COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, Colorado 80203

January 5, 2015

Ben Frei
Albert Frei & Sons Inc.
P.O. Box 700
Henderson, CO 80640

Re: Hatchery Pit, DRMS File No. M-2014-043,
112 Construction Materials Reclamation Permit Application,
Fourth Adequacy Review

Dear Mr. Frei:

The Division of Reclamation Mining and Safety (DRMS) has reviewed your submittals received on December 4, 2014, December 15, 2014 and December 29, 2014 in which you provided responses to DRMS's adequacy review letter dated October 24, 2014, November 24, 2014 and December 19, 2014. Responses are fully adequate for the following comments: 15, 30 and 31, our follow-up comments for questions 3 through 5, 15, 20, 21, and 29 are addressed in the Memo from DRMS staff reviewing the slope stability Analysis.

General Comments and Questions

29) Please address and respond to the following 11 questions asked in the attached Memo from DRMS's staff. The attached memo addressed the review of slope stability provided by Deere and Adult. Please address all changes resulting from the slope stability provided by Deere and Adult in the permit text and the required maps.

The current decision deadline for this application is January 9, 2014. Please provide responses to the above comments soon enough for the Division to review the responses and complete a follow-up exchange of comments and responses prior to the decision deadline. If you are unable to provide satisfactory responses to any inadequacies prior to the decision deadline, **it will be your responsibility to request an extension of time to allow for continued review of this application.** If there are still unresolved issues when the decision date arrives and no extension has been requested, the application will be denied.

If you need additional information please contact me at the Division of Reclamation, Mining and Safety, 1313 Sherman St., Room 215, Denver, CO 80203, by telephone at 303-866-3567, extension 8131, or by email at Tyler.ODonnell@state.co.us.

Sincerely,

Tyler O'Donnell

Tyler O'Donnell
Environmental Protection Specialist

Enclosure: DRMS Memo addressing slope stability

cc: Tom Kaldenbach, DRMS
Peter Hays, DRMS

Steve O'Brian
Environment, Inc.
7985 Vance Dr., #205A
Arvada, CO 80003

Ed Lanyon
City of Thornton
Infrastructure Maintenance Center
12450 Washington St.
Thornton, CO 80241

COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

1313 Sherman Street, Room 215
Denver, CO 80203

Date: January 5, 2015

To: Tyler O'Donnell, Division of Reclamation, Mining & Safety

From: Peter Hays, Division of Reclamation, Mining & Safety

Re: Third review of Slope Stability Analysis, Albert Frei & Sons Inc., Hatchery Pit, File No. M-2014-043

The Division of Reclamation, Mining and Safety (Division) staff has reviewed the stability analysis response dated December 24, 2014.

Using Clover Technology's Galena v6.1 slope stability software, the Division conducted further analysis of the five (5) critical slope area configurations and mining slope combinations for the Hatchery Pit. Specific comments and requirements for each of the cross sections are provided below.

West Section – Section A-A – City of Thornton Reservoir

1. The Division attempted to duplicate the Applicant's cross section for verification, however due to limitations of the Galena software the two slurry walls with the existing City of Thornton Reservoir embankment could not be duplicated by the Division. The Division will accept the Applicant's slope stability analysis for the West Section due to the high factor of safety produced by the Applicant (3.5) and the Applicant's commitment to not mining within 200 feet of the reservoir.

South Section – Section B-B – 88th Ave

2. The Applicant's cross section was duplicated for verification. The safety factor produced by Galena is significantly lower (1.19) than the safety factor produced by the Applicant's model (1.3). Therefore, this slope configuration is unacceptable for the South Section cross-section. A copy of the Galena model is attached. The Division will require the Applicant to obtain structure agreements for all property, including easement holders, and structure owners within two hundred feet of the affected land for this cross-section. Alternatively, the Applicant may revise the model perimeters to increase the factor of safety to 1.3 or greater.

3. The Deere & Ault stability analysis model reversed the cross-section positions of overburden and sand & gravel and labeled the slurry wall as "Sand & Gravel". Please review the analysis model and revise the model as needed.

East Section – Section D-D – Monaco Street

4. The Applicant's cross section was duplicated for verification. The safety factor produced by Galena is significantly lower (1.19) than the safety factor produced by the Applicant's model (1.3). Therefore, this slope configuration is unacceptable for the East Section cross-section. A copy of the Galena model is attached. The Division will require the Applicant to obtain structure agreements for all property, including easement holders, and structure owners within two hundred feet of the affected land for this cross-section. Alternatively, the Applicant may revise the model perimeters to increase the factor of safety to 1.3 or greater.

5. The Deere & Ault stability analysis model reversed the cross-section positions of overburden and sand & gravel. Please review the analysis model and revise the model as needed.

North Section – Section C-C – Haul Road

6. The Applicant's cross section was duplicated for verification. The safety factor produced by Galena is significantly lower (1.18) than the safety factor produced by the Applicant's model (1.3). Therefore, this slope configuration is unacceptable for the North Section cross-section. A copy of the Galena model is attached. The Division will require the Applicant to obtain structure agreements for all property, including easement holders, and structure owners within two hundred feet of the affected land for this cross-section. Alternatively, the Applicant may revise the model perimeters to increase the factor of safety to 1.3 or greater.

7. The Deere & Ault stability analysis model reversed the cross-section positions of overburden and sand & gravel and labeled the slurry wall as "Sand & Gravel". Please review the analysis model and revise the model as needed.

Phase 1 Section – Section E-E – Colorado Parks & Wildlife buildings

8. The Applicant's cross section was duplicated for verification. The safety factor produced by Galena is significantly lower (0.74) than the safety factor produced by the Applicant's model (1.3). Therefore, this slope configuration is unacceptable for the Phase 1 Section cross-section. A copy of the Galena model is attached. The Division will require the Applicant to obtain structure agreements for all property, including easement holders, and structure owners within two hundred feet of the affected land for this cross-section. Alternatively, the Applicant may revise the model perimeters to increase the factor of safety to 1.3 or greater.

9. The Deere & Ault stability analysis model reversed the cross-section positions of overburden and sand & gravel. Please review the analysis model and revise the model as needed.

General

10. In response to Item #3 in the Division memo dated December 18, 2014. The Applicant corrected cross-sections C-C and D-D on Deere & Ault Figure 6, revised to Figures 6 and 7. The Applicant failed to update the C-C and D-D cross-sections on Exhibit C-1 Mining Plan Map. Please review cross-sections C-C and DD on Exhibit C-1 Mining Plan Map and revise the map accordingly.

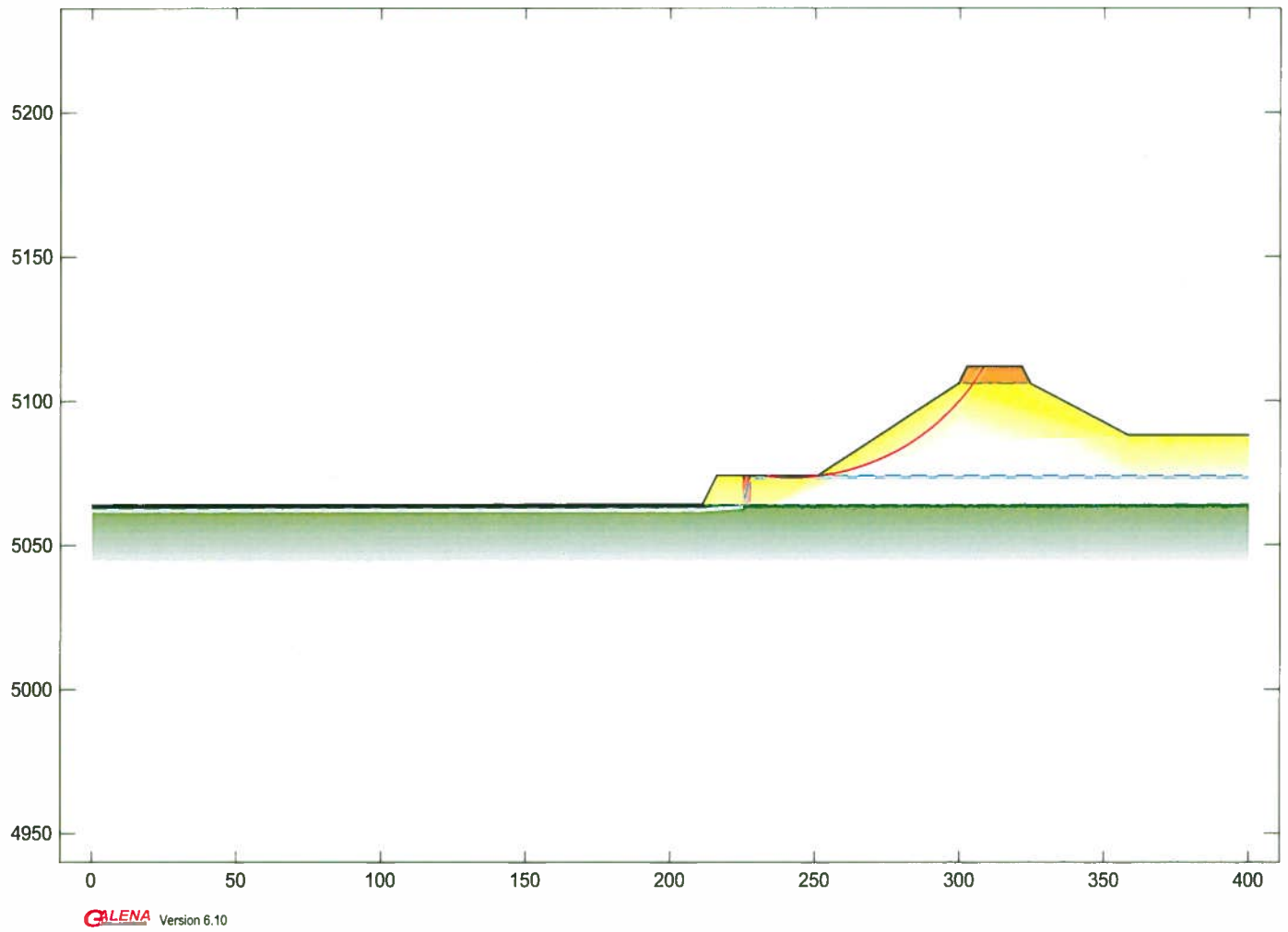
11. The Division noticed several inconsistencies between the Deere & Ault stability analysis cross-section profiles and the cross-section profiles on Figures 6 and 7. Please review the cross-sections profiles for each section and verify the cross-sections match exactly.

If you have any questions, please contact me at (303) 866-3567 Ext. 8124.

Sincerely,

Peter S. Hays
Environmental Protection Specialist

Cc: Tom Kaldenbach, Division of Reclamation, Mining & Safety



Material Keys

Overburden

Sand and Gravel

Slurry Wall

Bedrock

Analysis 1

Single Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Factor of Safety: 1.19

Edited: 2 Jan 2015 *Processed:* 5 Jan 2015

Project Albert Frei & Sons, Inc. - Hatchery Pit - M2014043
South Side

File: C:\Users\psh\Desktop\Hatchery Stability Review\South_Side.gmf

US Dept of Interior - Office of Surface Mining

Project: Albert Frei & Sons, Inc. - Hatchery Pit - M2014043
File: C:\Users\psh\Desktop\Hatchery Stability Review\South_Side.gmf Processed: 05 Jan 2015 12:42:39

DATA: Analysis 1 - South Side

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden

Cohesion	Phi	UnitWeight	Ru
50.00	28.0	114.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Slurry Wall

Cohesion	Phi	UnitWeight	Ru
0.00	0.0	130.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
100.00	28.0	124.00	Auto

Water Properties

Unit weight of water: 62.430 Unit weight of water/medium above ground: 62.430

Material Profiles (4 profiles)

Profile: 1 (2 points) Material beneath: 1 - Overburden
0.00 5112.00 400.00 5112.00
Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
0.00 5106.00 400.00 5106.00
Profile: 3 (2 points) Material beneath: 3 - Slurry Wall
225.00 5074.00 228.00 5074.00
Profile: 4 (2 points) Material beneath: 4 - Bedrock
0.00 5064.00 400.00 5064.00

Slope Surface (10 points)

0.00 5064.00 211.00 5064.00 216.00 5074.00 251.00 5074.00 299.50 5106.00
302.50 5112.00 321.50 5112.00 324.50 5106.00 358.50 5088.00 400.00 5088.00

Phreatic Surface (6 points)

0.00 5063.00 210.00 5063.00 225.00 5064.00 228.00 5074.00 251.00 5074.00
400.00 5074.00

Failure Surface

Circular surface defined by: XL,XR,R
Intersects: XL: 232.75 YL: 5074.00 XR: 308.45 YR: 5112.00
Centre: XC: 241.96 YC: 5150.05 Radius: R: 76.61

RESULTS: Analysis 1 - South Side

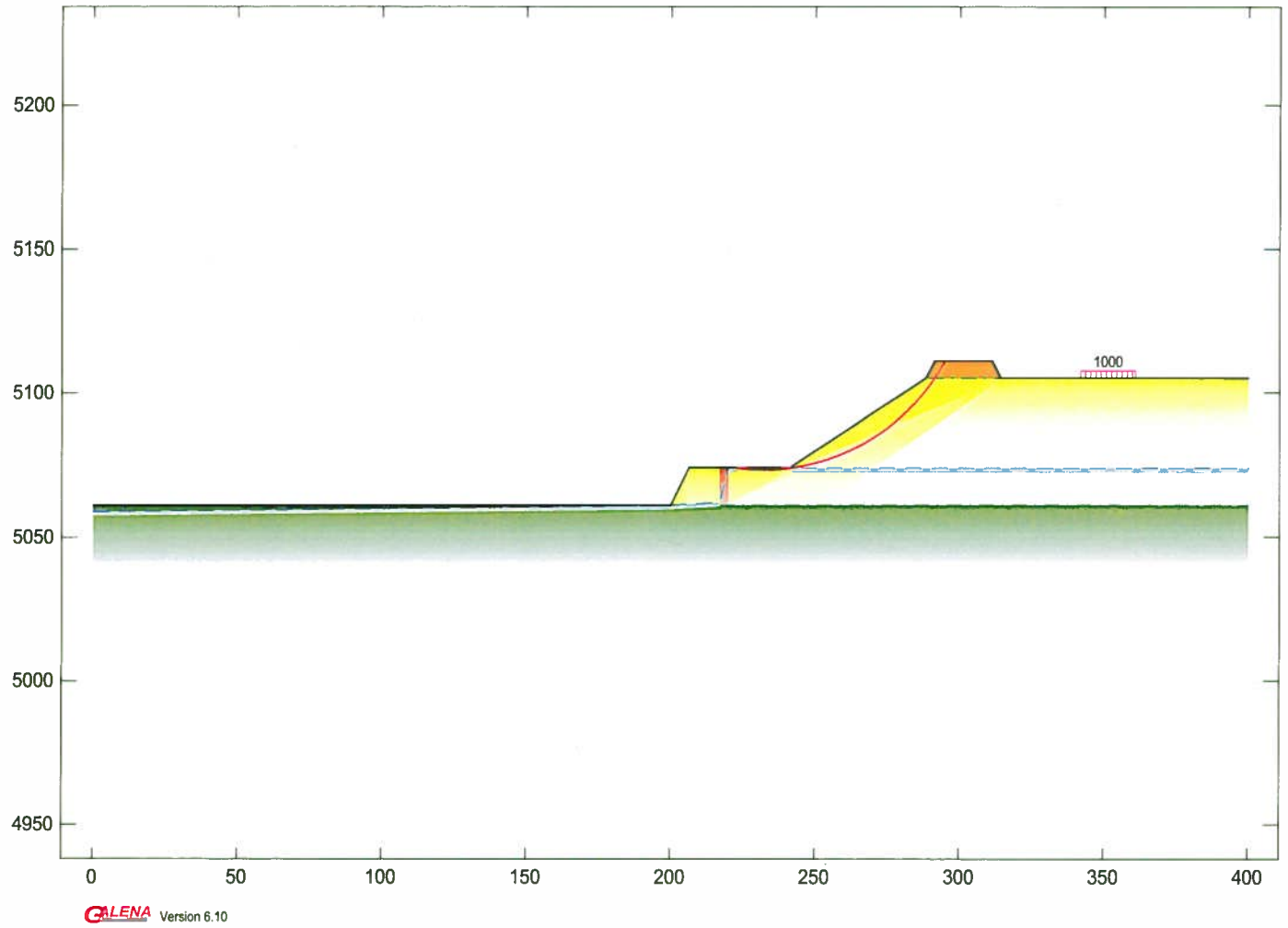
Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 1.19

Slice Geometry and Properties (38 slices)

Slice	X-S	Base							PoreWater	Normal	Test
X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	232.75	0.25	-5.1	2.35	2.36	2	0.00	35.0	32.40	15.62	14.17	1.06
2	235.10	0.75	-5.1	2.35	2.36	2	0.00	35.0	97.04	46.79	42.46	1.06
3	237.45	1.08	-1.6	2.36	2.36	2	0.00	35.0	140.09	67.30	59.87	1.02
4	239.81	1.23	-1.6	2.36	2.36	2	0.00	35.0	160.32	77.02	68.51	1.02
5	242.17	1.22	1.9	2.36	2.36	2	0.00	35.0	158.35	76.09	66.42	0.98
6	244.53	1.03	1.9	2.36	2.36	2	0.00	35.0	133.93	64.35	56.17	0.98
7	246.89	0.61	5.5	2.05	2.06	2	0.00	35.0	79.61	38.40	37.71	0.95
8	248.95	0.21	5.4	2.05	2.06	2	0.00	35.0	27.36	13.20	12.96	0.95
9	251.00	0.10	5.5	0.60	0.60	2	0.00	35.0	13.36	0.00	21.21	0.95
10	251.60	2.16	9.0	2.33	2.36	2	0.00	35.0	280.56	0.00	110.03	0.93
11	253.93	4.89	9.0	2.33	2.36	2	0.00	35.0	635.29	0.00	249.16	0.93
12	256.26	7.34	12.5	2.31	2.36	2	0.00	35.0	954.34	0.00	366.09	0.91
13	258.57	9.67	12.5	2.31	2.36	2	0.00	35.0	1256.64	0.00	482.12	0.91
14	260.87	11.62	16.1	2.27	2.36	2	0.00	35.0	1510.45	0.00	569.13	0.89
15	263.14	13.53	16.1	2.27	2.36	2	0.00	35.0	1759.36	0.00	662.92	0.89
16	265.41	14.96	19.6	2.22	2.36	2	0.00	35.0	1944.69	0.00	722.72	0.88
17	267.63	16.46	19.6	2.22	2.36	2	0.00	35.0	2140.28	0.00	795.32	0.88
18	269.86	17.35	23.1	2.17	2.36	2	0.00	35.0	2255.94	0.00	830.09	0.87
19	272.03	18.45	23.1	2.17	2.36	2	0.00	35.0	2398.75	0.00	882.64	0.87
20	274.20	18.82	26.7	2.11	2.36	2	0.00	35.0	2446.14	0.00	894.60	0.86
21	276.31	19.52	26.6	2.11	2.36	2	0.00	35.0	2537.50	0.00	928.11	0.86
22	278.42	19.38	30.2	2.04	2.36	2	0.00	35.0	2519.51	0.00	919.39	0.86

23	280.46	19.71	30.2	2.04	2.36	2	0.00	35.0	2561.75	0.00	934.80	0.86
24	282.51	19.10	33.7	1.96	2.36	2	0.00	35.0	2483.36	0.00	907.63	0.86
25	284.47	19.07	33.7	1.96	2.36	2	0.00	35.0	2479.62	0.00	906.26	0.86
26	286.43	18.06	37.2	1.88	2.36	2	0.00	35.0	2347.88	0.00	862.82	0.87
27	288.31	17.71	37.3	1.88	2.36	2	0.00	35.0	2301.71	0.00	845.76	0.87
28	290.19	16.35	40.8	1.79	2.36	2	0.00	35.0	2125.33	0.00	788.26	0.88
29	291.98	15.70	40.8	1.79	2.36	2	0.00	35.0	2040.92	0.00	756.95	0.88
30	293.77	14.08	44.3	1.69	2.36	2	0.00	35.0	1829.88	0.00	687.65	0.89
31	295.46	13.17	44.3	1.69	2.36	2	0.00	35.0	1712.45	0.00	643.53	0.89
32	297.15	16.48	47.9	2.35	3.51	2	0.00	35.0	2142.24	0.00	551.79	0.90
33	299.50	5.60	47.9	0.82	1.22	2	0.00	35.0	716.68	0.00	531.38	0.90
34	300.32	17.53	51.4	2.18	3.50	2	0.00	35.0	2145.52	0.00	565.77	0.92
35	302.50	6.40	51.4	0.76	1.22	2	0.00	35.0	758.30	0.00	570.98	0.92
36	303.26	9.22	54.9	1.33	2.31	2	0.00	35.0	1070.83	0.00	438.87	0.95
37	304.59	6.95	54.9	1.39	2.41	1	50.00	28.0	792.73	0.00	312.58	1.06
38	305.98	4.97	58.5	2.47	4.72	1	50.00	28.0	566.97	0.00	93.13	1.11
		---------			-------				----------			
	X-S Area:	400.72	Path Length:		89.73			X-S Weight:	51558.09			



Material Keys

Overburden

Sand and Gravel

Slurry Wall

Bedrock

Analysis 1

Single Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Factor of Safety: 1.19

Edited: 2 Jan 2015 *Processed:* 5 Jan 2015

Project Albert Frei & Sons, Inc. - Hatchery Pit - M2014043
East Side

File: C:\Users\psh\Desktop\Hatchery Stability Review\East_Side.gmf

US Dept of Interior - Office of Surface Mining

Project: Albert Frei & Sons, Inc. - Hatchery Pit - M2014043
File: C:\Users\psh\Desktop\Hatchery Stability Review\East_Side.gmf Processed: 05 Jan 2015 13:07:24

DATA: Analysis 1 - East Side

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden

Cohesion	Phi	UnitWeight	Ru
50.00	28.0	114.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Slurry Wall

Cohesion	Phi	UnitWeight	Ru
0.00	0.0	130.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
100.00	28.0	124.00	Auto

Water Properties

Unit weight of water: 62.430 Unit weight of water/medium above ground: 62.430

Material Profiles (4 profiles)

Profile: 1 (2 points) Material beneath: 1 - Overburden
0.00 5111.00 400.00 5111.00
Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
0.00 5105.00 400.00 5105.00
Profile: 3 (2 points) Material beneath: 3 - Slurry Wall
217.00 5074.00 220.00 5074.00
Profile: 4 (2 points) Material beneath: 4 - Bedrock
0.00 5061.00 400.00 5061.00

Slope Surface (9 points)

0.00 5061.00 200.00 5061.00 206.30 5074.00 241.30 5074.00 288.30 5105.00
291.30 5111.00 311.30 5111.00 314.30 5105.00 400.00 5105.00

Phreatic Surface (6 points)

0.00 5059.00 198.00 5061.00 217.00 5062.00 220.00 5074.00 243.00 5074.00
400.00 5074.00

Failure Surface

Circular surface defined by: XL,XR,R
Intersects: XL: 222.78 YL: 5074.00 XR: 295.00 YR: 5111.00
Centre: XC: 232.18 YC: 5144.64 Radius: R: 71.26

Distributed Loads (1 load)

Load	X-Left	Pressure	X-Right	Pressure
1	342.00	1000.0	361.00	1000.0

RESULTS: Analysis 1 - East Side

Bishop Simplified Method of Analysis - Circular Failure Surface

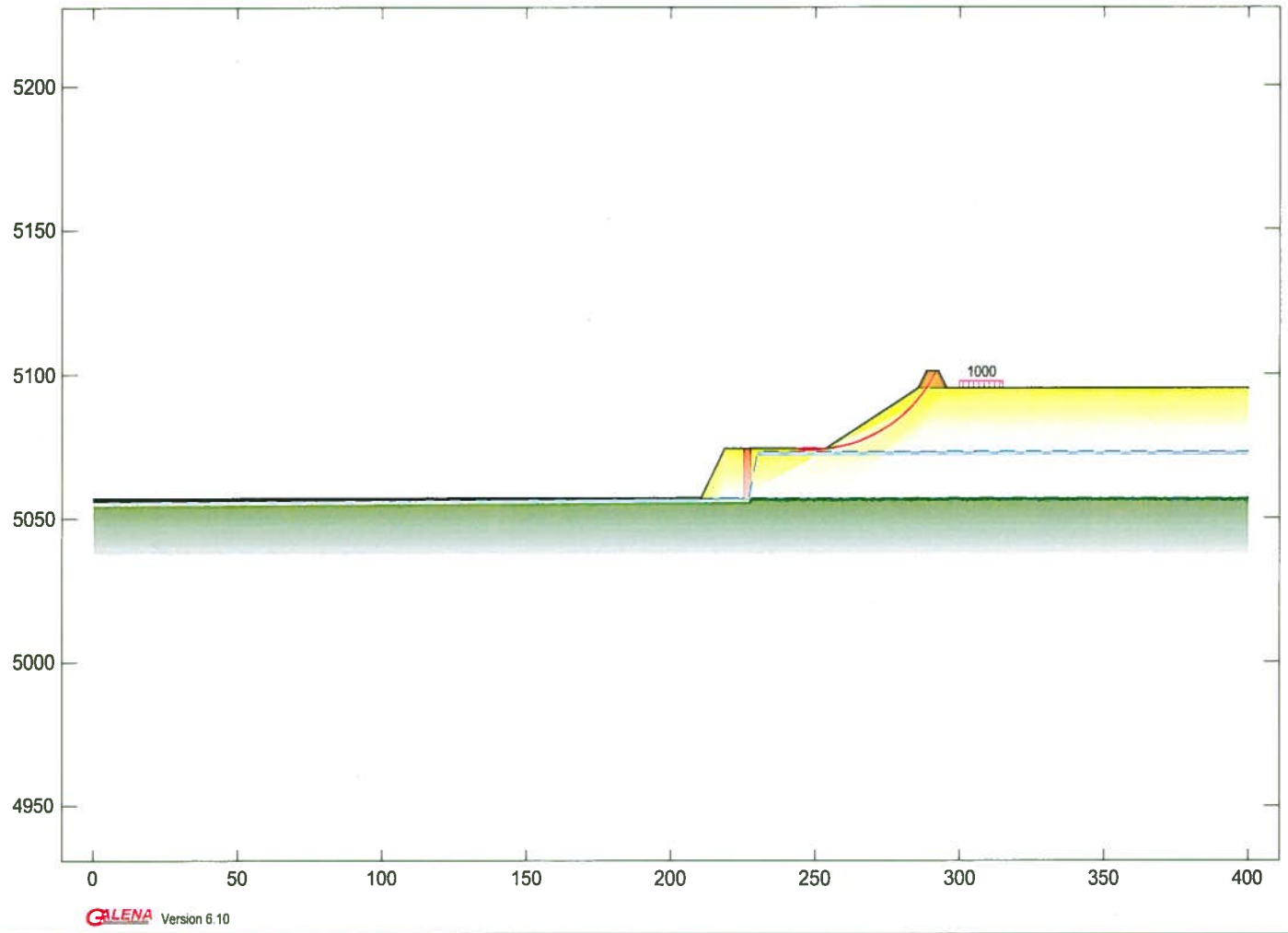
Factor of Safety: 1.19

Slice Geometry and Properties (38 slices)

Slice	X-S	Base						PoreWater	Normal	Test
X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	222.78	0.26	-5.7	2.26	2.27	2	0.00	35.0	33.43	16.13	15.28	1.07
2	225.04	0.77	-5.7	2.26	2.27	2	0.00	35.0	100.28	48.40	45.83	1.07
3	227.30	1.13	-2.1	2.27	2.27	2	0.00	35.0	146.54	70.42	65.30	1.02
4	229.57	1.32	-2.1	2.27	2.27	2	0.00	35.0	171.17	82.26	76.28	1.02
5	231.84	1.34	1.6	2.27	2.27	2	0.00	35.0	174.40	83.78	76.17	0.98
6	234.11	1.20	1.6	2.27	2.27	2	0.00	35.0	156.09	74.99	68.18	0.98
7	236.38	0.89	5.2	2.26	2.27	2	0.00	35.0	116.16	56.02	49.99	0.95
8	238.64	0.43	5.2	2.26	2.27	2	0.00	35.0	55.57	26.80	23.91	0.95
9	240.91	0.02	8.9	0.39	0.40	2	0.00	35.0	2.83	1.38	6.86	0.93
10	241.30	1.11	8.9	2.05	2.07	2	0.00	35.0	143.71	0.00	64.28	0.93
11	243.35	3.22	8.9	2.05	2.07	2	0.00	35.0	418.13	0.00	187.07	0.93
12	245.39	5.70	12.5	2.22	2.27	2	0.00	35.0	741.37	0.00	295.60	0.91
13	247.61	7.85	12.5	2.22	2.27	2	0.00	35.0	1021.06	0.00	407.12	0.91
14	249.83	9.66	16.2	2.18	2.27	2	0.00	35.0	1256.44	0.00	491.78	0.89
15	252.01	11.42	16.2	2.18	2.27	2	0.00	35.0	1485.21	0.00	581.26	0.89
16	254.19	12.74	19.8	2.14	2.27	2	0.00	35.0	1655.65	0.00	638.89	0.88
17	256.33	14.10	19.8	2.14	2.27	2	0.00	35.0	1833.33	0.00	707.46	0.88

18	258.47	14.90	23.5	2.08	2.27	2	0.00	35.0	1937.61	0.00	740.23	0.87
19	260.55	15.88	23.5	2.08	2.27	2	0.00	35.0	2064.57	0.00	788.73	0.87
20	262.63	16.19	27.1	2.02	2.27	2	0.00	35.0	2104.24	0.00	799.20	0.86
21	264.65	16.79	27.1	2.02	2.27	2	0.00	35.0	2182.38	0.00	828.88	0.86
22	266.68	16.62	30.8	1.95	2.27	2	0.00	35.0	2160.35	0.00	819.00	0.86
23	268.63	16.86	30.8	1.95	2.27	2	0.00	35.0	2191.81	0.00	830.93	0.86
24	270.58	16.26	34.4	1.87	2.27	2	0.00	35.0	2113.56	0.00	803.17	0.86
25	272.45	16.17	34.4	1.87	2.27	2	0.00	35.0	2101.55	0.00	798.52	0.86
26	274.33	15.19	38.1	1.79	2.27	2	0.00	35.0	1974.06	0.00	754.88	0.87
27	276.11	14.79	38.1	1.79	2.27	2	0.00	35.0	1922.50	0.00	735.25	0.87
28	277.90	13.50	41.7	1.69	2.27	2	0.00	35.0	1754.72	0.00	678.13	0.88
29	279.60	12.83	41.7	1.69	2.27	2	0.00	35.0	1667.79	0.00	644.54	0.88
30	281.29	11.31	45.4	1.60	2.27	2	0.00	35.0	1470.16	0.00	576.59	0.89
31	282.89	10.41	45.4	1.60	2.27	2	0.00	35.0	1352.92	0.00	530.61	0.89
32	284.48	8.75	49.0	1.49	2.27	2	0.00	35.0	1137.17	0.00	454.61	0.91
33	285.97	7.65	49.0	1.49	2.27	2	0.00	35.0	995.13	0.00	397.83	0.91
34	287.46	3.79	52.7	0.84	1.39	2	0.00	35.0	492.08	0.00	329.64	0.93
35	288.30	9.34	52.7	1.91	3.16	2	0.00	35.0	1155.22	0.00	340.43	0.93
36	290.21	6.32	56.4	1.09	1.96	2	0.00	35.0	736.49	0.00	358.71	0.96
37	291.30	7.16	56.4	1.43	2.58	1	50.00	28.0	815.78	0.00	303.29	1.08
38	292.73	4.47	60.0	2.27	4.54	1	50.00	28.0	509.33	0.00	85.13	1.13
		328.31			86.31				42350.76			

X-S Area: Path Length: X-S Weight:



Material Keys

Overburden

Sand and Gravel

Slurry Wall

Bedrock

Analysis 1

Single Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Factor of Safety: 1.18

Edited: 2 Jan 2015 *Processed:* 5 Jan 2015

Project Albert Frei & Sons, Inc. - Hatchery Pit - M2014043
North Side

File: C:\Users\psh\Desktop\Hatchery Stability Review\North_Side.gmf

US Dept of Interior - Office of Surface Mining

Project: Albert Frei & Sons, Inc. - Hatchery Pit - M2014043
File: C:\Users\psh\Desktop\Hatchery Stability Review\North_Side.gmf Processed: 05 Jan 2015 13:03:07

DATA: Analysis 1 - North Side

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden

Cohesion	Phi	UnitWeight	Ru
50.00	28.0	114.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Slurry Wall

Cohesion	Phi	UnitWeight	Ru
0.00	0.0	130.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
100.00	28.0	124.00	Auto

Water Properties

Unit weight of water: 62.430 Unit weight of water/medium above ground: 62.430

Material Profiles (4 profiles)

Profile: 1 (2 points)	Material beneath: 1 - Overburden			
0.00	5101.00	400.00	5101.00	
Profile: 2 (2 points)	Material beneath: 2 - Sand and Gravel			
0.00	5095.00	400.00	5095.00	
Profile: 3 (2 points)	Material beneath: 3 - Slurry Wall			
225.00	5074.00	228.00	5074.00	
Profile: 4 (2 points)	Material beneath: 4 - Bedrock			
0.00	5057.00	400.00	5057.00	

Slope Surface (9 points)

0.00	5057.00	210.40	5057.00	218.60	5074.00	253.60	5074.00	285.50	5095.00
288.50	5101.00	292.50	5101.00	295.50	5095.00	400.00	5095.00		

Phreatic Surface (5 points)

0.00	5056.00	227.00	5057.00	230.00	5073.00	254.00	5073.00	400.00	5073.00

Failure Surface

Circular surface defined by: XL,XR,R
Intersects: XL: 243.19 YL: 5074.00 XR: 291.92 YR: 5101.00
Centre: XC: 248.53 YC: 5121.84 Radius: R: 48.14

Distributed Loads (1 load)

Load	X-Left	Pressure	X-Right	Pressure
1	300.00	1000.0	315.00	1000.0

RESULTS: Analysis 1 - North Side

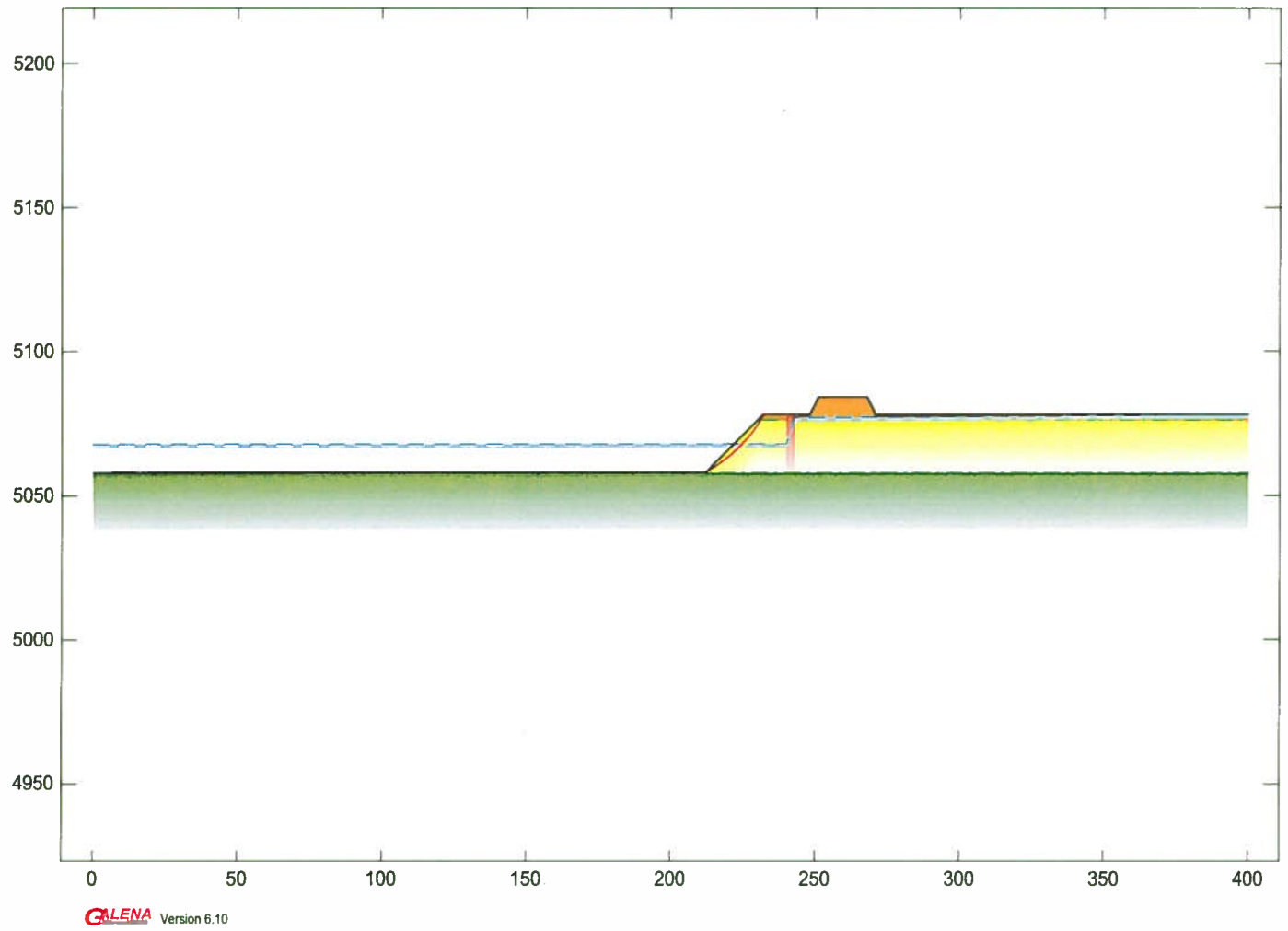
Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 1.18

Slice Geometry and Properties (37 slices)

Slice	X-S	Base							PoreWater	Normal	Test
X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	243.19	0.10	-4.5	1.56	1.56	2	0.00	35.0	12.46	0.00	8.39	1.05
2	244.75	0.29	-4.5	1.56	1.56	2	0.00	35.0	37.29	0.00	25.11	1.05
3	246.31	0.40	-0.8	1.56	1.56	2	0.00	35.0	52.09	0.00	33.59	1.01
4	247.87	0.43	-0.8	1.56	1.56	2	0.00	35.0	56.35	0.00	36.35	1.01
5	249.43	0.39	2.9	1.56	1.56	2	0.00	35.0	50.34	0.00	31.29	0.97
6	250.99	0.26	2.9	1.56	1.56	2	0.00	35.0	34.09	0.00	21.19	0.97
7	252.55	0.07	6.7	1.05	1.05	2	0.00	35.0	9.09	0.00	8.13	0.94
8	253.60	0.29	6.7	1.03	1.04	2	0.00	35.0	38.11	0.00	34.60	0.94
9	254.63	0.87	6.7	1.03	1.04	2	0.00	35.0	112.77	0.00	102.39	0.94
10	255.66	2.29	10.4	1.54	1.56	2	0.00	35.0	297.08	0.00	174.23	0.92
11	257.20	3.41	10.4	1.54	1.56	2	0.00	35.0	443.09	0.00	259.85	0.92
12	258.73	4.38	14.1	1.52	1.56	2	0.00	35.0	569.68	0.00	326.91	0.90
13	260.25	5.32	14.1	1.52	1.56	2	0.00	35.0	691.32	0.00	396.71	0.90
14	261.77	6.05	17.8	1.49	1.56	2	0.00	35.0	786.75	0.00	443.78	0.88
15	263.25	6.80	17.8	1.49	1.56	2	0.00	35.0	883.65	0.00	498.44	0.88
16	264.74	7.28	21.5	1.45	1.56	2	0.00	35.0	946.87	0.00	527.42	0.87
17	266.20	7.84	21.6	1.45	1.56	2	0.00	35.0	1019.32	0.00	567.68	0.87
18	267.65	8.08	25.3	1.41	1.56	2	0.00	35.0	1050.43	0.00	580.21	0.86

19	269.06	8.45	25.3	1.41	1.56	2	0.00	35.0	1098.82	0.00	606.83	0.86
20	270.48	8.45	29.0	1.37	1.56	2	0.00	35.0	1098.91	0.00	604.49	0.86
21	271.85	8.65	29.0	1.37	1.56	2	0.00	35.0	1124.28	0.00	618.34	0.86
22	273.21	8.43	32.7	1.32	1.56	2	0.00	35.0	1095.41	0.00	602.58	0.86
23	274.53	8.45	32.7	1.32	1.56	2	0.00	35.0	1099.09	0.00	604.60	0.86
24	275.84	8.03	36.4	1.26	1.56	2	0.00	35.0	1044.39	0.00	577.03	0.86
25	277.10	7.91	36.4	1.26	1.56	2	0.00	35.0	1028.05	0.00	567.99	0.86
26	278.36	7.32	40.1	1.19	1.56	2	0.00	35.0	951.66	0.00	530.35	0.87
27	279.55	7.06	40.2	1.19	1.56	2	0.00	35.0	917.18	0.00	511.04	0.87
28	280.75	6.34	43.9	1.13	1.56	2	0.00	35.0	823.81	0.00	465.03	0.88
29	281.87	5.95	43.9	1.13	1.56	2	0.00	35.0	773.67	0.00	436.73	0.88
30	283.00	5.14	47.6	1.05	1.56	2	0.00	35.0	668.82	0.00	384.23	0.90
31	284.06	4.66	47.6	1.05	1.56	2	0.00	35.0	605.86	0.00	348.01	0.90
32	285.11	1.59	51.3	0.39	0.63	2	0.00	35.0	207.05	0.00	303.89	0.92
33	285.50	7.11	51.3	1.56	2.50	2	0.00	35.0	884.84	0.00	324.74	0.92
34	287.06	7.77	55.0	1.40	2.45	2	0.00	35.0	907.99	0.00	349.45	0.94
35	288.47	2.22	55.0	0.39	0.68	1	50.00	28.0	252.97	0.00	359.33	1.06
36	288.85	6.66	58.8	1.62	3.13	1	50.00	28.0	759.43	0.00	228.29	1.11
37	290.48	2.00	62.5	1.44	3.13	1	50.00	28.0	228.24	0.00	40.95	1.16
		---			---				---			
	X-S Area:	176.74	Path Length:		59.40			X-S Weight:	22661.26			



Material Keys

- Overburden
- Sand and Gravel
- Slurry Wall
- Bedrock

Analysis 1

Single Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Factor of Safety: 0.74

Project Albert Frei & Sons, Inc. - Hatchery Pit - M2014043
Phase 1

File: C:\Users\psh\Desktop\Hatchery Stability Review\Phase 1_Side.gmf

Edited: 5 Jan 2015 *Processed:* 5 Jan 2015

US Dept of Interior - Office of Surface Mining

Project: Albert Frei & Sons, Inc. - Hatchery Pit - M2014043
File: C:\Users\psh\Desktop\Hatchery Stability Review\Phase 1_Side.gmf Processed: 05 Jan 2015 13:03:22

DATA: Analysis 1 - Phase 1

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden

Cohesion	Phi	UnitWeight	Ru
50.00	28.0	114.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Slurry Wall

Cohesion	Phi	UnitWeight	Ru
0.00	0.0	130.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
100.00	28.0	124.00	Auto

Water Properties

Unit weight of water: 62.430 Unit weight of water/medium above ground: 62.430

Material Profiles (4 profiles)

Profile: 1 (2 points) Material beneath: 1 - Overburden
0.00 5084.00 400.00 5084.00
Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
0.00 5076.00 400.00 5076.00
Profile: 3 (2 points) Material beneath: 3 - Slurry Wall
240.00 5078.00 243.00 5078.00
Profile: 4 (2 points) Material beneath: 4 - Bedrock
0.00 5058.00 400.00 5058.00

Slope Surface (8 points)

0.00 5058.00 212.00 5058.00 232.00 5078.00 248.00 5078.00 251.00 5084.00
268.00 5084.00 271.00 5078.00 400.00 5078.00

Phreatic Surface (6 points)

0.00 5068.00 220.00 5068.00 240.00 5068.00 243.00 5077.00 257.00 5077.00
400.00 5078.00

Failure Surface

Circular surface defined by: XL,XR,R
Intersects: XL: 212.28 YL: 5058.28 XR: 232.28 YR: 5078.00
Centre: XC: 188.40 YC: 5102.50 Radius: R: 50.26

RESULTS: Analysis 1 - Phase 1

Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 0.74

Negative normal stresses exist on the base of one or more slices - examine slice data and consult the GALENA Help utility

Slice Geometry and Properties (40 slices)

Slice	X-S	Base							PoreWater	Normal	Test
X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	212.28	0.09	29.2	0.65	0.75	2	0.00	35.0	12.24	446.03	601.76	0.75
2	212.93	0.28	29.2	0.65	0.75	2	0.00	35.0	36.77	428.94	591.68	0.75
3	213.59	0.45	30.9	0.64	0.75	2	0.00	35.0	58.89	411.28	579.52	0.74
4	214.23	0.62	30.9	0.64	0.75	2	0.00	35.0	80.39	393.41	566.53	0.74
5	214.87	0.76	32.6	0.63	0.75	2	0.00	35.0	98.78	374.83	551.08	0.74
6	215.50	0.90	32.7	0.63	0.75	2	0.00	35.0	117.40	356.08	535.38	0.74
7	216.13	1.02	34.3	0.62	0.75	2	0.00	35.0	132.06	336.60	516.75	0.73
8	216.75	1.14	34.4	0.62	0.75	2	0.00	35.0	147.84	316.97	498.39	0.73
9	217.37	1.22	36.1	0.61	0.75	2	0.00	35.0	158.95	296.74	476.76	0.73
10	217.98	1.32	36.1	0.61	0.75	2	0.00	35.0	171.91	276.12	455.81	0.73
11	218.58	1.38	37.7	0.59	0.75	2	0.00	35.0	179.56	255.01	431.29	0.73
12	219.17	1.46	37.8	0.59	0.75	2	0.00	35.0	189.86	233.67	407.83	0.73
13	219.77	1.49	39.5	0.58	0.75	2	0.00	35.0	194.20	211.72	380.60	0.73
14	220.34	1.55	39.5	0.58	0.75	2	0.00	35.0	201.88	189.54	354.71	0.73
15	220.92	1.49	41.2	0.54	0.72	2	0.00	35.0	193.94	159.83	325.58	0.73
16	221.46	1.53	41.2	0.54	0.72	2	0.00	35.0	198.65	138.72	298.70	0.73
17	222.00	1.66	42.8	0.57	0.78	2	0.00	35.0	216.05	127.28	276.43	0.72
18	222.57	1.69	42.9	0.57	0.78	2	0.00	35.0	219.10	101.46	263.41	0.72
19	223.15	1.58	44.6	0.53	0.75	2	0.00	35.0	205.22	72.22	245.26	0.72
20	223.68	1.58	44.6	0.53	0.75	2	0.00	35.0	205.76	47.65	229.92	0.72
21	224.22	1.07	46.3	0.36	0.52	2	0.00	35.0	139.03	18.50	210.69	0.73

22	224.58	1.06	46.3	0.36	0.52	2	0.00	35.0	138.24	6.17	197.84	0.73
23	224.94	0.92	46.3	0.31	0.45	2	0.00	35.0	119.19	0.00	190.90	0.73
24	225.25	1.45	48.0	0.50	0.75	2	0.00	35.0	188.56	0.00	183.04	0.73
25	225.75	1.42	48.0	0.50	0.75	2	0.00	35.0	184.97	0.00	179.55	0.73
26	226.25	1.34	49.7	0.48	0.75	2	0.00	35.0	174.27	0.00	169.64	0.73
27	226.74	1.30	49.7	0.48	0.75	2	0.00	35.0	168.74	0.00	164.19	0.73
28	227.22	1.20	51.4	0.47	0.75	2	0.00	35.0	156.51	0.00	152.85	0.73
29	227.69	1.15	51.4	0.47	0.75	2	0.00	35.0	149.30	0.00	145.87	0.73
30	228.15	1.04	53.1	0.45	0.75	2	0.00	35.0	135.81	0.00	133.30	0.74
31	228.60	0.98	53.1	0.45	0.75	2	0.00	35.0	127.05	0.00	124.65	0.74
32	229.05	0.87	54.8	0.43	0.75	2	0.00	35.0	112.66	0.00	111.19	0.74
33	229.49	0.79	54.8	0.43	0.75	2	0.00	35.0	102.51	0.00	101.16	0.74
34	229.92	0.14	56.5	0.08	0.15	2	0.00	35.0	18.65	0.00	91.51	0.74
35	230.00	0.59	56.6	0.37	0.67	2	0.00	35.0	76.06	0.00	84.02	0.74
36	230.37	0.52	56.5	0.37	0.67	2	0.00	35.0	64.65	0.00	71.45	0.74
37	230.74	0.43	58.3	0.35	0.67	2	0.00	35.0	50.13	0.00	55.93	0.75
38	231.10	0.42	58.3	0.43	0.83	1	50.00	28.0	47.66	0.00	-0.07	0.88
39	231.53	0.31	60.0	0.47	0.94	1	50.00	28.0	35.12	0.00	-18.96	0.89
40	232.00	0.07	60.0	0.28	0.56	1	50.00	28.0	7.73	0.00	-39.94	0.89
		---			---				---			
	X-S Area:	40.30	Path Length:		28.47			X-S Weight:	5216.30			