration of 0.07g. Results of the stability analyses are presented in Appendix C. As a worst-case condition, the debris slope at the base of the near-vertical stream cut was not included in the analyses since Crandall Creek may wash this debris away during a period of peak flow.

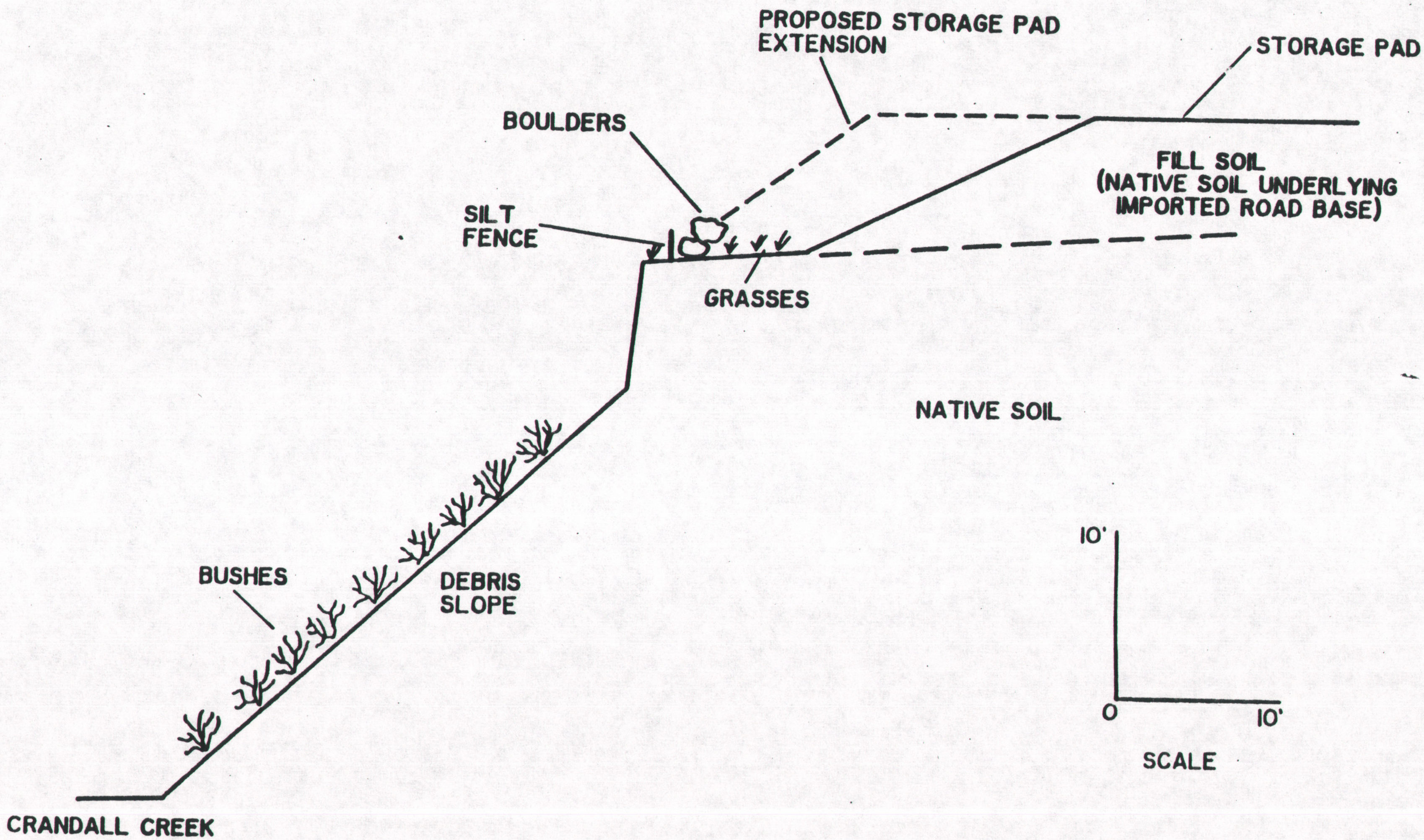

FIGURE 4-1. STORAGE PAD CROSS-SECTION.

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5.0 CONCLUSIONS AND RECOMMENDATIONS

This report represents an expression of opinions and recommendations based on field observations, laboratory analyses, and professional judgement. It is recommended that a geotechnical or geological engineer be on site during construction of the storage pad extension to allow adequate field decisions to be made regarding local conditions.

Slope stability analyses were conducted using an angle of internal friction of 46 degrees and an internal cohesion of 700 psf. In the interest of conservatism, shear strengths imparted through root/soil interaction, calcium carbonate cementation, and inter-particle capillarity were neglected. In addition, as a worst-case condition, the debris slope at the base of the near-vertical stream cut was not included in the analyses since Crandall Creek may wash this debris away during a period of peak flow. The proposed slope in Figure 4-1 is stable with a critical safety factor of 1.58 under static conditions and 1.45 under dynamic conditions using a horizontal acceleration of 0.07g.

6.0 REFERENCES

Arabasz, W. J., R. B. Smith, and W. D. Richins (Ed.). 1979. Earthquake Studies in Utah 1850 to 1978. University of Utah Seismograph Stations, Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah.

Davis and Doelling. 1977. Coal Drilling at Trail Mountain, North Horn Mountain, and Johns Peak Areas, Wasatch Plateau. Utah Geological and Mineral Survey Bulletin 112. Salt Lake City, Utah.

EarthFax Engineering, Inc. 1990. Flexible Pavement Design for the Haul Road at the Crandall Canyon Mine, Emery County, Utah. Project Report Prepared for Genwal Coal Company, Huntington, Utah.

Seed, H. B., and I. M. Idriss. 1982. Ground Motions and Soil Liquefaction during Earthquakes. Earthquake Engineering Research Institute, Berkeley, California.

APPENDIX A

Soils Laboratory Test Results

NVLAP
Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So. Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

October 15, 1990

Earth Fax Engineering
Attn: Rhett Brooks
7324 S. 1300 E., Ste 100
Midvale, Utah 84047

Subject: Physical Properties on samples submitted from the Genwall project.

Direct Shear Unconsolidated - Undrained
Lab #33098 - I.D.: FS-1

Soil I.D.:	SM	Maximum Dry Density =	132.8
% Compaction:	93%	Optimum Moisture =	6.9%

Fee Angle = 55 deg
Cohesion = 1600 psf

Lab #33099 - I.D.: SS-1 REMOLDED TO 110 pcf

Soil I.D.:	SM	~~Maximum Dry Density =~~	~~132.8~~
~~% Compaction:~~	~~93%~~	~~Optimum Moisture =~~	~~6.9%~~

Fee Angle = 46 deg
Cohesion = 700 psf

Atterberg Limit
Lab #33101 SAMPLE SS-1

Non Plastic

ASTM D-1883 California Bearing Ratio
Lab #33092 - I.D.: BS-1

Maximum Density =	132.8	Surcharge =	50 psf
Optimum Moisture =	6.9%	% Swell =	0
% Compaction =	94.8%		

Bearing Values

Penetration	PSI	% of Standard
.100	485	48
.200	866	58
.300	1117	59
.400	1342	58
.500	1564	60

Lab #33093 - I.D.: BS-2

Maximum Density	=	132.8	Surcharge	=	50 psf
Optimum Moisture	=	6.9%	% Swell	=	0.53%
% Compaction	=	95.4%			

Bearing Values

Penetration	PSI	% of Standard
.100	216	21
.200	291	19
.300	365	19
.400	451	19
.500	539	20

Lab #33092 - I.D.: BS-3

Maximum Density	=	132.8	Surcharge	=	50 psf
Optimum Moisture	=	6.9%	% Swell	=	0
% Compaction	=	95.4%			

Bearing Values

Penetration	PSI	% of Standard
.100	171	17
.200	316	21
.300	420	22
.400	529	23
.500	656	25

Atterberg Limit
Lab #33096 - I.D.: Combined material BS-1, BS-2, BS-3

Non Plastic

ASTM D-1557-D Proctor
Lab #33095 - I.D.: Combined material BS-1, BS-2, BS-3

Maximum Density = 132.8 pcf
Optimum Moisture = 6.9%

Sincerely,

D. Watson

Doug Watson
General Manager

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So. Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

91 9/28/90

RTH FAX ENGINEERING, INC.
24 SOUTH 1300 EAST, STE 100
DVALE, UTAH 84047
TN: RANDOLPH GAINER

LAB NO.: 33100
MATERIAL: SS-1
PIT/PLANT:

PROJECT: QUALITY CONTROL
ENTIFICATION:
PECIFICATION:

TEST DATE: 9/25/90
SAMPLE BY: CUST RUN BY: KRIS

REMARKS: #33101:ATTERBERG LIMIT-NON PLASTIC

USA SIEVE NUMBER	GRAMS RETAINED	% RETAINED	ACCUM. % RETAINED	% PASSING	SPECIFICATION % PASSING
2.5"	320.0	16.4	16.4	83.6	
1.5"	0		16.4	83.6	
1"	79.0	4.0	20.4	79.6	
3/4"	17.8	.9	21.3	78.7	
1/2"	48.8	2.5	23.8	76.2	SILTY GRAVELLY SAN
3/8"	34.4	1.8	25.6	74.4	SM
\	66.1	3.4	29.0	71.0	
#8	49.0	2.5	31.5	68.5	
#16	40.2	2.1	33.6	66.4	
#30	51.3	2.6	36.2	63.8	
#50	239.2	12.2	48.4	51.6	
#100	422.0	21.6	70.0	30.0	
#200	200.3	10.2	X 80.2	19.8	

RIGINAL WT. 1955.5
ASHED WT. 1595.4
#200 W.O. 360.1
#200 S.O. 26.5
OTAL -#200 386.6 = 19.8%

F.M. 3.72
DESIGN F.M.

SINCERELY
D. Watson
MANAGER

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So. Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

9/28/90

091
ARTH FAX ENGINEERING, INC.
324 SOUTH 1300 EAST, STE 100
IDVALE, UTAH 84047
TTN: RANDOLPH GAINER

LAB NO.: 33097
MATERIAL: COMBINED MATERIAL
PIT/PLANT: FROM BS-1, BS-2, AND BS-3

PROJECT: QUALITY CONTROL
DENTIFICATION: COMB BS-1,BS-2,BS-3
SPECIFICATION:

TEST DATE: 9/25/90
SAMPLE BY: CUST RUN BY: KRIS

REMARKS: #33096:ATTERBERG LIMIT-NON PLASTIC

USA SIEVE NUMBER	GRAMS RETAINED	% RETAINED	ACCUM. % RETAINED	% PASSING	SPECIFICATION % PASSING
2"	292.1	9.4	9.4	90.6	
1.5"	274.2	8.8	18.2	81.8	
1"	42.5	1.4	19.6	80.4	
3/4"	50.0	1.6	21.2	78.8	
1/2"	241.5	7.8	29.0	71.0	
3/8"	135.6	4.4	33.4	66.6	
4	316.6	10.2	43.6	56.4	SILTY SANDY GRAVE
#8	220.6	7.1	50.7	49.3	GM
#16	137.8	4.4	55.1	44.9	
#30	92.4	3.0	58.1	41.9	
#50	124.6	4.0	62.1	37.9	
#100	330.9	10.6	72.7	27.3	
#200	230.5	7.4	X 80.1	19.9	

ORIGINAL WT. 3113.7
WASHED WT. 2529.2
-#200 W.O. 584.5
-#200 S.O. 39.0
TOTAL -#200 623.5 = 20.0%

F.M. 4.73
DESIGN F.M.

SINCERELY,
D. Watson
MANAGER

GARCO TESTING LABORATORIES

5826 South 1900 West
Roy, Utah 84067

532 West 3560 South
Salt Lake City, Utah 84115

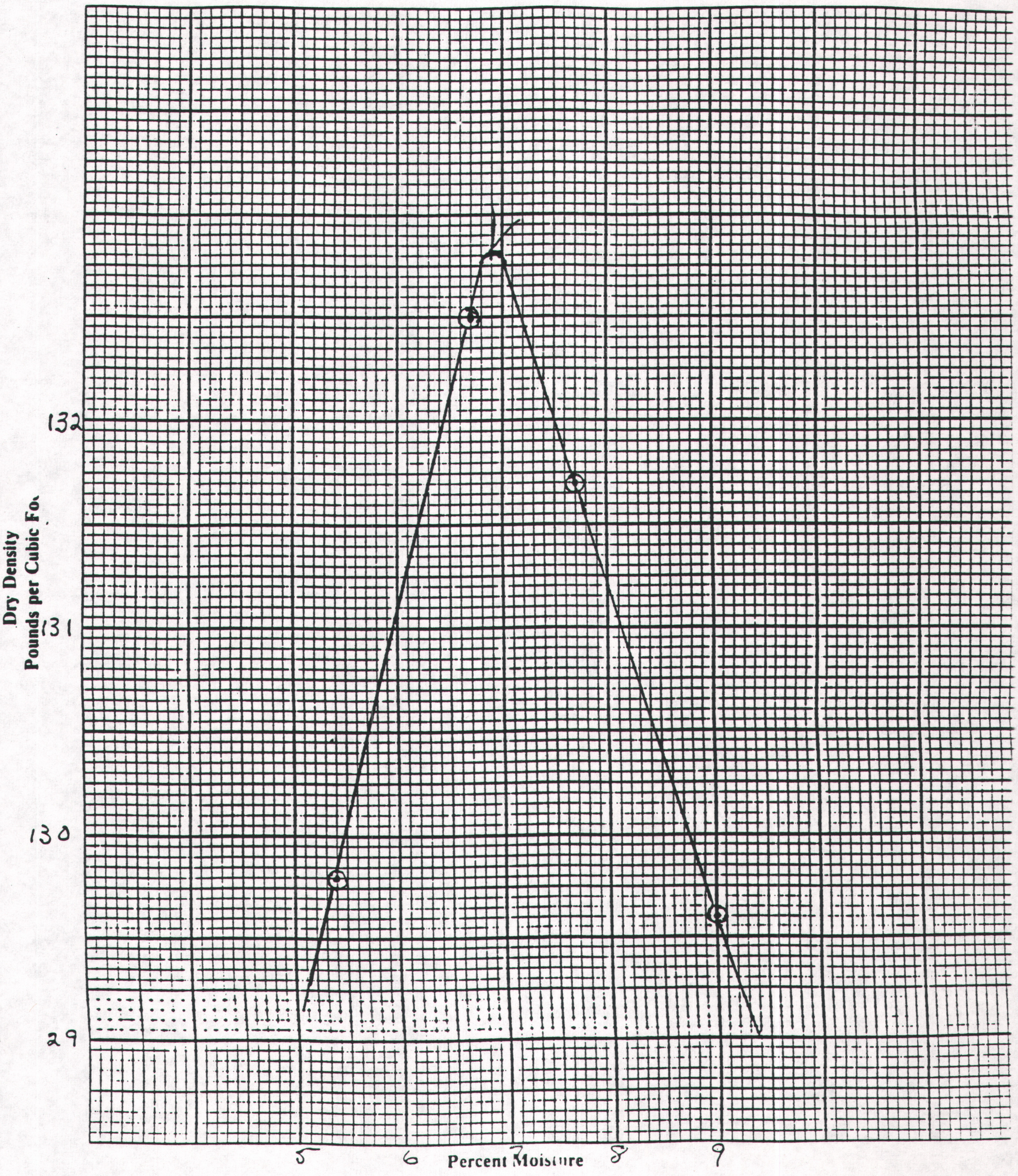
5071 S. Arville
Las Vegas, Nevada 89118

MOISTURE DENSITY CURVE ASTM C-698, D-1557

Job # 33095 Material Source comb. BS-1, BS-2, BS-3

Customer Earth Fax Project Genwal Date 9-26-90

Test Method T-180-D Max. Compaction 132.8 Opt. Moist. 6.9



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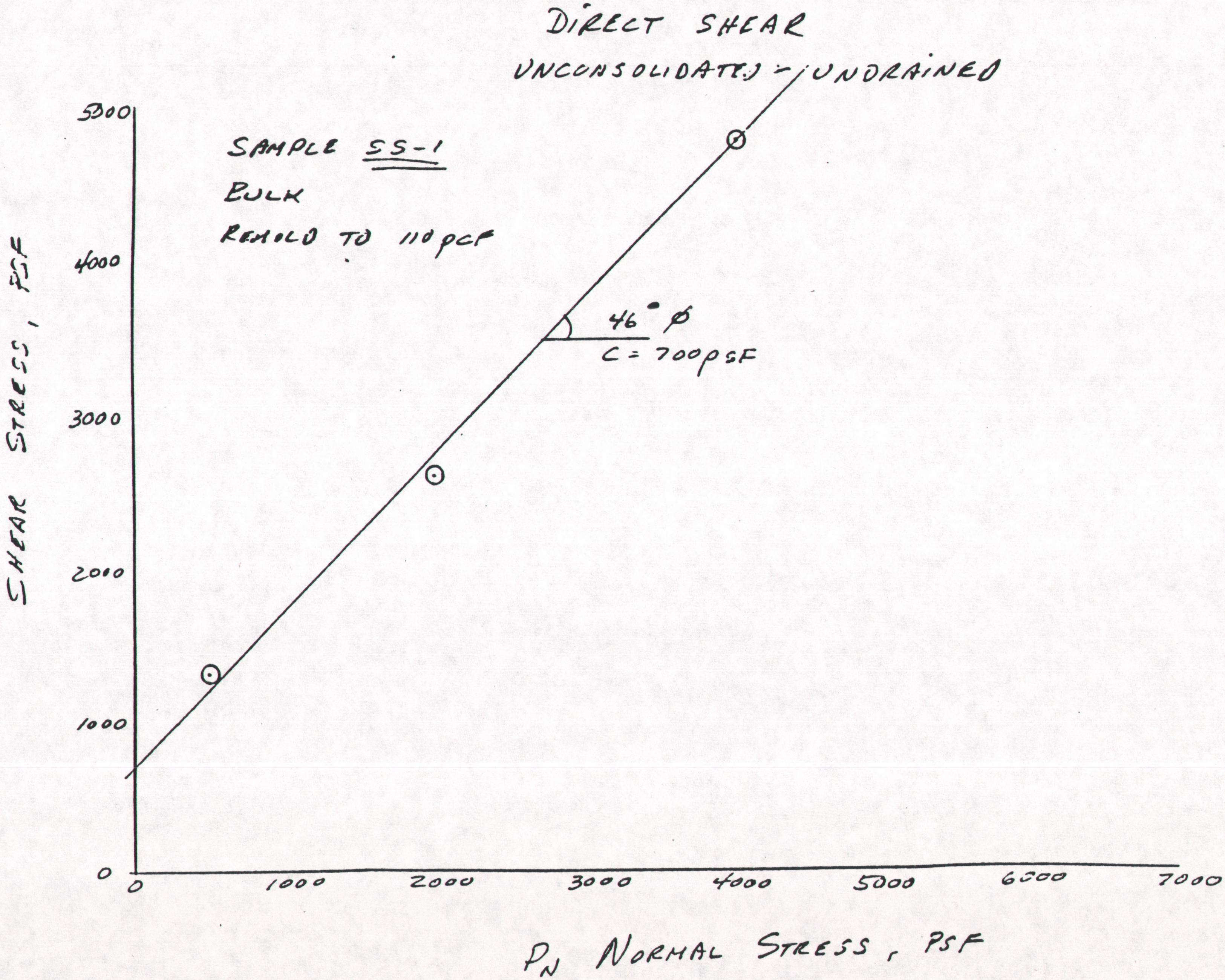

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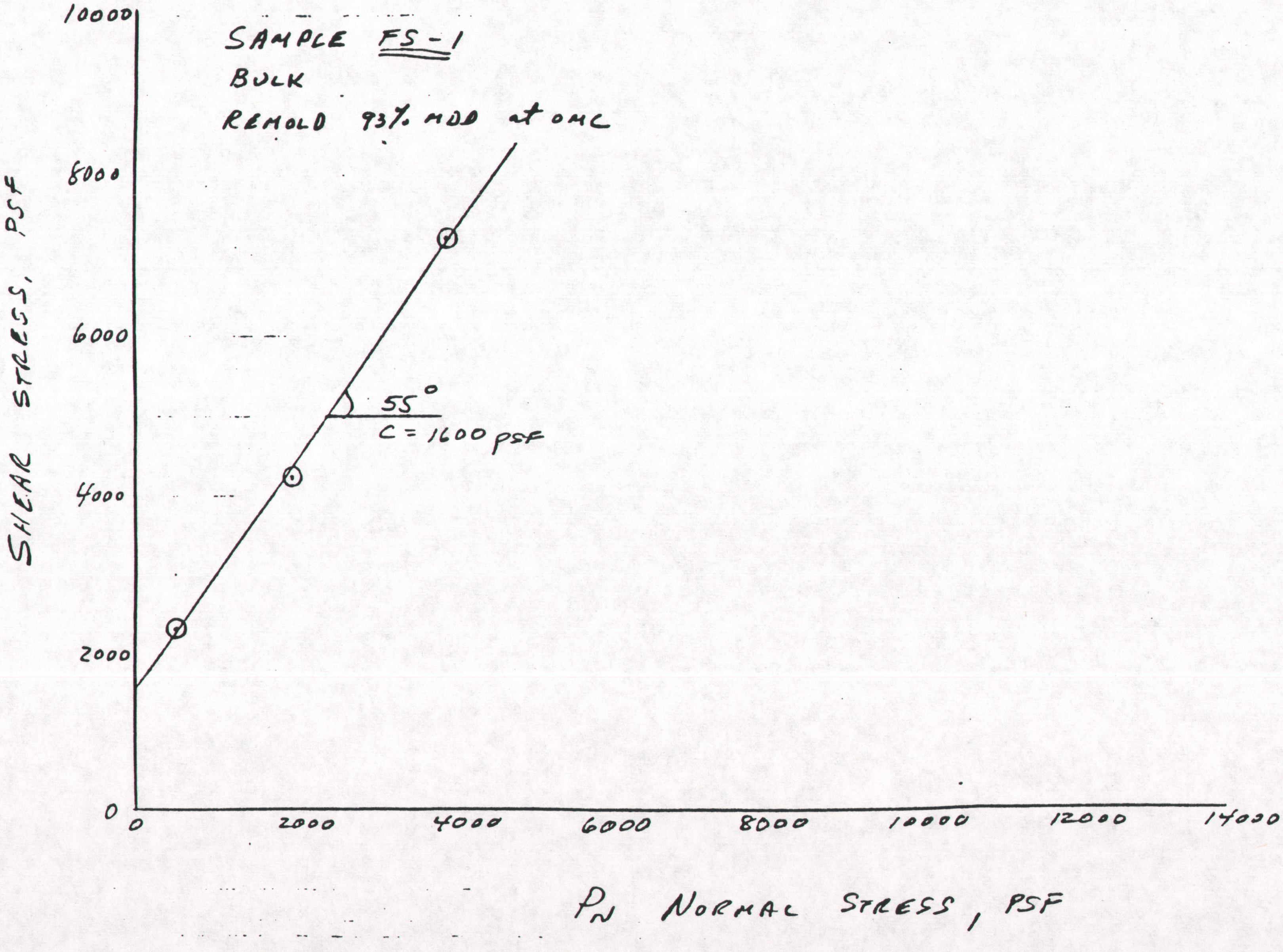

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APPENDIX B

Slope Stability Analysis Under Static Conditions - Computer Output

```
PROFIL
GENWAL - Proposed storage pad expansion with debris slope at base of slope
scoured
6
6
0.0 100.0 25.0 100.0 1
25.0 100.0 50.0 102.0 1
50.0 102.0 53.3 131.7 1
53.3 131.7 55.0 131.8 1
55.0 131.8 67.0 140.4 1
67.0 140.4 150.0 140.4 1
SOIL
1
120.0 130.0 700.0 46.0 0.0 0.0 1
CIRCL2
11
10
50.0 52.0
55.0 90.0
0.0
3.0
80.0
5.0
```

GEOSLOPE
Version 3.11

Supplied by GEOCOMP Corp.
342 Sudbury Rd., Concord, MA. 01742
(617) 369-8304

GEOSLOPE is based on the program, STABL3, developed at Purdue University under sponsorship of the Federal Highway Administration.

GEOCOMP Corp. has modified the program to run on various microcomputers and plotting devices.

GEOCOMP Corp. makes no warranties as to the fitness of this software. The user bears all responsibility for accuracy and correctness of results produced by this software. See the users manual for further warranty information.

Supplied under exclusive license to :
EARTH FAX
Midvale, UT (s/n 5080)

1
EARTH FAX
Midvale, UT (s/n 5080)

—SLOPE STABILITY ANALYSIS—
SIMPLIFIED JANBU METHOD OF SLICES
IRREGULAR FAILURE SURFACES

PROBLEM DESCRIPTION GENWAL - Proposed storage pad expansion with debris slope at base of slope scour

BOUNDARY COORDINATES

6 TOP BOUNDARIES
6 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT	Y-LEFT	X-RIGHT	Y-RIGHT	SOIL TYPE BELOW BND
1	.00	100.00	25.00	100.00	1
2	25.00	100.00	50.00	102.00	1
3	50.00	102.00	53.30	131.70	1
4	53.30	131.70	55.00	131.80	1
5	55.00	131.80	67.00	140.40	1
6	67.00	140.40	150.00	140.40	1

ISOTROPIC SOIL PARAMETERS

1 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT.	SATURATED UNIT WT.	COHESION INTERCEPT	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT	PIEZOMETRIC SURFACE NO.
1	120.0	130.0	700.0	46.0	.00	.0	1

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED.

110 TRIAL SURFACES HAVE BEEN GENERATED.

10 SURFACES INITIATE FROM EACH OF 11 POINTS EQUALLY SPACED ALONG THE GROUND SURFACE BETWEEN X = 50.00
AND X = 52.00

EACH SURFACE TERMINATES BETWEEN X = 55.00
AND X = 90.00

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION AT WHICH A SURFACE EXTENDS IS Y = .00

3.00 FT. LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

RESTRICTIONS HAVE BEEN IMPOSED UPON THE ANGLE OF INITIATION.
THE ANGLE HAS BEEN RESTRICTED BETWEEN THE ANGLES OF 5.0 AND 80.0 DEG.

FACTOR OF SAFETY CALCULATION HAS GONE THROUGH TEN ITERATIONS

FACTOR OF SAFETY FOR THE PRECEDING SPECIFIED SURFACE = 2.320

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL FIRST.

SAFETY FACTORS ARE CALCULATED BY THE MODIFIED BISHOP METHOD.

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 1 SPECIFIED BY 17 COORDINATE POINTS

SAFETY FACTOR = 1.583

X-CENTER = -226.27
Y-CENTER = 318.27
RADIUS = 350.85

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.00	102.00	52.19
2	51.84	104.37	52.68
3	53.66	106.76	53.17
4	55.46	109.16	53.66
5	57.23	111.58	54.15
6	58.99	114.01	54.64
7	60.73	116.46	55.13
8	62.44	118.92	55.62
9	64.14	121.39	56.11
10	65.81	123.88	56.60
11	67.46	126.39	57.09
12	69.09	128.91	57.58
13	70.70	131.44	58.07
14	72.29	133.99	58.56
15	73.85	136.55	59.05
16	75.39	139.12	59.54
17	76.15	140.40	

SLICE NO.	X	DX	DW	DQ	DU	DN	DSr
1	50.92	1.84	1564.91	.00	.00	457.11	741.43
2	52.57	1.46	3469.14	.00	.00	2327.11	1965.03
3	53.48	.36	1083.11	.00	.00	776.80	950.61
4	54.33	1.34	3880.66	.00	.00	2749.57	2241.46
5	55.23	.46	1266.32	.00	.00	887.29	1022.91
6	56.35	1.78	4777.27	.00	.00	3312.08	2609.54

7	58.11	1.76	4477.53	.00	.00	3048.24	2436.90
8	59.86	1.74	4176.98	.00	.00	2782.24	2262.84
9	61.59	1.72	3875.97	.00	.00	2514.29	2087.51
10	63.29	1.69	3574.77	.00	.00	2244.58	1911.04
11	64.97	1.67	3273.69	.00	.00	1973.31	1733.53
12	66.40	1.19	2169.54	.00	.00	1250.00	1260.24
13	67.23	.46	794.36	.00	.00	442.35	731.77
14	68.28	1.63	2494.25	.00	.00	1263.20	1268.88
15	69.90	1.61	1973.77	.00	.00	784.25	955.48
16	71.49	1.59	1463.65	.00	.00	311.26	645.99
17	73.07	1.56	964.15	.00	.00	-155.57	340.53
18	74.62	1.54	475.51	.00	.00	-616.02	39.24
19	75.77	.75	57.98	.00	.00	-475.27	131.33

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 2 SPECIFIED BY 16 COORDINATE POINTS

SAFETY FACTOR = 1.584

X-CENTER = -13.14
Y-CENTER = 167.20
RADIUS = 89.61

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.20	103.80	45.93
2	52.29	105.96	47.85
3	54.30	108.18	49.77
4	56.24	110.47	51.69
5	58.10	112.83	53.60
6	59.88	115.24	55.52
7	61.58	117.72	57.44
8	63.19	120.24	59.36
9	64.72	122.83	61.28
10	66.16	125.46	63.20
11	67.51	128.13	65.11
12	68.78	130.86	67.03
13	69.95	133.62	68.95
14	71.02	136.42	70.87
15	72.01	139.25	72.79
16	72.36	140.40	

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 3 SPECIFIED BY 16 COORDINATE POINTS

SAFETY FACTOR = 1.592
X-CENTER = -92.96
Y-CENTER = 199.06
RADIUS = 172.79

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.00	102.00	56.32
2	51.66	104.50	57.32
3	53.28	107.03	58.31
4	54.86	109.58	59.31
5	56.39	112.16	60.30
6	57.88	114.76	61.30
7	59.32	117.40	62.29
8	60.71	120.05	63.29
9	62.06	122.73	64.28
10	63.36	125.43	65.28
11	64.62	128.16	66.27
12	65.83	130.91	67.27
13	66.98	133.67	68.26
14	68.10	136.46	69.26
15	69.16	139.26	70.25
16	69.57	140.40	

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 4 SPECIFIED BY 15 COORDINATE POINTS

SAFETY FACTOR - 1.639

X-CENTER - 2.42
Y-CENTER - 157.34
RADIUS - 70.56

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.40	105.60	44.06
2	52.56	107.69	46.50
3	54.62	109.87	48.93
4	56.59	112.13	51.37
5	58.46	114.47	53.81
6	60.24	116.89	56.24
7	61.90	119.39	58.68
8	63.46	121.95	61.12
9	64.91	124.58	63.55
10	66.25	127.26	65.99
11	67.47	130.00	68.42
12	68.57	132.79	70.86
13	69.56	135.63	73.30
14	70.42	138.50	75.73
15	70.90	140.40	

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 5 SPECIFIED BY 16 COORDINATE POINTS

SAFETY FACTOR = 1.694

X-CENTER = -1430.94
Y-CENTER = 1028.77
RADIUS = 1746.23

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.20	103.80	58.06
2	51.79	106.35	58.16
3	53.37	108.90	58.26
4	54.95	111.45	58.36
5	56.52	114.00	58.46
6	58.09	116.56	58.56
7	59.66	119.12	58.65
8	61.22	121.68	58.75
9	62.77	124.25	58.85
10	64.32	126.82	58.95
11	65.87	129.39	59.05
12	67.41	131.96	59.15
13	68.95	134.53	59.24
14	70.49	137.11	59.34
15	72.02	139.69	59.44
16	72.44	140.40	

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 6 SPECIFIED BY 17 COORDINATE POINTS

SAFETY FACTOR = 1.703

X-CENTER = -68.42
Y-CENTER = 234.85
RADIUS = 176.76

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.20	103.80	42.64
2	52.41	105.84	43.61
3	54.58	107.91	44.58
4	56.72	110.01	45.55
5	58.82	112.15	46.53
6	60.88	114.33	47.50
7	62.91	116.54	48.47
8	64.90	118.79	49.44
9	66.85	121.07	50.42
10	68.76	123.38	51.39
11	70.63	125.72	52.36
12	72.46	128.10	53.33

13	74.25	130.51	54.31
14	76.00	132.94	55.28
15	77.71	135.41	56.25
16	79.38	137.90	57.22
17	80.99	140.40	

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 7 SPECIFIED BY 19 COORDINATE POINTS

SAFETY FACTOR = 1.704

X-CENTER = -648.15
Y-CENTER = 764.60
RADIUS = 962.53

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.00	102.00	46.59
2	52.06	104.18	46.76
3	54.12	106.37	46.94
4	56.17	108.56	47.12
5	58.21	110.76	47.30
6	60.24	112.96	47.48
7	62.27	115.18	47.66
8	64.29	117.39	47.84
9	66.30	119.62	48.01
10	68.31	121.85	48.19
11	70.31	124.08	48.37
12	72.30	126.33	48.55
13	74.29	128.57	48.73
14	76.27	130.83	48.91
15	78.24	133.09	49.09
16	80.20	135.36	49.26
17	82.16	137.63	49.44
18	84.11	139.91	49.62
19	84.53	140.40	

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 8 SPECIFIED BY 17 COORDINATE POINTS

SAFETY FACTOR = 1.758

X-CENTER = -126.92
Y-CENTER = 285.45
RADIUS = 252.56

FAILURE SURFACE #10 SPECIFIED BY 19 COORDINATE POINTS

SAFETY FACTOR = 1.850

X-CENTER = 20.10
Y-CENTER = 163.40
RADIUS = 68.29

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.00	102.00	27.22
2	52.67	103.38	29.74
3	55.27	104.86	32.26
4	57.81	106.47	34.77
5	60.27	108.18	37.29
6	62.66	109.99	39.81
7	64.97	111.92	42.33
8	67.18	113.94	44.84
9	69.31	116.05	47.36
10	71.34	118.26	49.88
11	73.28	120.55	52.39
12	75.11	122.93	54.91
13	76.83	125.38	57.43
14	78.45	127.91	59.95
15	79.95	130.51	62.46
16	81.34	133.17	64.98
17	82.60	135.89	67.50
18	83.75	138.66	70.02
19	84.39	140.40	

1

EARTH FAX
Midvale, UT (s/n 5080)

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.40	105.60	44.94
2	52.52	107.72	45.62
3	54.62	109.87	46.30
4	56.70	112.04	46.98
5	58.74	114.23	47.66
6	60.76	116.45	48.34
7	62.76	118.69	49.02
8	64.72	120.95	49.70
9	66.66	123.24	50.38
10	68.58	125.55	51.06
11	70.46	127.89	51.74
12	72.32	130.24	52.42
13	74.15	132.62	53.10
14	75.95	135.02	53.78
15	77.72	137.44	54.46
16	79.47	139.88	55.14
17	79.83	140.40	

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 9 SPECIFIED BY 13 COORDINATE POINTS

SAFETY FACTOR = 1.812

X-CENTER = -15.12
Y-CENTER = 156.97
RADIUS = 82.31

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.60	107.40	54.02
2	52.36	109.83	56.11
3	54.04	112.32	58.20
4	55.62	114.87	60.29
5	57.10	117.48	62.37
6	58.49	120.14	64.46
7	59.79	122.84	66.55
8	60.98	125.59	68.64
9	62.07	128.39	70.73
10	63.06	131.22	72.82
11	63.95	134.09	74.90
12	64.73	136.98	76.99
13	65.23	139.13	

1

EARTH FAX
Midvale, UT (s/n 5080)

```
             Y            A     X     I     S

                   100.00    118.75    137.50    156.25    175.00    193.75
X           .00 *---------+---------+---------+---------+---------+
                -
                -
                -
                -
                -
          18.75 +
                -
                *
                -
                -
                -
A         37.50 +
                -
                -
                -
                -*249...
                -.1214.9..... .  *
X         56.25 +..0.11599..... .*.
                - ..0.6121539.......
                - ...0..72123539 99..
                -  ...00.76121233 3 99*
                -   .....0..67112423.33
                -    .....00..668112522
I         75.00 +     ......0..76861 11
                -      .......00..7668.
                -         ......0.077.6
                -           .........77
                -              ........
                -                   ...
S         93.75 +
                -
                -
                -
                -
                -
         112.50 +
                -
                -
                -
                -
                -
         131.25 +
                -
                -
                -
                -
                -
         150.00 +                       *
```

APPENDIX C

Slope Stability Analysis Under Dynamic Conditions - Computer Output

```
PROFIL
GENWAL - Proposed storage pad expansion. Scoured debris slope. E.Q. = 0.07g
6
6
0.0 100.0 25.0 100.0 1
25.0 100.0 50.0 102.0 1
50.0 102.0 53.3 131.7 1
53.3 131.7 55.0 131.8 1
55.0 131.8 67.0 140.4 1
67.0 140.4 150.0 140.4 1
SOIL
1
120.0 130.0 700.0 46.0 0.0 0.0 1
EQUAKE
0.07
0.0
0.0
CIRCL2
11
10
50.0 52.0
55.0 90.0
0.0
3.0
80.0
5.0
```

GEOSLOPE
Version 3.11

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EARTH FAX
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EARTH FAX
Midvale, UT (s/n 5080)

—SLOPE STABILITY ANALYSIS—
SIMPLIFIED JANBU METHOD OF SLICES
IRREGULAR FAILURE SURFACES

PROBLEM DESCRIPTION GENWAL - Proposed storage pad expansion.
Scoured debris slope. E.Q. = 0.07g

BOUNDARY COORDINATES

6 TOP BOUNDARIES
6 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT	Y-LEFT	X-RIGHT	Y-RIGHT	SOIL TYPE BELOW BND
1	.00	100.00	25.00	100.00	1
2	25.00	100.00	50.00	102.00	1
3	50.00	102.00	53.30	131.70	1
4	53.30	131.70	55.00	131.80	1
5	55.00	131.80	67.00	140.40	1
6	67.00	140.40	150.00	140.40	1

ISOTROPIC SOIL PARAMETERS

1 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT.	SATURATED UNIT WT.	COHESION INTERCEPT	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT	PIEZOMETRIC SURFACE NO.
1	120.0	130.0	700.0	46.0	.00	.0	1

A HORIZONTAL EARTHQUAKE LOADING COEFFICIENT
OF .070 HAS BEEN ASSIGNED

A VERTICAL EARTHQUAKE LOADING COEFFICIENT
OF .000 HAS BEEN ASSIGNED

CAVITATION PRESSURE = .0

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED.

110 TRIAL SURFACES HAVE BEEN GENERATED.

10 SURFACES INITIATE FROM EACH OF 11 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 50.00
AND X = 52.00

EACH SURFACE TERMINATES BETWEEN X = 55.00
AND X = 90.00

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00

3.00 FT. LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

RESTRICTIONS HAVE BEEN IMPOSED UPON THE ANGLE OF INITIATION.
THE ANGLE HAS BEEN RESTRICTED BETWEEN THE ANGLES OF 5.0 AND 80.0 DEG.

FACTOR OF SAFETY CALCULATION HAS GONE THROUGH TEN ITERATIONS

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

SAFETY FACTORS ARE CALCULATED BY THE MODIFIED BISHOP METHOD.

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 1 SPECIFIED BY 17 COORDINATE POINTS

SAFETY FACTOR = 1.450

X-CENTER = -226.27
Y-CENTER = 318.27
RADIUS = 350.85

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.00	102.00	52.19
2	51.84	104.37	52.68
3	53.66	106.76	53.17
4	55.46	109.16	53.66
5	57.23	111.58	54.15
6	58.99	114.01	54.64
7	60.73	116.46	55.13
8	62.44	118.92	55.62
9	64.14	121.39	56.11
10	65.81	123.88	56.60
11	67.46	126.39	57.09
12	69.09	128.91	57.58
13	70.70	131.44	58.07
14	72.29	133.99	58.56
15	73.85	136.55	59.05
16	75.39	139.12	59.54
17	76.15	140.40	

SLICE NO.	X	DX	DW	DQ	DU	DN	DSr
1	50.92	1.84	1564.91	.00	.00	357.64	737.98
2	52.57	1.46	3469.14	.00	.00	2167.32	2030.05
3	53.48	.36	1083.11	.00	.00	729.28	1003.32
4	54.33	1.34	3880.66	.00	.00	2575.80	2321.69
5	55.23	.46	1266.32	.00	.00	830.12	1075.32
6	56.35	1.78	4777.27	.00	.00	3092.40	2690.53
7	58.11	1.76	4477.53	.00	.00	2837.50	2508.54
8	59.86	1.74	4176.98	.00	.00	2580.73	2325.21
9	61.59	1.72	3875.97	.00	.00	2322.28	2140.68
10	63.29	1.69	3574.77	.00	.00	2062.34	1955.10
11	64.97	1.67	3273.69	.00	.00	1801.11	1768.58
12	66.40	1.19	2169.54	.00	.00	1132.24	1291.02
13	67.23	.46	794.36	.00	.00	398.56	767.20
14	68.28	1.63	2494.25	.00	.00	1119.00	1281.57
15	69.90	1.61	1973.77	.00	.00	659.93	953.81
16	71.49	1.59	1463.65	.00	.00	206.93	630.37
17	73.07	1.56	964.15	.00	.00	-239.82	311.41
18	74.62	1.54	475.51	.00	.00	-680.12	-2.95
19	75.77	.75	57.98	.00	.00	-499.55	125.97

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 2 SPECIFIED BY 16 COORDINATE POINTS

SAFETY FACTOR = 1.470

X-CENTER = -13.14
Y-CENTER = 167.20
RADIUS = 89.61

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.20	103.80	45.93
2	52.29	105.96	47.85
3	54.30	108.18	49.77
4	56.24	110.47	51.69
5	58.10	112.83	53.60
6	59.88	115.24	55.52
7	61.58	117.72	57.44
8	63.19	120.24	59.36
9	64.72	122.83	61.28
10	66.16	125.46	63.20
11	67.51	128.13	65.11
12	68.78	130.86	67.03
13	69.95	133.62	68.95
14	71.02	136.42	70.87
15	72.01	139.25	72.79
16	72.36	140.40	

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EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 3 SPECIFIED BY 16 COORDINATE POINTS

SAFETY FACTOR = 1.483

X-CENTER = -92.96
Y-CENTER = 199.06
RADIUS = 172.79

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.00	102.00	56.32
2	51.66	104.50	57.32
3	53.28	107.03	58.31
4	54.86	109.58	59.31
5	56.39	112.16	60.30
6	57.88	114.76	61.30
7	59.32	117.40	62.29
8	60.71	120.05	63.29
9	62.06	122.73	64.28

10	63.36	125.43	65.28
11	64.62	128.16	66.27
12	65.83	130.91	67.27
13	66.98	133.67	68.26
14	68.10	136.46	69.26
15	69.16	139.26	70.25
16	69.57	140.40	

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 4 SPECIFIED BY 15 COORDINATE POINTS

SAFETY FACTOR = 1.520

X-CENTER = 2.42
Y-CENTER = 157.34
RADIUS = 70.56

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.40	105.60	44.06
2	52.56	107.69	46.50
3	54.62	109.87	48.93
4	56.59	112.13	51.37
5	58.46	114.47	53.81
6	60.24	116.89	56.24
7	61.90	119.39	58.68
8	63.46	121.95	61.12
9	64.91	124.58	63.55
10	66.25	127.26	65.99
11	67.47	130.00	68.42
12	68.57	132.79	70.86
13	69.56	135.63	73.30
14	70.42	138.50	75.73
15	70.90	140.40	

1

EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 5 SPECIFIED BY 19 COORDINATE POINTS

SAFETY FACTOR = 1.535

X-CENTER = -648.15
Y-CENTER = 764.60
RADIUS = 962.53

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.00	102.00	46.59
2	52.06	104.18	46.76

3	54.12	106.37	46.94
4	56.17	108.56	47.12
5	58.21	110.76	47.30
6	60.24	112.96	47.48
7	62.27	115.18	47.66
8	64.29	117.39	47.84
9	66.30	119.62	48.01
10	68.31	121.85	48.19
11	70.31	124.08	48.37
12	72.30	126.33	48.55
13	74.29	128.57	48.73
14	76.27	130.83	48.91
15	78.24	133.09	49.09
16	80.20	135.36	49.26
17	82.16	137.63	49.44
18	84.11	139.91	49.62
19	84.53	140.40	

1

FAILURE SURFACE # 6 SPECIFIED BY 17 COORDINATE POINTS

SAFETY FACTOR = 1.546

X-CENTER = -68.42
Y-CENTER = 234.85
RADIUS = 176.76

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.20	103.80	42.64
2	52.41	105.84	43.61
3	54.58	107.91	44.58
4	56.72	110.01	45.55
5	58.82	112.15	46.53
6	60.88	114.33	47.50
7	62.91	116.54	48.47
8	64.90	118.79	49.44
9	66.85	121.07	50.42
10	68.76	123.38	51.39
11	70.63	125.72	52.36
12	72.46	128.10	53.33
13	74.25	130.51	54.31
14	76.00	132.94	55.28
15	77.71	135.41	56.25
16	79.38	137.90	57.22
17	80.99	140.40	

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FAILURE SURFACE # 7 SPECIFIED BY 16 COORDINATE POINTS

SAFETY FACTOR = 1.555

X-CENTER = -1430.94
Y-CENTER = 1028.77
RADIUS = 1746.23

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.20	103.80	58.06
2	51.79	106.35	58.16
3	53.37	108.90	58.26
4	54.95	111.45	58.36
5	56.52	114.00	58.46
6	58.09	116.56	58.56
7	59.66	119.12	58.65
8	61.22	121.68	58.75
9	62.77	124.25	58.85
10	64.32	126.82	58.95
11	65.87	129.39	59.05
12	67.41	131.96	59.15
13	68.95	134.53	59.24
14	70.49	137.11	59.34
15	72.02	139.69	59.44
16	72.44	140.40	

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EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 8 SPECIFIED BY 17 COORDINATE POINTS

SAFETY FACTOR = 1.594

X-CENTER = -126.92
Y-CENTER = 285.45
RADIUS = 252.56

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.40	105.60	44.94
2	52.52	107.72	45.62
3	54.62	109.87	46.30
4	56.70	112.04	46.98
5	58.74	114.23	47.66
6	60.76	116.45	48.34
7	62.76	118.69	49.02
8	64.72	120.95	49.70
9	66.66	123.24	50.38
10	68.58	125.55	51.06
11	70.46	127.89	51.74
12	72.32	130.24	52.42

13	74.15	132.62	53.10
14	75.95	135.02	53.78
15	77.72	137.44	54.46
16	79.47	139.88	55.14
17	79.83	140.40	

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EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE # 9 SPECIFIED BY 19 COORDINATE POINTS

SAFETY FACTOR = 1.689

X-CENTER = 20.10
Y-CENTER = 163.40
RADIUS = 68.29

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.00	102.00	27.22
2	52.67	103.38	29.74
3	55.27	104.86	32.26
4	57.81	106.47	34.77
5	60.27	108.18	37.29
6	62.66	109.99	39.81
7	64.97	111.92	42.33
8	67.18	113.94	44.84
9	69.31	116.05	47.36
10	71.34	118.26	49.88
11	73.28	120.55	52.39
12	75.11	122.93	54.91
13	76.83	125.38	57.43
14	78.45	127.91	59.95
15	79.95	130.51	62.46
16	81.34	133.17	64.98
17	82.60	135.89	67.50
18	83.75	138.66	70.02
19	84.39	140,40	

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EARTH FAX
Midvale, UT (s/n 5080)

FAILURE SURFACE #10 SPECIFIED BY 15 COORDINATE POINTS

SAFETY FACTOR = 1.692

X-CENTER = -67.32
Y-CENTER = 225.16
RADIUS = 165.52

POINT NO.	X-SURF	Y-SURF	ALPHA (DEG)
1	50.80	109.20	46.05
2	52.88	111.36	47.09
3	54.93	113.56	48.13
4	56.93	115.80	49.16
5	58.89	118.07	50.20
6	60.81	120.37	51.24
7	62.69	122.71	52.28
8	64.52	125.08	53.32
9	66.32	127.49	54.36
10	68.06	129.93	55.39
11	69.77	132.40	56.43
12	71.43	134.90	57.47
13	73.04	137.42	58.51
14	74.61	139.98	59.55
15	74.85	140.40	

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EARTH FAX
Midvale, UT (s/n 5080)

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                    Y            A     X     I     S

                   100.00    118.75    137.50    156.25    175.00    193.75
          X        .00 *---------+---------+---------+---------+---------+
                       -
                       -
                       -
                       -
                       -
                 18.75 +
                       -
                       *
                       -
                       -
                       -
          A      37.50 +
                       -
                       -
                       -
                       -*24.0..
                       -.12140...... .  *
          X      56.25 +..9.1170...... .*.
                       - ..9.512173........
                       - ...9..5212373. ....
                       -  ...99.55121233 3 ..*
                       -   .....9..55112423.33
                       -    .....99..568112722
          I      75.00 +     ......9..55861 11
                       -      .......99..5668.
                       -         ......9.955.6
                       -           .........55
                       -               ........
                       -                    ...
          S      93.75 +
                       -
                       -
                       -
                       -
                       -
                112.50 +
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                       -
                       -
                       -
                       -
                131.25 +
                       -
                       -
                       -
                       -
                       -
                150.00 +                     *
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