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Elam Construction
556 Struthers Ave
Grand Junction, CO 81501

Electronically recieved GJFO DRMS
1/4/2019

Orchard Grove Industrial Pit - Mining and Reclamation Slope Stability Analysis 2

Elam Construction is mining and reclaiming a sand and gravel pit in Grand Junction, CO. The southeast slope of the planned pit is within 200' of structures owned by adjacent property owners. This slope stability analysis evaluated the proposed mining slope condition and the proposed reclamation slope condition. A diagram of the slopes analyzed, the failure circles, and the neighboring structures is attached as Figure 1. Also attached are the data logs from the GALENA Software used.

1. Slope Stability Analysis

The materials used in the analysis are sand and gravel, mixed grain size for the aggregate deposit, and loose sand, mixed grain size for the overburden. The material properties for these two materials are shown in the table below. They are from the SME Mining Reference Handbook (2002 edition)¹.

Table 1 – Material Properties

	Aggregate	Overburden
Description	sand and gravel, mixed grain size	loose sand, mixed grain size
Unit Weight (lbs/ft ³)	110	99
Friction angle (°)	45	34
Cohesion	0	0

1.1 Active Mining Slope

The current active mining slope varies from 1H:1V to vertical. An analysis of a vertical slope within 50 feet of the property line showed a failure circle with a minimum FOS < 1.5, which is the minimum required by DRMS for slopes near critical structures using general data inputs. Further analysis was conducted to determine the location of the failure slope at a FOS = 1.5. This failure circle can be seen on Fig. 1 – Slope Layout. It is 11' from the crest of the active mining slope, and at least 39' from the property line. Furthermore, this failure slope is >25' from the telephone/power poles. These poles have a minimum setback of 25' until the start of excavation. Based on the analysis of the vertical mining slope, there is no risk to structures as long as the

¹ Table 2.5; Originally from *Houk and Bray*, 1977

crest of a vertical mining highwall stays at least 41' from the property line :30' to cover the power pole and its setback; 11' to cover the distance from the failure circle to the highwall crest.

Note, this distance is based on the mining depth of roughly 18'. If the mining depth increases, the vertical highwall will have to maintain a further offset from the poles to protect structures and contain potential slope failure within the property.

1.2 Reclaimed Slope

The reclamation slope is proposed to be 3H:1V. It will be created by backfilling the mining slope with overburden and broken pieces of waste concrete. This mixture is similar in form to the source aggregate, being a mixture of sand and pieces of competent rock from the concrete. Therefore, the sand and gravel, mixed grain size material type is used to represent the backfill. The mining slope was evaluated using Bishop's Method of Slices in the GALENA software. The results showed that the lowest factor of safety that produced a slope failure circle was 2.7.

2. Conclusion

The failure slope with a FOS = 1.5 will be contained with the property during mining conditions, and assuming a vertical highwall. This is sufficient to satisfy DRMS requirements for slope stability. The permanent condition of 3H:1V slope will have an FOS = 2.7, which is also sufficient.

Ben Langenfeld, P.E.



CO License #0047151

Project: 23.25 Pit Slope Stability

File: E:\Work\Dropbox (GLA)\Elam\23.25 Pit\Slope Stability\23.25 Slope Stability.gmf

Processed: 21 Dec 2018 13:59:13

DATA: Analysis 1

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size

Cohesion Phi UnitWeight Ru

0.00 45.0 110.00 Auto

Material: 2 (Mohr-Coulomb Isotropic) - Loose sand, mixed grain size

Cohesion Phi UnitWeight Ru

0.00 34.0 99.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (2 profiles)

Profile: 1 (2 points) Material beneath: 2 - Loose sand, mixed grain size

0.00 15.00 500.00 15.00

Profile: 2 (2 points) Material beneath: 1 - Sand and gravel, mixed grain size

0.00 10.00 500.00 10.00

Slope Surface (4 points)

0.00 0.00 100.00 0.00 101.00 15.00 500.00 15.00

Phreatic Surface (2 points)

0.00 8.00 500.00 8.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 96.00 YL: 0.00 XR: 115.00 YR: 15.00

Centre: XC: 100.01 YC: 14.45 Radius: R: 15.00

Variable Restraints

Parameter descriptor: XL XR R

Range of variation: 8.00 16.00 0.00
Trial positions within range: 20 20 1

RESULTS: Analysis 1

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 2.053

There were: 214 successful analyses from a total of 401 trial surfaces
187 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 0.91

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	100.00	0.00	107.00	15.00	92.16	12.79	15.00	0.911	<-- Critical Surface
2	100.00	0.00	107.84	15.00	92.95	13.24	15.00	0.995	
3	100.00	0.00	108.68	15.00	93.75	13.63	15.00	1.082	
4	100.00	0.00	109.53	15.00	94.56	13.98	15.00	1.179	
5	100.00	0.00	110.37	15.00	95.39	14.27	15.00	1.284	
6	100.00	0.00	111.21	15.00	96.22	14.52	15.00	1.396	
7	92.00	0.00	111.21	15.00	96.22	14.39	15.00	1.441	
8	100.00	0.00	112.05	15.00	97.06	14.71	15.00	1.518	
9	93.68	0.00	112.05	15.00	97.06	14.62	15.00	1.538	
10	93.26	0.00	112.05	15.00	97.06	14.51	15.00	1.547	
11	92.84	0.00	112.05	15.00	97.06	14.39	15.00	1.559	
12	92.42	0.00	112.05	15.00	97.07	14.26	15.00	1.573	
13	92.00	0.00	112.05	15.00	97.08	14.11	15.00	1.588	
14	100.00	0.00	112.89	15.00	97.90	14.85	15.00	1.651	
15	95.37	0.00	112.89	15.00	97.90	14.79	15.00	1.658	
16	94.95	0.00	112.89	15.00	97.90	14.71	15.00	1.662	
17	94.53	0.00	112.89	15.00	97.90	14.62	15.00	1.669	
18	94.11	0.00	112.89	15.00	97.90	14.51	15.00	1.677	
19	93.68	0.00	112.89	15.00	97.91	14.39	15.00	1.686	
20	93.26	0.00	112.89	15.00	97.91	14.26	15.00	1.694	
21	92.84	0.00	112.89	15.00	97.92	14.11	15.00	1.707	
22	92.42	0.00	112.89	15.00	97.93	13.95	15.00	1.725	
23	92.00	0.00	112.89	15.00	97.95	13.77	15.00	1.747	
24	100.00	0.00	113.74	15.00	98.74	14.95	15.00	1.796	
25	96.63	0.00	113.74	15.00	98.74	14.85	15.00	1.798	
26	97.05	0.00	113.74	15.00	98.74	14.91	15.00	1.798	
27	96.21	0.00	113.74	15.00	98.74	14.79	15.00	1.801	
28	95.79	0.00	113.74	15.00	98.74	14.71	15.00	1.806	
29	95.37	0.00	113.74	15.00	98.74	14.62	15.00	1.810	
30	94.95	0.00	113.74	15.00	98.74	14.51	15.00	1.813	
31	94.53	0.00	113.74	15.00	98.75	14.39	15.00	1.822	

32	94.11	0.00	113.74	15.00	98.76	14.26	15.00	1.833
33	93.68	0.00	113.74	15.00	98.76	14.11	15.00	1.845
34	93.26	0.00	113.74	15.00	98.77	13.95	15.00	1.859
35	92.84	0.00	113.74	15.00	98.79	13.77	15.00	1.874
36	92.42	0.00	113.74	15.00	98.80	13.57	15.00	1.896
37	92.00	0.00	113.74	15.00	98.83	13.36	15.00	1.923
38	98.32	0.00	114.58	15.00	99.58	14.95	15.00	1.953
39	97.89	0.00	114.58	15.00	99.58	14.91	15.00	1.954
40	100.00	0.00	114.58	15.00	99.58	14.99	15.00	1.955
41	98.74	0.00	114.58	15.00	99.58	14.98	15.00	1.955
42	97.47	0.00	114.58	15.00	99.58	14.85	15.00	1.956
43	96.63	0.00	114.58	15.00	99.58	14.71	15.00	1.959
44	97.05	0.00	114.58	15.00	99.58	14.79	15.00	1.959
45	96.21	0.00	114.58	15.00	99.58	14.62	15.00	1.962
46	95.79	0.00	114.58	15.00	99.59	14.51	15.00	1.969
47	95.37	0.00	114.58	15.00	99.59	14.39	15.00	1.977
48	94.95	0.00	114.58	15.00	99.60	14.26	15.00	1.983
49	94.53	0.00	114.58	15.00	99.61	14.11	15.00	1.990
50	94.11	0.00	114.58	15.00	99.62	13.95	15.00	2.005
51	93.68	0.00	114.58	15.00	99.63	13.77	15.00	2.023
52	93.26	0.00	114.58	15.00	99.65	13.57	15.00	2.044
53	96.00	0.00	115.00	15.00	100.01	14.45	15.00	2.053
54	92.84	0.00	114.58	15.00	99.67	13.36	15.00	2.066
55	92.42	0.00	114.58	15.00	99.70	13.12	15.00	2.091
56	92.00	0.00	114.58	15.00	99.73	12.85	15.00	2.126
57	99.16	0.00	115.42	15.00	100.42	14.95	15.00	2.128
58	99.58	0.00	115.42	15.00	100.42	14.98	15.00	2.128
59	97.89	0.00	115.42	15.00	100.42	14.79	15.00	2.129
60	98.32	0.00	115.42	15.00	100.42	14.85	15.00	2.130
61	98.74	0.00	115.42	15.00	100.42	14.91	15.00	2.130
62	100.00	0.00	115.42	15.00	100.42	14.99	15.00	2.131
63	97.47	0.00	115.42	15.00	100.42	14.71	15.00	2.132
64	97.05	0.00	115.42	15.00	100.43	14.62	15.00	2.137
65	96.63	0.00	115.42	15.00	100.43	14.51	15.00	2.139
66	96.21	0.00	115.42	15.00	100.43	14.39	15.00	2.142
67	95.79	0.00	115.42	15.00	100.44	14.26	15.00	2.151
68	95.37	0.00	115.42	15.00	100.45	14.11	15.00	2.160
69	94.95	0.00	115.42	15.00	100.46	13.95	15.00	2.172
70	94.53	0.00	115.42	15.00	100.47	13.77	15.00	2.183
71	94.11	0.00	115.42	15.00	100.49	13.57	15.00	2.200
72	93.68	0.00	115.42	15.00	100.51	13.36	15.00	2.224
73	93.26	0.00	115.42	15.00	100.54	13.12	15.00	2.254
74	92.84	0.00	115.42	15.00	100.58	12.85	15.00	2.288
75	99.16	0.00	116.26	15.00	101.26	14.85	15.00	2.323
76	99.58	0.00	116.26	15.00	101.26	14.91	15.00	2.324
77	97.89	0.00	116.26	15.00	101.27	14.62	15.00	2.325
78	100.00	0.00	116.26	15.00	101.26	14.95	15.00	2.325
79	98.74	0.00	116.26	15.00	101.26	14.79	15.00	2.325
80	98.32	0.00	116.26	15.00	101.27	14.71	15.00	2.326
81	92.42	0.00	115.42	15.00	100.62	12.56	15.00	2.328
82	97.47	0.00	116.26	15.00	101.27	14.51	15.00	2.329
83	97.05	0.00	116.26	15.00	101.28	14.39	15.00	2.335
84	96.63	0.00	116.26	15.00	101.28	14.26	15.00	2.341

85	96.21	0.00	116.26	15.00	101.29	14.11	15.00	2.343
86	95.79	0.00	116.26	15.00	101.30	13.95	15.00	2.354
87	95.37	0.00	116.26	15.00	101.31	13.77	15.00	2.371
88	92.00	0.00	115.42	15.00	100.68	12.23	15.00	2.372
89	94.95	0.00	116.26	15.00	101.33	13.57	15.00	2.388
90	94.53	0.00	116.26	15.00	101.35	13.36	15.00	2.406
91	94.11	0.00	116.26	15.00	101.38	13.12	15.00	2.428
92	93.68	0.00	116.26	15.00	101.42	12.85	15.00	2.460
93	93.26	0.00	116.26	15.00	101.46	12.56	15.00	2.506
94	99.16	0.00	117.11	15.00	102.11	14.71	15.00	2.542
95	99.58	0.00	117.11	15.00	102.11	14.79	15.00	2.544
96	98.74	0.00	117.11	15.00	102.11	14.62	15.00	2.545
97	100.00	0.00	117.11	15.00	102.11	14.85	15.00	2.546
98	97.89	0.00	117.11	15.00	102.12	14.39	15.00	2.546
99	98.32	0.00	117.11	15.00	102.11	14.51	15.00	2.547

Critical Failure Surface (circle 1)

Intersects: XL: 100.00 YL: 0.00 XR: 107.00 YR: 15.00
Centre: XC: 92.16 YC: 12.79 Radius: R: 15.00

Generated failure surface: (20 points)

100.00	0.00	100.77	0.51	101.51	1.06	102.21	1.66	102.88	2.29
103.50	2.97	104.09	3.69	104.62	4.44	105.11	5.22	105.55	6.03
105.95	6.87	106.28	7.73	106.57	8.60	106.80	9.50	106.97	10.40
107.09	11.32	107.15	12.24	107.16	13.16	107.11	14.08	107.00	15.00

Slice Geometry and Properties - Critical Failure Surface (circle 1, 40 slices)

Slice	X-S	Base							PoreWater		Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	100.00	0.23	33.3	0.18	0.21	1	0.00	45.0	24.93	105.36	530.85	0.70
2	100.18	0.68	33.3	0.18	0.21	1	0.00	45.0	74.80	103.81	594.14	0.70
3	100.36	1.13	33.3	0.18	0.21	1	0.00	45.0	124.67	102.26	657.43	0.70
4	100.53	1.15	33.3	0.13	0.16	1	0.00	45.0	126.23	75.68	749.08	0.70
5	100.67	1.08	33.3	0.10	0.13	1	0.00	45.0	118.16	58.95	851.29	0.70
6	100.77	2.90	36.8	0.23	0.29	1	0.00	45.0	310.71	131.84	955.48	0.69
7	101.00	2.43	36.8	0.17	0.21	1	0.00	45.0	257.61	96.27	1035.42	0.69
8	101.17	2.41	36.8	0.17	0.21	1	0.00	45.0	255.23	94.58	1024.15	0.69
9	101.34	2.38	36.8	0.17	0.21	1	0.00	45.0	252.85	92.89	1012.89	0.69
10	101.51	3.25	40.3	0.23	0.31	1	0.00	45.0	344.23	131.32	965.74	0.68
11	101.75	3.20	40.3	0.23	0.31	1	0.00	45.0	339.09	127.49	948.42	0.68
12	101.98	3.15	40.3	0.23	0.31	1	0.00	45.0	333.96	123.68	931.10	0.68
13	102.21	2.94	43.8	0.22	0.31	1	0.00	45.0	310.88	119.72	881.87	0.67
14	102.44	2.89	43.8	0.22	0.31	1	0.00	45.0	305.68	115.64	863.64	0.67
15	102.66	2.84	43.8	0.22	0.31	1	0.00	45.0	300.48	111.55	845.41	0.67
16	102.88	2.62	47.4	0.21	0.31	1	0.00	45.0	277.15	107.33	796.52	0.67
17	103.09	2.58	47.4	0.21	0.31	1	0.00	45.0	271.96	102.99	777.49	0.67
18	103.30	2.53	47.4	0.21	0.31	1	0.00	45.0	266.78	98.65	758.46	0.67
19	103.50	2.31	50.9	0.19	0.31	1	0.00	45.0	243.49	94.19	709.82	0.67
20	103.70	2.26	50.9	0.19	0.31	1	0.00	45.0	238.41	89.61	690.10	0.67
21	103.89	2.22	50.9	0.19	0.31	1	0.00	45.0	233.31	85.03	670.38	0.67
22	104.09	2.00	54.4	0.18	0.31	1	0.00	45.0	210.41	80.34	621.96	0.68
23	104.27	1.96	54.4	0.18	0.31	1	0.00	45.0	205.50	75.54	601.65	0.68

24	104.45	1.91	54.4	0.18	0.31	1	0.00	45.0	200.56	70.74	581.35	0.68
25	104.62	1.70	57.9	0.16	0.31	1	0.00	45.0	178.37	65.83	533.11	0.68
26	104.79	1.66	57.9	0.16	0.31	1	0.00	45.0	173.69	60.83	512.34	0.68
27	104.95	1.62	57.9	0.16	0.31	1	0.00	45.0	169.00	55.83	491.56	0.68
28	105.11	2.11	61.5	0.22	0.46	1	0.00	45.0	220.07	74.16	438.20	0.69
29	105.33	2.02	61.5	0.22	0.46	1	0.00	45.0	210.25	62.49	406.52	0.69
30	105.55	1.71	65.0	0.20	0.46	1	0.00	45.0	177.25	50.64	347.97	0.71
31	105.75	1.63	65.0	0.20	0.46	1	0.00	45.0	168.27	38.60	315.95	0.71
32	105.95	1.34	68.5	0.17	0.46	1	0.00	45.0	137.91	26.41	257.48	0.72
33	106.11	1.27	68.5	0.17	0.46	1	0.00	45.0	129.93	14.05	225.30	0.72
34	106.28	0.63	72.0	0.09	0.29	1	0.00	45.0	64.71	2.45	173.02	0.74
35	106.37	1.31	72.0	0.20	0.64	1	0.00	45.0	133.61	0.00	155.43	0.74
36	106.57	1.37	75.6	0.23	0.92	1	0.00	45.0	137.93	0.00	113.87	0.76
37	106.80	0.51	79.1	0.10	0.51	1	0.00	45.0	50.61	0.00	78.08	0.79
38	106.89	0.37	79.1	0.08	0.41	2	0.00	34.0	37.01	0.00	98.14	1.09
39	106.97	0.49	82.6	0.12	0.92	2	0.00	34.0	48.63	0.00	61.07	1.16
40	107.09	0.22	87.9	0.07	1.84	2	0.00	34.0	21.32	0.00	14.88	1.29

X-S Area: 73.01 Path Length: 15.69 X-S Weight: 7685.66

DATA: Analysis 2

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size

Cohesion Phi UnitWeight Ru
0.00 45.0 110.00 Auto

Material: 2 (Mohr-Coulomb Isotropic) - Loose sand, mixed grain size

Cohesion Phi UnitWeight Ru
0.00 34.0 99.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (2 profiles)

Profile: 1 (2 points) Material beneath: 2 - Loose sand, mixed grain size

0.00 15.00 500.00 15.00

Profile: 2 (2 points) Material beneath: 1 - Sand and gravel, mixed grain size

0.00 10.00 500.00 10.00

Slope Surface (4 points)

0.00 0.00 70.00 0.00 115.00 15.00 500.00 15.00

Phreatic Surface (2 points)

0.00 8.00 500.00 8.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 71.00 YL: 0.33 XR: 123.00 YR: 15.00
Centre: XC: 85.58 YC: 48.16 Radius: R: 50.00

Variable Restraints

Parameter descriptor: XL XR R
Range of variation: 1.00 28.00 5.00
Trial positions within range: 1 20 1

RESULTS: Analysis 2

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 2.971

There were: 21 successful analyses from a total of 21 trial surfaces

Critical (minimum) Factor of Safety: 2.69

Results Summary - Lowest 21 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS
1	71.00	0.33	114.89	14.96	78.93	49.70	50.00	2.690 <-- Critical Surface
2	71.00	0.33	116.37	15.00	80.16	49.49	50.00	2.699
3	71.00	0.33	113.42	14.47	78.07	49.83	50.00	2.701
4	71.00	0.33	111.95	13.98	77.21	49.95	50.00	2.712
5	71.00	0.33	110.47	13.49	76.36	50.05	50.00	2.727
6	71.00	0.33	117.84	15.00	81.40	49.24	50.00	2.733
7	71.00	0.33	109.00	13.00	75.51	50.13	50.00	2.746
8	71.00	0.33	119.32	15.00	82.62	48.96	50.00	2.787
9	71.00	0.33	120.79	15.00	83.82	48.66	50.00	2.854
10	71.00	0.33	122.26	15.00	85.00	48.33	50.00	2.931
11	71.00	0.33	123.00	15.00	85.58	48.16	50.00	2.971
12	71.00	0.33	123.74	15.00	86.16	47.98	50.00	3.014
13	71.00	0.33	125.21	15.00	87.30	47.60	50.00	3.102
14	71.00	0.33	126.68	15.00	88.43	47.20	50.00	3.196
15	71.00	0.33	128.16	15.00	89.55	46.77	50.00	3.295
16	71.00	0.33	129.63	15.00	90.65	46.31	50.00	3.400
17	71.00	0.33	131.11	15.00	91.74	45.83	50.00	3.506
18	71.00	0.33	132.58	15.00	92.82	45.32	50.00	3.624
19	71.00	0.33	134.05	15.00	93.89	44.78	50.00	3.744
20	71.00	0.33	135.53	15.00	94.95	44.22	50.00	3.870
21	71.00	0.33	137.00	15.00	96.01	43.63	50.00	4.002

Critical Failure Surface (circle 1)

Intersects: XL: 71.00 YL: 0.33 XR: 114.89 YR: 14.96
Centre: XC: 78.93 YC: 49.70 Radius: R: 50.00

Generated failure surface: (20 points)

71.00	0.33	73.51	-0.00	76.03	-0.22	78.56	-0.30	81.09	-0.25
83.62	-0.08	86.13	0.22	88.63	0.65	91.10	1.20	93.54	1.88
95.94	2.68	98.30	3.60	100.60	4.64	102.86	5.80	105.05	7.06
107.17	8.44	109.22	9.92	111.20	11.51	113.09	13.19	114.89	14.96

Slice Geometry and Properties - Critical Failure Surface (circle 1, 40 slices)

Slice	X-S			Base					PoreWater		Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	71.00	0.37	-7.7	1.25	1.27	1	0.00	45.0	40.51	612.20	498.39	1.06
2	72.25	1.10	-7.7	1.25	1.27	1	0.00	45.0	121.53	625.56	538.36	1.06
3	73.51	1.81	-4.8	1.26	1.27	1	0.00	45.0	199.42	636.39	573.39	1.04
4	74.77	2.48	-4.8	1.26	1.27	1	0.00	45.0	272.37	644.71	605.79	1.04
5	76.03	3.11	-1.9	1.27	1.27	1	0.00	45.0	341.97	650.50	632.35	1.01
6	77.30	3.69	-1.9	1.27	1.27	1	0.00	45.0	406.41	653.77	657.24	1.01
7	78.56	4.24	1.0	1.27	1.27	1	0.00	45.0	466.57	654.51	675.58	0.99
8	79.83	4.75	1.0	1.27	1.27	1	0.00	45.0	522.14	652.72	693.03	0.99
9	81.09	5.20	3.9	1.26	1.27	1	0.00	45.0	571.92	648.39	703.38	0.98
10	82.36	5.62	3.9	1.26	1.27	1	0.00	45.0	618.34	641.54	713.48	0.98
11	83.62	5.97	6.8	1.26	1.27	1	0.00	45.0	657.05	632.18	716.05	0.96
12	84.87	6.31	6.8	1.26	1.27	1	0.00	45.0	694.15	620.28	718.88	0.96
13	86.13	6.56	9.7	1.25	1.27	1	0.00	45.0	721.31	605.88	713.90	0.95
14	87.38	6.81	9.7	1.25	1.27	1	0.00	45.0	749.02	588.99	709.58	0.95
15	88.63	6.95	12.6	1.24	1.27	1	0.00	45.0	764.44	569.61	697.26	0.95
16	89.86	7.12	12.6	1.24	1.27	1	0.00	45.0	782.76	547.74	685.91	0.95
17	91.10	7.15	15.5	1.22	1.27	1	0.00	45.0	786.46	523.43	666.48	0.94
18	92.32	7.23	15.5	1.22	1.27	1	0.00	45.0	795.52	496.66	648.24	0.94
19	93.54	2.77	18.4	0.46	0.49	1	0.00	45.0	304.51	184.45	629.58	0.94
20	94.00	5.78	18.4	0.97	1.02	1	0.00	45.0	635.50	369.72	623.64	0.94
21	94.97	5.78	18.4	0.97	1.02	1	0.00	45.0	635.50	349.14	621.42	0.94
22	95.94	6.99	21.3	1.18	1.27	1	0.00	45.0	769.09	401.86	609.88	0.94
23	97.12	6.91	21.3	1.18	1.27	1	0.00	45.0	760.33	365.49	599.75	0.94
24	98.30	4.93	24.2	0.85	0.93	1	0.00	45.0	541.83	245.28	582.20	0.94
25	99.15	4.84	24.2	0.85	0.93	1	0.00	45.0	532.49	222.90	569.38	0.94
26	100.00	3.38	24.2	0.60	0.66	1	0.00	45.0	370.82	144.33	557.49	0.94
27	100.60	6.15	27.1	1.13	1.27	1	0.00	45.0	671.47	242.42	531.39	0.94
28	101.73	5.92	27.1	1.13	1.27	1	0.00	45.0	641.80	196.82	503.50	0.94
29	102.86	5.50	30.0	1.10	1.27	1	0.00	45.0	591.53	149.00	465.18	0.95
30	103.95	5.21	30.0	1.10	1.27	1	0.00	45.0	554.78	98.95	430.57	0.95
31	105.05	6.34	32.9	1.44	1.72	1	0.00	45.0	667.29	50.27	377.92	0.96
32	106.49	2.76	32.9	0.68	0.81	1	0.00	45.0	286.36	0.00	339.49	0.96
33	107.17	3.85	35.8	1.03	1.27	1	0.00	45.0	394.42	0.00	303.04	0.97
34	108.20	3.44	35.8	1.03	1.27	1	0.00	45.0	345.51	0.00	265.46	0.97
35	109.22	2.88	38.7	0.99	1.27	2	0.00	34.0	285.43	0.00	240.71	1.07
36	110.21	2.43	38.7	0.99	1.27	2	0.00	34.0	240.18	0.00	202.54	1.07
37	111.20	1.86	41.6	0.95	1.27	2	0.00	34.0	183.82	0.00	158.91	1.09
38	112.14	1.36	41.6	0.95	1.27	2	0.00	34.0	134.58	0.00	116.35	1.09
39	113.09	0.79	44.5	0.90	1.27	2	0.00	34.0	78.66	0.00	69.94	1.13

40 113.99 0.26 44.5 0.90 1.27 2 0.00 34.0 26.22 0.00 23.31 1.13

X-S Area: 176.60 Path Length: 48.10 X-S Weight: 19164.04

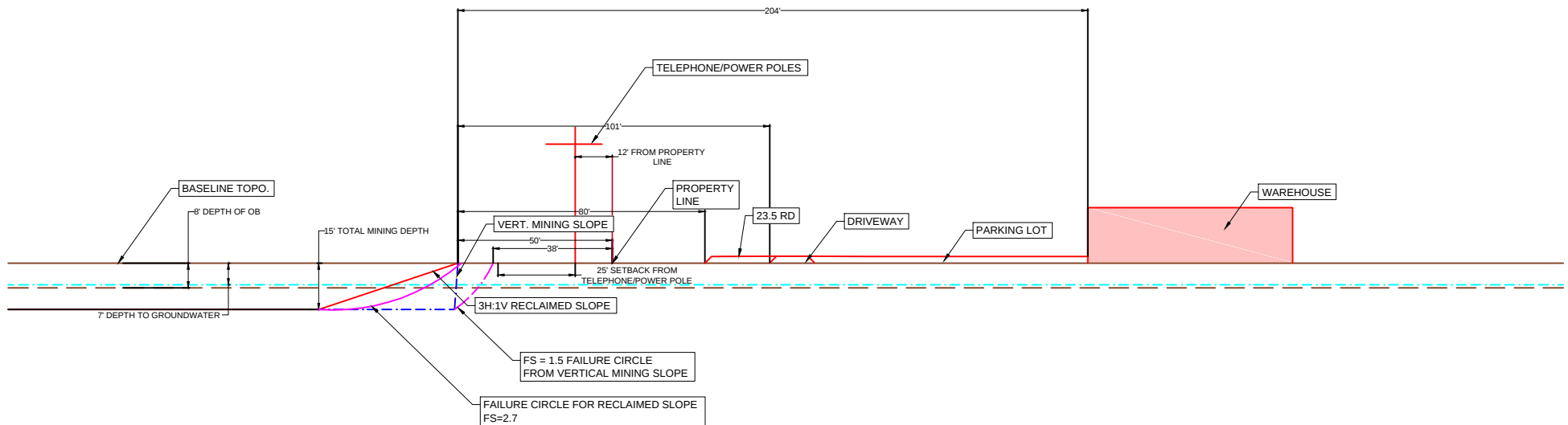


Fig. 1 Slope Layout
Orchard Grove Industrial Pit
Grand Junction Pipe

DRMS Permit Number: M-1994-094
 Mine Entry Location: Latitude: 39.1045 Longitude: -108.6191
 State: CO County: Mesa Nearest Town: Grand Junction
 Section: 5 Township: 1S Range: 1W PM: Ute
 Major Watershed: Colorado River
 Map Scale as Shown

Map Georeferencing Information: Datum: NAD83 Projection: CO Central
 Survey Source: N/A Survey Date: N/A
 Imagery Source: N/A Imagery Date: N/A
 Drawn by: BEL Date: 12/20/18
 Checked by: BEL Date: 12/21/18
 Approved by: BEL Date: 12/21/18

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