



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

## MEMORANDUM

Date: January 12, 2021

To: Eric Scott; Division of Reclamation, Mining & Safety

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

Re: **Second Adequacy Review of Exhibit 6.5 – Geotechnical Stability  
Kilgore Companies, LLC dba Peak Materials; Peak Ranch Resource; File No. M-2020-041**

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The Division of Reclamation, Mining and Safety (Division/DRMS) reviewed the Geotechnical Stability Exhibit adequacy response submitted by Greg Lewicki and Associates, PLLC (Lewicki) on December 18, 2020 for the Peak Ranch Resource 112c permit application.

The following list describes the information used by the Division as presented in the permit application adequacy response to evaluate slope stability for the proposed site:

- Geotechnical boring and sampling data is not available for the site.
- Mining Areas North and South will be dry mined during Phase 1 with excavation stopping two feet above the typical seasonal high-water table.
- Mining Areas North and South will be wet mined during Phase 2 by a dragline to a maximum depth of 46 feet below grade in the north cell and 52 feet below grade in the south cell.
- Bedrock was encountered in three (3) exploration borings at depths of 62, 47 and 58 feet below grade.
- The typical soil profile consists of 0 to 6 inches of topsoil, 12 to 15 inches of overburden and bedrock at approximately 50 to 60 feet below grade.
- The soil strength parameters were derived from Table 2.5 in the SME Mining Reference Handbook
- The Applicant used the following soil parameters for the anticipated soil types;
  - Alluvial Material - 110 pcf, 45° friction angle, 0 psf cohesion
  - Overburden - 99 pcf, 34° friction angle, 0 psf cohesion
- A minimum 100 foot setback will be maintained from the top of excavation slope to the north and south property boundaries.
- A minimum 50 foot setback will be maintained from the top of excavation slope to the east and west property boundaries.



- A minimum 300 foot setback will be maintained from the top of excavation slope to the Blue River.
- The depth to groundwater ranged from 5.5 feet to 28.8 feet below grade in the five (5) groundwater wells (GW-1 through GW-5) install around the perimeter of the site.
- Groundwater is expected a seven (7) feet below grade.
- The final reclamation slopes will be created during mining at a 3H:1V slope to ten (10) feet below groundwater and at a 2H:1V slope from ten (10) feet below groundwater to the final depth. No backfilling will occur to create the final reclamation slopes.
- No dewatering will occur during the mining operation.
- No blasting will occur during the mining operation.

In accordance with Table 1 - Recommended Factors of Safety for Slope Stability Analysis for Operations and Reclamation within Section 30.4 of the Policies of the Mined Land Reclamation Board (MLRB) effective May 16, 2018, the Division will require the Applicant to comply with the factor of safety (FOS) of 1.5 for critical structures in static conditions since the Applicant utilized generalized strength measurements in the analysis.

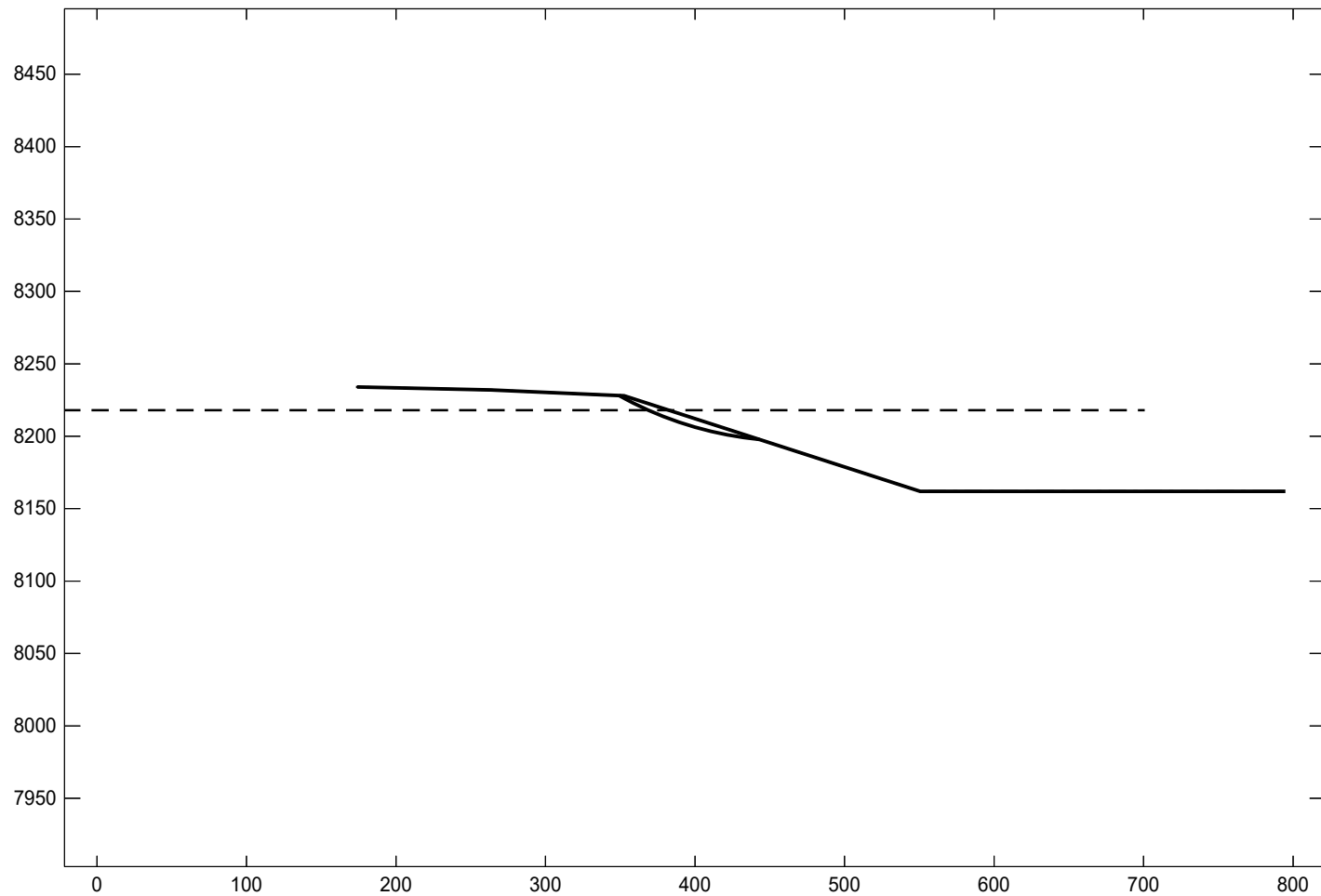
The Division duplicated the Operator's slope stability analysis using Clover Technologies Galena Slope Stability Analysis System, Version 7.2. A table of the Applicant's and the Division's analysis factor of safety (FOS) results are below:

| <b>Analysis Name</b>                                 | <b>Applicant's FOS</b> | <b>DRMS FOS</b> |
|------------------------------------------------------|------------------------|-----------------|
| 1 East side of affected area                         | 2.0                    | 2.80            |
| 2 East side of affected area                         | 2.2                    | 2.80            |
| 3 Northwest corner of affected area                  | 2.1                    | 2.11            |
| 4 Southeast corner of affected area                  | 2.0                    | 2.64            |
| 5 East side of affected area                         | 2.0                    | 2.20            |
| 6 West side of affected area, nearest the Blue River | 2.0                    | 2.02            |
| 7 Drainage easement bisecting property               | 2.0                    | 2.23            |
| 8 Closest area of USPS land                          | 3.9                    | 4.25            |

The Division accepts the Lewicki slope stability analysis as an alternative to the Operator obtaining agreements with all structure owners within 200-feet of the affected lands.

If the soils differ from the expected profiles, the Operator must contact the Division immediately and reevaluate the slope stability analysis based on the updated information. Please note any transgression from the proposed slope geometries will be considered a violation if the application is approved and issued by the Division. Copies of the Division's stability analysis model results are attached.

If you have any questions regarding these adequacy items, please contact me at [peter.hays@state.co.us](mailto:peter.hays@state.co.us) or (303) 866-3567, Ext. 8124.



**GALENA** Version 7.2

Analysis 1

Single Stability Analysis  
Method: Bishop Simplified  
Surface: Circular

Results

Factor of Safety: 2.80

Edited: 12 Jan 2021 Processed: 12 Jan 2021

Project Peak Ranch Resource  
Geotechnical Stability Analysis

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**Dept of the Interior - Office of Surface Mining**

Project: Peak Ranch Resource  
 File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Peak Ranch M2020041\...\Peak Ranch 1 Ad DRMS.gmf  
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## DATA: Analysis 1 - Geotechnical Stability Analysis

## 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 (11 points) Material beneath: 2 - Loose sand, mixed grain size

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 0.00   | 8234.00 | 5.21   | 8234.00 | 90.56  | 8234.00 | 106.53 | 8236.00 | 158.60 | 8236.00 |
| 174.09 | 8234.00 | 263.55 | 8232.00 | 306.41 | 8230.00 | 352.53 | 8228.00 | 712.73 | 8228.00 |
| 800.00 | 8228.00 |        |         |        |         |        |         |        |         |

Profile: 2 (11 points) Material beneath: 1 - Sand and gravel, mixed grain size

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 0.00   | 8232.50 | 5.21   | 8232.50 | 90.65  | 8232.50 | 106.63 | 8234.50 | 158.51 | 8234.50 |
| 173.98 | 8232.50 | 263.50 | 8230.50 | 306.34 | 8228.50 | 352.47 | 8226.50 | 712.66 | 8226.50 |
| 800.00 | 8226.50 |        |         |        |         |        |         |        |         |

## Slope Surface (7 points)

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 174.09 | 8234.00 | 263.55 | 8232.00 | 306.41 | 8230.00 | 336.00 | 8228.70 | 352.53 | 8228.00 |
| 550.53 | 8162.00 | 794.70 | 8162.00 |        |         |        |         |        |         |

## Phreatic Surface (2 points)

|         |         |        |         |
|---------|---------|--------|---------|
| -200.00 | 8218.00 | 700.00 | 8218.00 |
|---------|---------|--------|---------|

## Failure Surface

Circular surface defined by: XL, XR, R

|             |     |        |     |         |         |        |        |         |
|-------------|-----|--------|-----|---------|---------|--------|--------|---------|
| Intersects: | XL: | 349.15 | YL: | 8228.14 | XR:     | 443.00 | YR:    | 8197.84 |
| Centre:     | XC: | 466.71 | YC: | 8431.78 | Radius: | R:     | 235.13 |         |

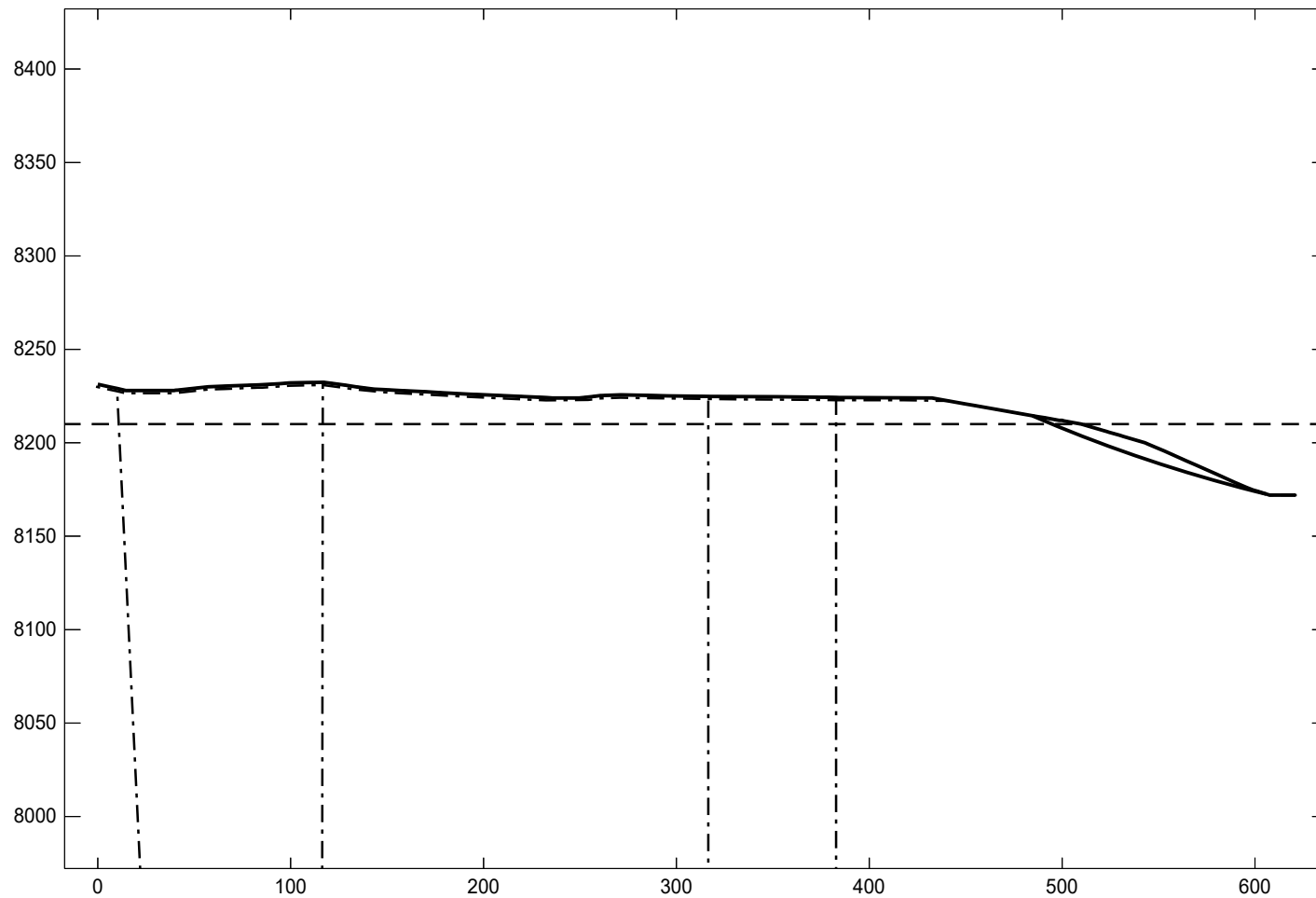
## RESULTS: Analysis 1 - Geotechnical Stability Analysis

## Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 2.80

## Slice Geometry and Properties (42 slices)

| Slice     | X-Left | X-S Area | Angle        | Width | Base Length | Matl        | Cohesion | Phi      | Weight  | Porewater Force | Normal Stress | Test Factor |
|-----------|--------|----------|--------------|-------|-------------|-------------|----------|----------|---------|-----------------|---------------|-------------|
| 1         | 349.15 | 2.17     | 29.4         | 2.89  | 3.31        | 2           | 0.00     | 34.0     | 214.77  | 0.00            | 65.48         | 1.01        |
| 2         | 352.04 | 0.70     | 29.3         | 0.43  | 0.49        | 1           | 0.00     | 45.0     | 69.44   | 0.00            | 134.16        | 0.96        |
| 3         | 352.47 | 2.33     | 29.4         | 1.24  | 1.42        | 1           | 0.00     | 45.0     | 238.83  | 0.00            | 160.71        | 0.96        |
| 4         | 353.71 | 3.65     | 28.1         | 1.66  | 1.88        | 1           | 0.00     | 45.0     | 385.79  | 0.00            | 195.07        | 0.95        |
| 5         | 355.37 | 4.20     | 28.1         | 1.66  | 1.88        | 1           | 0.00     | 45.0     | 456.77  | 0.00            | 230.96        | 0.95        |
| 6         | 357.03 | 3.64     | 28.1         | 1.29  | 1.46        | 1           | 0.00     | 45.0     | 400.92  | 0.00            | 260.84        | 0.95        |
| 7         | 358.32 | 7.36     | 26.8         | 2.33  | 2.61        | 1           | 0.00     | 45.0     | 809.41  | 0.00            | 293.89        | 0.95        |
| 8         | 360.65 | 8.29     | 26.8         | 2.33  | 2.61        | 1           | 0.00     | 45.0     | 912.45  | 0.00            | 331.25        | 0.95        |
| 9         | 362.99 | 9.26     | 25.6         | 2.36  | 2.61        | 1           | 0.00     | 45.0     | 1018.80 | 0.00            | 368.89        | 0.95        |
| 10        | 365.35 | 10.07    | 25.5         | 2.36  | 2.61        | 1           | 0.00     | 45.0     | 1107.23 | 0.00            | 400.97        | 0.95        |
| 11        | 367.71 | 5.03     | 24.3         | 1.12  | 1.23        | 1           | 0.00     | 45.0     | 553.84  | 0.00            | 426.70        | 0.94        |
| 12        | 368.82 | 8.53     | 24.3         | 1.82  | 2.00        | 1           | 0.00     | 45.0     | 938.43  | 51.34           | 446.63        | 0.94        |
| 13        | 370.65 | 8.92     | 24.3         | 1.82  | 2.00        | 1           | 0.00     | 45.0     | 981.37  | 154.03          | 474.00        | 0.94        |
| 14        | 372.47 | 12.29    | 23.0         | 2.41  | 2.61        | 1           | 0.00     | 45.0     | 1351.99 | 351.60          | 505.56        | 0.94        |
| 15        | 374.88 | 12.82    | 23.0         | 2.41  | 2.61        | 1           | 0.00     | 45.0     | 1409.67 | 518.16          | 534.70        | 0.94        |
| 16        | 377.29 | 13.39    | 21.7         | 2.43  | 2.61        | 1           | 0.00     | 45.0     | 1472.97 | 680.36          | 563.30        | 0.94        |
| 17        | 379.72 | 13.78    | 21.7         | 2.43  | 2.61        | 1           | 0.00     | 45.0     | 1515.26 | 838.27          | 586.05        | 0.94        |
| 18        | 382.15 | 2.21     | 20.5         | 0.38  | 0.41        | 1           | 0.00     | 45.0     | 243.40  | 145.75          | 600.65        | 0.94        |
| 19        | 382.53 | 13.12    | 20.4         | 2.26  | 2.41        | 1           | 0.00     | 45.0     | 1442.86 | 929.93          | 630.07        | 0.94        |
| 20        | 384.79 | 13.32    | 20.4         | 2.26  | 2.41        | 1           | 0.00     | 45.0     | 1464.93 | 1056.64         | 686.30        | 0.94        |
| 21        | 387.05 | 14.72    | 19.2         | 2.47  | 2.61        | 1           | 0.00     | 45.0     | 1619.10 | 1285.13         | 743.91        | 0.94        |
| 22        | 389.52 | 14.81    | 19.2         | 2.47  | 2.61        | 1           | 0.00     | 45.0     | 1628.92 | 1425.34         | 799.06        | 0.94        |
| 23        | 391.98 | 14.93    | 17.9         | 2.49  | 2.61        | 1           | 0.00     | 45.0     | 1642.21 | 1560.69         | 853.06        | 0.94        |
| 24        | 394.47 | 14.87    | 17.9         | 2.49  | 2.61        | 1           | 0.00     | 45.0     | 1635.28 | 1692.03         | 902.09        | 0.94        |
| 25        | 396.96 | 14.83    | 16.6         | 2.51  | 2.61        | 1           | 0.00     | 45.0     | 1630.96 | 1818.46         | 950.05        | 0.94        |
| 26        | 399.47 | 14.61    | 16.6         | 2.51  | 2.61        | 1           | 0.00     | 45.0     | 1606.74 | 1940.51         | 992.95        | 0.94        |
| 27        | 401.97 | 14.40    | 15.3         | 2.52  | 2.61        | 1           | 0.00     | 45.0     | 1584.22 | 2057.77         | 1034.72       | 0.94        |
| 28        | 404.49 | 14.03    | 15.3         | 2.52  | 2.61        | 1           | 0.00     | 45.0     | 1543.05 | 2170.57         | 1071.43       | 0.94        |
| 29        | 407.01 | 13.66    | 14.1         | 2.54  | 2.61        | 1           | 0.00     | 45.0     | 1502.25 | 2279.07         | 1106.92       | 0.95        |
| 30        | 409.55 | 13.12    | 14.1         | 2.54  | 2.61        | 1           | 0.00     | 45.0     | 1443.38 | 2382.61         | 1137.31       | 0.95        |
| 31        | 412.09 | 12.58    | 12.8         | 2.55  | 2.61        | 1           | 0.00     | 45.0     | 1383.70 | 2481.70         | 1166.39       | 0.95        |
| 32        | 414.64 | 11.89    | 12.8         | 2.55  | 2.61        | 1           | 0.00     | 45.0     | 1308.11 | 2576.34         | 1190.72       | 0.95        |
| 33        | 417.19 | 11.18    | 11.5         | 2.56  | 2.61        | 1           | 0.00     | 45.0     | 1229.35 | 2666.23         | 1213.29       | 0.95        |
| 34        | 419.75 | 10.33    | 11.5         | 2.56  | 2.61        | 1           | 0.00     | 45.0     | 1135.78 | 2751.32         | 1231.09       | 0.95        |
| 35        | 422.31 | 9.44     | 10.2         | 2.57  | 2.61        | 1           | 0.00     | 45.0     | 1038.11 | 2831.84         | 1247.12       | 0.95        |
| 36        | 424.88 | 8.43     | 10.2         | 2.57  | 2.61        | 1           | 0.00     | 45.0     | 927.00  | 2907.68         | 1258.57       | 0.95        |
| 37        | 427.46 | 7.37     | 9.0          | 2.58  | 2.61        | 1           | 0.00     | 45.0     | 810.39  | 2979.09         | 1267.88       | 0.96        |
| 38        | 430.04 | 6.20     | 9.0          | 2.58  | 2.61        | 1           | 0.00     | 45.0     | 681.66  | 3045.36         | 1272.89       | 0.96        |
| 39        | 432.62 | 4.96     | 7.7          | 2.59  | 2.61        | 1           | 0.00     | 45.0     | 546.09  | 3107.25         | 1275.40       | 0.96        |
| 40        | 435.21 | 3.63     | 7.7          | 2.59  | 2.61        | 1           | 0.00     | 45.0     | 399.69  | 3164.49         | 1273.96       | 0.96        |
| 41        | 437.80 | 2.24     | 6.4          | 2.60  | 2.61        | 1           | 0.00     | 45.0     | 245.88  | 3216.82         | 1269.76       | 0.97        |
| 42        | 440.40 | 0.74     | 6.4          | 2.60  | 2.61        | 1           | 0.00     | 45.0     | 81.77   | 3264.59         | 1261.70       | 0.97        |
| -----     |        |          |              |       |             |             |          |          |         |                 |               |             |
| X-S Area: |        | 388.02   | Path Length: |       | 99.36       | X-S Weight: |          | 42612.74 |         |                 |               |             |



**GALENA** Version 7.2

#### Analysis 1

Single Stability Analysis  
Method: Bishop Simplified  
Surface: Circular

#### Results

Factor of Safety: 2.80

Edited: 12 Jan 2021 Processed: 12 Jan 2021

Project Peak Ranch Resource - Section 2  
Geotechnical Stability Analysis

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**Dept of the Interior - Office of Surface Mining**

Project: Peak Ranch Resource - Section 2  
 File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Peak Ranch M2020041\...\Peak Ranch 2 Ad DRMS.gmf  
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## DATA: Analysis 1 - Geotechnical Stability Analysis

## Material Properties (2 materials)

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

Cohesion 0.00  
 Phi 45.0  
 UnitWeight 110.00  
 Ru Auto

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

Cohesion 0.00  
 Phi 34.0  
 UnitWeight 99.00  
 Ru Auto

## Water Properties

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

## Material Profiles (2 profiles)

Profile: 1 (80 points) Material beneath: 2 - Loose sand, mixed grain size

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 0.00   | 8231.32 | 5.88   | 8230.00 | 9.98   | 8229.08 | 14.53  | 8228.00 | 39.62  | 8228.00 |
| 40.31  | 8228.11 | 41.61  | 8228.24 | 57.22  | 8230.00 | 65.43  | 8230.27 | 69.21  | 8230.41 |
| 77.81  | 8230.82 | 81.32  | 8230.94 | 82.85  | 8230.98 | 83.83  | 8230.97 | 85.13  | 8230.99 |
| 99.29  | 8232.00 | 106.22 | 8232.16 | 116.70 | 8232.39 | 117.24 | 8232.36 | 119.64 | 8232.00 |
| 128.39 | 8230.84 | 133.76 | 8230.00 | 142.70 | 8228.77 | 143.69 | 8228.71 | 148.58 | 8228.48 |
| 156.63 | 8228.00 | 170.03 | 8227.29 | 178.59 | 8226.80 | 193.32 | 8226.00 | 199.41 | 8225.73 |
| 218.10 | 8224.86 | 232.49 | 8224.22 | 235.64 | 8224.00 | 249.56 | 8224.00 | 254.07 | 8224.45 |
| 256.14 | 8224.69 | 260.52 | 8225.22 | 270.95 | 8225.63 | 271.88 | 8225.62 | 279.06 | 8225.48 |
| 283.96 | 8225.37 | 290.14 | 8225.23 | 302.51 | 8224.98 | 316.57 | 8224.81 | 327.32 | 8224.75 |
| 335.81 | 8224.70 | 341.16 | 8224.67 | 353.76 | 8224.58 | 374.79 | 8224.41 | 378.91 | 8224.34 |
| 382.78 | 8224.26 | 384.51 | 8224.25 | 387.29 | 8224.22 | 388.44 | 8224.19 | 391.55 | 8224.24 |
| 433.78 | 8224.00 | 434.39 | 8224.00 | 434.44 | 8223.98 | 434.66 | 8223.98 | 439.83 | 8223.98 |
| 457.58 | 8223.98 | 458.08 | 8224.00 | 461.34 | 8224.00 | 530.79 | 8224.65 | 531.41 | 8224.65 |
| 532.68 | 8224.66 | 551.60 | 8224.74 | 551.96 | 8224.74 | 552.60 | 8224.75 | 554.39 | 8224.77 |
| 556.14 | 8224.79 | 561.28 | 8225.09 | 564.03 | 8225.10 | 565.26 | 8225.10 | 569.01 | 8224.98 |
| 569.68 | 8224.96 | 612.03 | 8224.52 | 614.72 | 8224.49 | 617.08 | 8224.47 | 621.00 | 8224.45 |

Profile: 2 (80 points) Material beneath: 1 - Sand and gravel, mixed grain size

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| -0.33  | 8229.86 | 5.55   | 8228.54 | 9.65   | 8227.62 | 14.36  | 8226.50 | 39.74  | 8226.50 |
| 40.50  | 8226.63 | 41.77  | 8226.75 | 57.33  | 8228.50 | 65.48  | 8228.77 | 69.27  | 8228.91 |
| 77.87  | 8229.32 | 81.36  | 8229.44 | 82.86  | 8229.48 | 83.84  | 8229.47 | 85.20  | 8229.49 |
| 99.36  | 8230.50 | 106.25 | 8230.66 | 116.66 | 8230.89 | 117.08 | 8230.87 | 119.43 | 8230.51 |
| 128.17 | 8229.35 | 133.54 | 8228.52 | 148.50 | 8226.98 | 156.54 | 8226.50 | 169.95 | 8225.79 |
| 178.51 | 8225.30 | 193.25 | 8224.50 | 218.03 | 8223.36 | 232.40 | 8222.72 | 254.23 | 8222.96 |
| 256.32 | 8223.20 | 260.64 | 8223.72 | 270.98 | 8224.13 | 279.03 | 8223.98 | 336.77 | 8223.19 |
| 341.15 | 8223.17 | 353.75 | 8223.08 | 374.77 | 8222.91 | 378.88 | 8222.84 | 382.76 | 8222.76 |
| 384.49 | 8222.75 | 385.92 | 8222.74 | 387.26 | 8222.72 | 388.42 | 8222.69 | 389.79 | 8222.68 |
| 389.81 | 8222.74 | 391.55 | 8222.74 | 411.99 | 8222.78 | 414.38 | 8222.80 | 415.03 | 8222.80 |
| 417.70 | 8222.78 | 433.76 | 8222.50 | 434.10 | 8222.50 | 434.13 | 8222.49 | 434.64 | 8222.48 |
| 439.83 | 8222.48 | 457.60 | 8222.48 | 458.11 | 8222.50 | 461.35 | 8222.50 | 530.80 | 8223.15 |
| 531.42 | 8223.15 | 532.69 | 8223.16 | 551.60 | 8223.24 | 551.97 | 8223.24 | 552.61 | 8223.25 |
| 554.41 | 8223.27 | 556.16 | 8223.29 | 556.67 | 8223.30 | 561.33 | 8223.59 | 564.03 | 8223.60 |
| 565.23 | 8223.60 | 566.58 | 8223.55 | 568.97 | 8223.48 | 569.66 | 8223.46 | 576.62 | 8223.38 |
| 607.06 | 8223.09 | 612.01 | 8223.02 | 614.71 | 8222.99 | 617.07 | 8222.97 | 620.99 | 8222.95 |

Slope Surface (104 points)

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 0.00   | 8231.32 | 5.88   | 8230.00 | 9.98   | 8229.08 | 14.53  | 8228.00 | 39.62  | 8228.00 |
| 40.31  | 8228.11 | 41.61  | 8228.24 | 57.22  | 8230.00 | 65.43  | 8230.27 | 69.21  | 8230.41 |
| 77.81  | 8230.82 | 81.32  | 8230.94 | 82.85  | 8230.98 | 83.83  | 8230.97 | 85.13  | 8230.99 |
| 99.29  | 8232.00 | 106.22 | 8232.16 | 116.70 | 8232.39 | 117.24 | 8232.36 | 119.64 | 8232.00 |
| 128.39 | 8230.84 | 133.76 | 8230.00 | 142.70 | 8228.77 | 143.69 | 8228.71 | 148.58 | 8228.48 |
| 156.63 | 8228.00 | 170.03 | 8227.29 | 178.59 | 8226.80 | 193.32 | 8226.00 | 199.41 | 8225.73 |
| 218.10 | 8224.86 | 232.49 | 8224.22 | 235.64 | 8224.00 | 249.56 | 8224.00 | 254.07 | 8224.45 |
| 256.14 | 8224.69 | 260.52 | 8225.22 | 270.95 | 8225.63 | 271.88 | 8225.62 | 279.06 | 8225.48 |
| 283.96 | 8225.37 | 290.14 | 8225.23 | 302.51 | 8224.98 | 316.57 | 8224.81 | 327.32 | 8224.75 |
| 335.81 | 8224.70 | 336.78 | 8224.69 | 341.16 | 8224.67 | 353.76 | 8224.58 | 374.79 | 8224.41 |
| 378.91 | 8224.34 | 382.78 | 8224.26 | 384.51 | 8224.25 | 385.94 | 8224.24 | 387.29 | 8224.22 |
| 388.44 | 8224.19 | 388.80 | 8224.19 | 388.82 | 8224.24 | 432.14 | 8223.96 | 432.54 | 8223.95 |
| 443.32 | 8222.00 | 449.84 | 8220.80 | 454.38 | 8220.00 | 476.25 | 8216.00 | 483.29 | 8214.71 |
| 487.22 | 8214.00 | 490.89 | 8213.41 | 498.38 | 8212.00 | 499.98 | 8212.00 | 501.04 | 8211.71 |
| 509.96 | 8210.00 | 516.56 | 8208.00 | 523.18 | 8206.00 | 524.36 | 8205.63 | 529.89 | 8204.00 |
| 531.82 | 8203.38 | 538.64 | 8201.30 | 542.94 | 8200.00 | 544.85 | 8199.13 | 547.42 | 8198.00 |
| 549.07 | 8197.26 | 552.08 | 8196.00 | 556.45 | 8194.00 | 558.56 | 8192.97 | 560.73 | 8192.00 |
| 562.85 | 8191.04 | 565.12 | 8190.00 | 567.70 | 8188.83 | 569.64 | 8188.00 | 571.77 | 8186.98 |
| 573.98 | 8186.00 | 576.41 | 8184.83 | 578.26 | 8184.00 | 579.42 | 8183.47 | 582.84 | 8182.00 |
| 586.30 | 8180.33 | 587.02 | 8180.00 | 591.40 | 8178.00 | 595.25 | 8176.16 | 599.05 | 8174.75 |
| 601.55 | 8174.00 | 606.59 | 8172.32 | 607.56 | 8172.00 | 621.00 | 8172.00 |        |         |

Phreatic Surface (3 points)

|         |         |        |         |        |         |
|---------|---------|--------|---------|--------|---------|
| -200.00 | 8210.00 | 875.00 | 8210.00 | 950.00 | 8210.00 |
|---------|---------|--------|---------|--------|---------|

Failure Surface

|                                      |         |        |        |         |         |        |         |           |
|--------------------------------------|---------|--------|--------|---------|---------|--------|---------|-----------|
| Circular surface defined by: XL,XR,R |         |        |        |         |         |        |         |           |
| Intersects:                          | XL:     | 484.58 | YL:    | 8214.48 | XR:     | 605.78 | YR:     | 8172.59   |
|                                      | Centre: | XC:    | 785.00 | YC:     | 8887.47 |        | Radius: | R: 737.00 |

RESULTS: Analysis 1 - Geotechnical Stability Analysis

Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 2.80

Slice Geometry and Properties (56 slices)

| Slice | X-Left | X-S<br>Area | Angle | Width | Base<br>Length | Matl | Cohesion | Phi  | Weight  | Porewater<br>Force | Normal<br>Stress | Test<br>Factor |
|-------|--------|-------------|-------|-------|----------------|------|----------|------|---------|--------------------|------------------|----------------|
| 1     | 484.58 | 0.91        | 23.8  | 2.64  | 2.89           | 1    | 0.00     | 45.0 | 99.83   | 0.00               | 32.67            | 0.94           |
| 2     | 487.22 | 4.19        | 23.8  | 3.54  | 3.87           | 1    | 0.00     | 45.0 | 461.34  | 0.00               | 112.48           | 0.94           |
| 3     | 490.76 | 3.93        | 23.3  | 2.03  | 2.21           | 1    | 0.00     | 45.0 | 431.86  | 0.00               | 184.00           | 0.94           |
| 4     | 492.80 | 4.93        | 23.3  | 2.03  | 2.21           | 1    | 0.00     | 45.0 | 542.01  | 0.00               | 230.93           | 0.94           |
| 5     | 494.83 | 6.26        | 23.3  | 2.14  | 2.33           | 1    | 0.00     | 45.0 | 688.63  | 66.83              | 282.90           | 0.94           |
| 6     | 496.97 | 4.72        | 22.8  | 1.41  | 1.53           | 1    | 0.00     | 45.0 | 518.69  | 115.79             | 330.14           | 0.94           |
| 7     | 498.38 | 6.15        | 22.7  | 1.60  | 1.73           | 1    | 0.00     | 45.0 | 676.85  | 199.78             | 382.98           | 0.94           |
| 8     | 499.98 | 4.51        | 22.7  | 1.06  | 1.15           | 1    | 0.00     | 45.0 | 496.57  | 172.37             | 426.99           | 0.94           |
| 9     | 501.04 | 9.92        | 22.7  | 2.16  | 2.35           | 1    | 0.00     | 45.0 | 1090.68 | 450.83             | 463.41           | 0.94           |
| 10    | 503.20 | 16.16       | 22.2  | 3.13  | 3.38           | 1    | 0.00     | 45.0 | 1777.50 | 879.36             | 529.06           | 0.94           |
| 11    | 506.33 | 18.28       | 22.2  | 3.13  | 3.38           | 1    | 0.00     | 45.0 | 2010.69 | 1148.66            | 604.27           | 0.94           |
| 12    | 509.46 | 3.12        | 21.7  | 0.50  | 0.54           | 1    | 0.00     | 45.0 | 342.97  | 207.82             | 648.45           | 0.94           |
| 13    | 509.96 | 18.56       | 21.7  | 2.89  | 3.11           | 1    | 0.00     | 45.0 | 2041.43 | 1331.20            | 695.78           | 0.94           |

|    |        |       |      |      |      |   |      |      |         |         |         |      |
|----|--------|-------|------|------|------|---|------|------|---------|---------|---------|------|
| 14 | 512.85 | 19.35 | 21.7 | 2.89 | 3.11 | 1 | 0.00 | 45.0 | 2128.36 | 1554.25 | 778.90  | 0.94 |
| 15 | 515.74 | 5.64  | 21.2 | 0.82 | 0.88 | 1 | 0.00 | 45.0 | 620.34  | 480.52  | 832.80  | 0.94 |
| 16 | 516.56 | 19.24 | 21.2 | 2.74 | 2.94 | 1 | 0.00 | 45.0 | 2115.91 | 1729.69 | 882.21  | 0.94 |
| 17 | 519.30 | 19.88 | 21.2 | 2.74 | 2.94 | 1 | 0.00 | 45.0 | 2186.32 | 1924.59 | 958.18  | 0.94 |
| 18 | 522.04 | 8.44  | 20.6 | 1.14 | 1.22 | 1 | 0.00 | 45.0 | 928.94  | 853.82  | 1012.41 | 0.94 |
| 19 | 523.18 | 8.84  | 20.7 | 1.18 | 1.26 | 1 | 0.00 | 45.0 | 972.35  | 918.97  | 1042.86 | 0.94 |
| 20 | 524.36 | 30.81 | 20.6 | 4.00 | 4.28 | 1 | 0.00 | 45.0 | 3388.85 | 3378.50 | 1112.36 | 0.94 |
| 21 | 528.36 | 12.07 | 20.1 | 1.53 | 1.62 | 1 | 0.00 | 45.0 | 1327.59 | 1387.49 | 1187.06 | 0.94 |
| 22 | 529.89 | 15.46 | 20.1 | 1.93 | 2.06 | 1 | 0.00 | 45.0 | 1700.47 | 1836.58 | 1230.68 | 0.94 |
| 23 | 531.82 | 23.53 | 20.1 | 2.89 | 3.08 | 1 | 0.00 | 45.0 | 2588.34 | 2919.75 | 1291.32 | 0.94 |
| 24 | 534.71 | 32.74 | 19.6 | 3.93 | 4.17 | 1 | 0.00 | 45.0 | 3600.97 | 4276.69 | 1377.08 | 0.94 |
| 25 | 538.64 | 20.70 | 19.6 | 2.44 | 2.59 | 1 | 0.00 | 45.0 | 2276.90 | 2834.49 | 1454.73 | 0.94 |
| 26 | 541.08 | 16.03 | 19.1 | 1.86 | 1.97 | 1 | 0.00 | 45.0 | 1762.90 | 2253.75 | 1507.53 | 0.94 |
| 27 | 542.94 | 16.30 | 19.1 | 1.91 | 2.02 | 1 | 0.00 | 45.0 | 1793.31 | 2392.28 | 1545.46 | 0.94 |
| 28 | 544.85 | 21.36 | 19.1 | 2.57 | 2.72 | 1 | 0.00 | 45.0 | 2349.26 | 3350.34 | 1584.23 | 0.94 |
| 29 | 547.42 | 13.36 | 18.6 | 1.65 | 1.74 | 1 | 0.00 | 45.0 | 1469.57 | 2222.78 | 1621.28 | 0.94 |
| 30 | 549.07 | 23.71 | 18.5 | 3.01 | 3.17 | 1 | 0.00 | 45.0 | 2608.39 | 4209.28 | 1660.76 | 0.94 |
| 31 | 552.08 | 13.68 | 18.5 | 1.79 | 1.89 | 1 | 0.00 | 45.0 | 1505.16 | 2598.68 | 1700.96 | 0.94 |
| 32 | 553.87 | 18.99 | 18.0 | 2.58 | 2.71 | 1 | 0.00 | 45.0 | 2089.09 | 3854.55 | 1734.98 | 0.94 |
| 33 | 556.45 | 14.81 | 18.0 | 2.11 | 2.22 | 1 | 0.00 | 45.0 | 1629.22 | 3258.61 | 1767.94 | 0.94 |
| 34 | 558.56 | 11.71 | 18.0 | 1.74 | 1.83 | 1 | 0.00 | 45.0 | 1288.41 | 2753.94 | 1795.18 | 0.94 |
| 35 | 560.30 | 16.50 | 17.5 | 2.55 | 2.68 | 1 | 0.00 | 45.0 | 1815.15 | 4149.62 | 1826.94 | 0.94 |
| 36 | 562.85 | 13.90 | 17.5 | 2.27 | 2.38 | 1 | 0.00 | 45.0 | 1529.55 | 3802.82 | 1859.86 | 0.94 |
| 37 | 565.12 | 9.49  | 17.5 | 1.62 | 1.70 | 1 | 0.00 | 45.0 | 1044.15 | 2782.85 | 1886.39 | 0.94 |
| 38 | 566.74 | 5.43  | 17.0 | 0.96 | 1.00 | 1 | 0.00 | 45.0 | 597.05  | 1663.13 | 1904.38 | 0.94 |
| 39 | 567.70 | 10.63 | 17.0 | 1.94 | 2.03 | 1 | 0.00 | 45.0 | 1168.80 | 3425.06 | 1923.76 | 0.94 |
| 40 | 569.64 | 11.02 | 17.0 | 2.13 | 2.23 | 1 | 0.00 | 45.0 | 1212.12 | 3846.89 | 1949.48 | 0.94 |
| 41 | 571.77 | 7.02  | 17.0 | 1.44 | 1.50 | 1 | 0.00 | 45.0 | 772.09  | 2644.17 | 1971.16 | 0.94 |
| 42 | 573.21 | 3.66  | 16.4 | 0.77 | 0.81 | 1 | 0.00 | 45.0 | 402.86  | 1438.33 | 1985.88 | 0.94 |
| 43 | 573.98 | 10.81 | 16.4 | 2.43 | 2.53 | 1 | 0.00 | 45.0 | 1188.88 | 4589.81 | 2003.18 | 0.94 |
| 44 | 576.41 | 7.55  | 16.4 | 1.85 | 1.93 | 1 | 0.00 | 45.0 | 830.11  | 3570.46 | 2026.69 | 0.94 |
| 45 | 578.26 | 4.46  | 16.4 | 1.16 | 1.21 | 1 | 0.00 | 45.0 | 490.39  | 2271.92 | 2044.25 | 0.94 |
| 46 | 579.42 | 11.99 | 16.0 | 3.42 | 3.56 | 1 | 0.00 | 45.0 | 1318.37 | 6829.67 | 2071.34 | 0.94 |
| 47 | 582.84 | 9.79  | 15.9 | 3.35 | 3.48 | 1 | 0.00 | 45.0 | 1077.01 | 6889.62 | 2106.61 | 0.94 |
| 48 | 586.19 | 2.10  | 15.4 | 0.83 | 0.87 | 1 | 0.00 | 45.0 | 230.95  | 1745.02 | 2126.22 | 0.94 |
| 49 | 587.02 | 4.91  | 15.4 | 2.19 | 2.27 | 1 | 0.00 | 45.0 | 540.03  | 4640.61 | 2140.24 | 0.94 |
| 50 | 589.21 | 4.04  | 15.4 | 2.19 | 2.27 | 1 | 0.00 | 45.0 | 444.28  | 4726.02 | 2160.61 | 0.94 |
| 51 | 591.40 | 1.97  | 15.4 | 1.30 | 1.35 | 1 | 0.00 | 45.0 | 216.73  | 2849.55 | 2176.26 | 0.94 |
| 52 | 592.70 | 2.83  | 14.9 | 2.55 | 2.64 | 1 | 0.00 | 45.0 | 311.52  | 5650.01 | 2191.28 | 0.95 |
| 53 | 595.25 | 2.43  | 14.9 | 3.80 | 3.93 | 1 | 0.00 | 45.0 | 267.37  | 8631.64 | 2223.33 | 0.95 |
| 54 | 599.05 | 0.96  | 14.4 | 2.50 | 2.58 | 1 | 0.00 | 45.0 | 105.81  | 5799.03 | 2263.79 | 0.95 |
| 55 | 601.55 | 0.52  | 14.3 | 2.12 | 2.18 | 1 | 0.00 | 45.0 | 57.48   | 4985.63 | 2294.59 | 0.95 |
| 56 | 603.67 | 0.17  | 14.3 | 2.11 | 2.18 | 1 | 0.00 | 45.0 | 19.20   | 5059.13 | 2321.14 | 0.95 |

X-S Area:

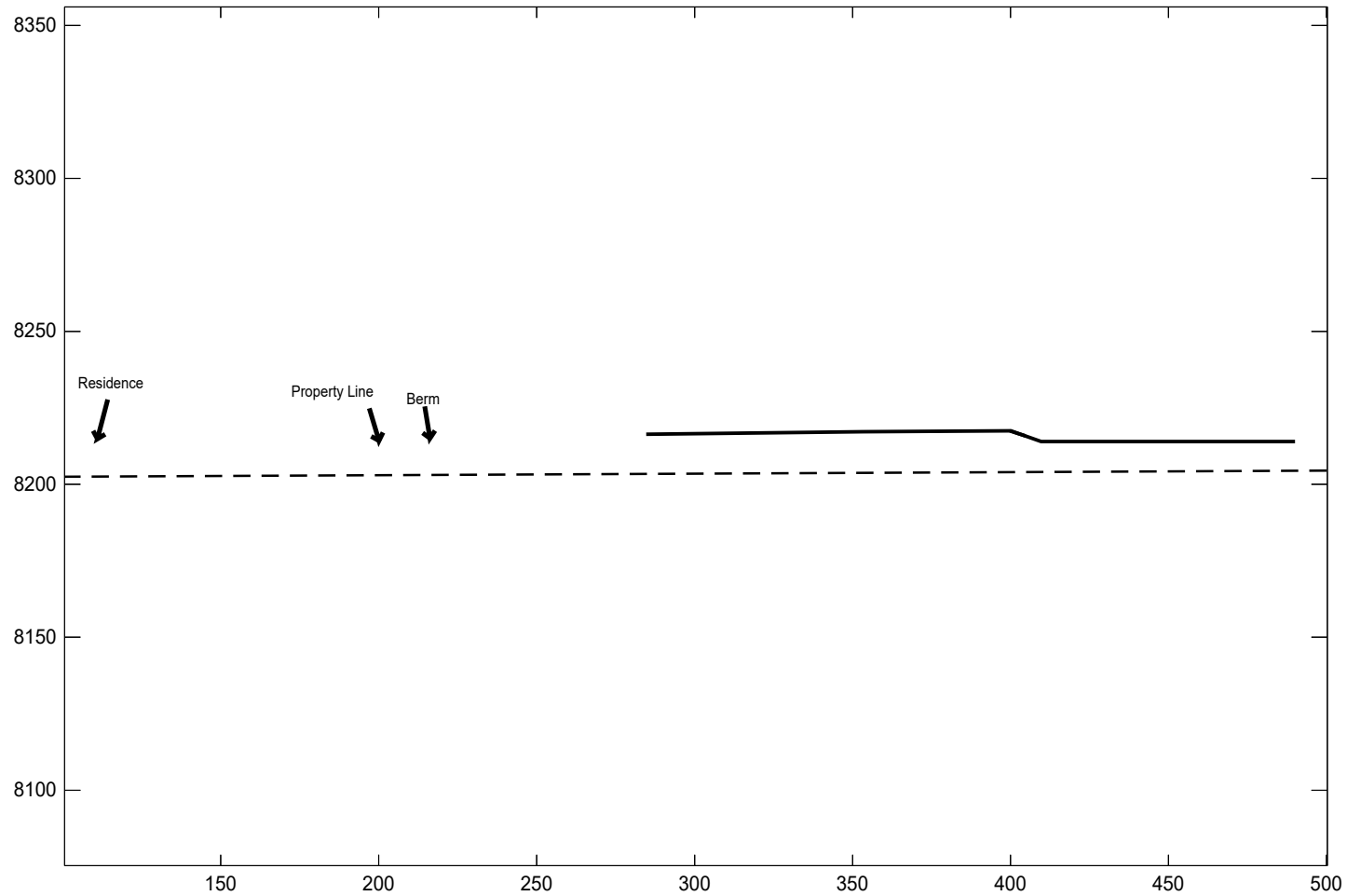
610.45

Path Length:

128.40

X-S Weight:

67149.62



Analysis 1  
Single Stability Analysis  
Method: Bishop Simplified  
Surface: Circular

Results  
Factor of Safety: 2.11

Edited: 12 Jan 2021 Processed: 12 Jan 2021

Project Peak Ranch Resource - Section 3  
Geotechnical Stability Analysis

File: G:\My Driv...\Peak Ranch 3 Ad DRMS.gmf

Dept of the Interior - Office of Surface Mining

Project: Peak Ranch Resource - Section 3  
 File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Peak Ranch M2020041\...\Peak Ranch 3 Ad DRMS.gmf  
 Processed: 12 Jan 2021 11:36:45

## DATA: Analysis 1 - Geotechnical Stability Analysis

## Material Properties (2 materials)

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

Cohesion 0.00 Phi 45.0 UnitWeight 110.00 Ru Auto

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

Cohesion 0.00 Phi 34.0 UnitWeight 99.00 Ru Auto

## Water Properties

Unit weight of water: 62.400

Unit weight of water/medium above ground: 62.400

## Material Profiles (2 profiles)

Profile: 1 (5 points) Material beneath: 2 - Loose sand, mixed grain size

110.87 8214.17 216.87 8215.55 284.77 8216.37 412.53 8218.00 489.97 8218.72

Profile: 2 (5 points) Material beneath: 1 - Sand and gravel, mixed grain size

110.89 8212.67 216.89 8214.05 284.78 8214.87 412.55 8216.50 489.99 8217.22

## Slope Surface (5 points)

284.69 8216.37 353.41 8217.18 400.09 8217.50 409.69 8214.00 489.97 8214.00

## Phreatic Surface (2 points)

0.00 8202.00 500.00 8204.50

## Failure Surface

Circular surface defined by: XL, XR, R

Intersects: XL: 399.77 YL: 8217.50 XR: 404.70 YR: 8215.82  
 Centre: XC: 483.16 YC: 8454.32 Radius: R: 251.07

## RESULTS: Analysis 1 - Geotechnical Stability Analysis

## Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 2.11

## Slice Geometry and Properties (40 slices)

| Slice | X-Left | X-S<br>Area | Angle | Width | Base<br>Length | Matl | Cohesion | Phi  | Weight | Porewater<br>Force | Normal<br>Stress | Test<br>Factor |
|-------|--------|-------------|-------|-------|----------------|------|----------|------|--------|--------------------|------------------|----------------|
| 1     | 399.77 | 0.00        | 19.1  | 0.13  | 0.14           | 2    | 0.00     | 34.0 | 0.29   | 0.00               | 2.00             | 0.95           |
| 2     | 399.90 | 0.01        | 19.5  | 0.13  | 0.14           | 2    | 0.00     | 34.0 | 0.89   | 0.00               | 6.16             | 0.95           |
| 3     | 400.03 | 0.01        | 19.3  | 0.06  | 0.06           | 2    | 0.00     | 34.0 | 0.63   | 0.00               | 9.21             | 0.95           |

|    |        |      |      |      |      |   |      |      |      |      |       |      |
|----|--------|------|------|------|------|---|------|------|------|------|-------|------|
| 4  | 400.09 | 0.01 | 19.6 | 0.10 | 0.10 | 2 | 0.00 | 34.0 | 1.12 | 0.00 | 10.15 | 0.95 |
| 5  | 400.19 | 0.01 | 19.1 | 0.10 | 0.10 | 2 | 0.00 | 34.0 | 1.10 | 0.00 | 10.01 | 0.95 |
| 6  | 400.29 | 0.01 | 19.1 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.41 | 0.00 | 9.83  | 0.95 |
| 7  | 400.42 | 0.01 | 19.1 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.39 | 0.00 | 9.66  | 0.95 |
| 8  | 400.55 | 0.01 | 19.1 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.36 | 0.00 | 9.48  | 0.95 |
| 9  | 400.68 | 0.01 | 19.5 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.34 | 0.00 | 9.29  | 0.95 |
| 10 | 400.81 | 0.01 | 18.7 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.31 | 0.00 | 9.16  | 0.95 |
| 11 | 400.93 | 0.01 | 19.1 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.28 | 0.00 | 8.88  | 0.95 |
| 12 | 401.06 | 0.01 | 19.1 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.24 | 0.00 | 8.62  | 0.95 |
| 13 | 401.19 | 0.01 | 19.1 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.21 | 0.00 | 8.44  | 0.95 |
| 14 | 401.32 | 0.01 | 19.1 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.18 | 0.00 | 8.18  | 0.95 |
| 15 | 401.45 | 0.01 | 18.7 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.14 | 0.00 | 7.94  | 0.95 |
| 16 | 401.58 | 0.01 | 19.1 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.12 | 0.00 | 7.75  | 0.95 |
| 17 | 401.71 | 0.01 | 19.1 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.08 | 0.00 | 7.48  | 0.95 |
| 18 | 401.84 | 0.01 | 18.7 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 1.04 | 0.00 | 7.24  | 0.95 |
| 19 | 401.97 | 0.01 | 18.7 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 0.99 | 0.00 | 6.89  | 0.95 |
| 20 | 402.10 | 0.01 | 19.1 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 0.97 | 0.00 | 6.70  | 0.95 |
| 21 | 402.23 | 0.01 | 18.7 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 0.93 | 0.00 | 6.45  | 0.95 |
| 22 | 402.36 | 0.01 | 18.7 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 0.89 | 0.00 | 6.19  | 0.95 |
| 23 | 402.49 | 0.01 | 18.7 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 0.85 | 0.00 | 5.93  | 0.95 |
| 24 | 402.62 | 0.01 | 18.7 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 0.79 | 0.00 | 5.50  | 0.95 |
| 25 | 402.75 | 0.01 | 18.7 | 0.13 | 0.14 | 2 | 0.00 | 34.0 | 0.77 | 0.00 | 5.32  | 0.95 |
| 26 | 402.88 | 0.01 | 18.3 | 0.14 | 0.15 | 2 | 0.00 | 34.0 | 0.77 | 0.00 | 4.90  | 0.95 |
| 27 | 403.02 | 0.01 | 18.7 | 0.12 | 0.12 | 1 | 0.00 | 45.0 | 0.63 | 0.00 | 4.61  | 0.91 |
| 28 | 403.14 | 0.00 | 19.7 | 0.02 | 0.02 | 1 | 0.00 | 45.0 | 0.12 | 0.00 | 4.55  | 0.91 |
| 29 | 403.16 | 0.01 | 18.6 | 0.12 | 0.13 | 1 | 0.00 | 45.0 | 0.61 | 0.00 | 4.45  | 0.91 |
| 30 | 403.28 | 0.01 | 18.6 | 0.12 | 0.13 | 1 | 0.00 | 45.0 | 0.58 | 0.00 | 4.17  | 0.91 |
| 31 | 403.40 | 0.01 | 18.7 | 0.13 | 0.14 | 1 | 0.00 | 45.0 | 0.57 | 0.00 | 3.80  | 0.91 |
| 32 | 403.53 | 0.00 | 18.3 | 0.13 | 0.14 | 1 | 0.00 | 45.0 | 0.53 | 0.00 | 3.53  | 0.91 |
| 33 | 403.66 | 0.00 | 18.3 | 0.13 | 0.14 | 1 | 0.00 | 45.0 | 0.46 | 0.00 | 3.06  | 0.91 |
| 34 | 403.79 | 0.00 | 18.3 | 0.13 | 0.14 | 1 | 0.00 | 45.0 | 0.40 | 0.00 | 2.69  | 0.91 |
| 35 | 403.92 | 0.00 | 18.3 | 0.13 | 0.14 | 1 | 0.00 | 45.0 | 0.34 | 0.00 | 2.23  | 0.91 |
| 36 | 404.05 | 0.00 | 18.7 | 0.13 | 0.14 | 1 | 0.00 | 45.0 | 0.29 | 0.00 | 1.94  | 0.91 |
| 37 | 404.18 | 0.00 | 18.3 | 0.13 | 0.14 | 1 | 0.00 | 45.0 | 0.22 | 0.00 | 1.49  | 0.91 |
| 38 | 404.31 | 0.00 | 18.3 | 0.13 | 0.14 | 1 | 0.00 | 45.0 | 0.15 | 0.00 | 1.02  | 0.91 |
| 39 | 404.44 | 0.00 | 18.3 | 0.13 | 0.14 | 1 | 0.00 | 45.0 | 0.10 | 0.00 | 0.65  | 0.91 |
| 40 | 404.57 | 0.00 | 18.3 | 0.13 | 0.14 | 1 | 0.00 | 45.0 | 0.03 | 0.00 | 0.19  | 0.91 |

X-S Area:

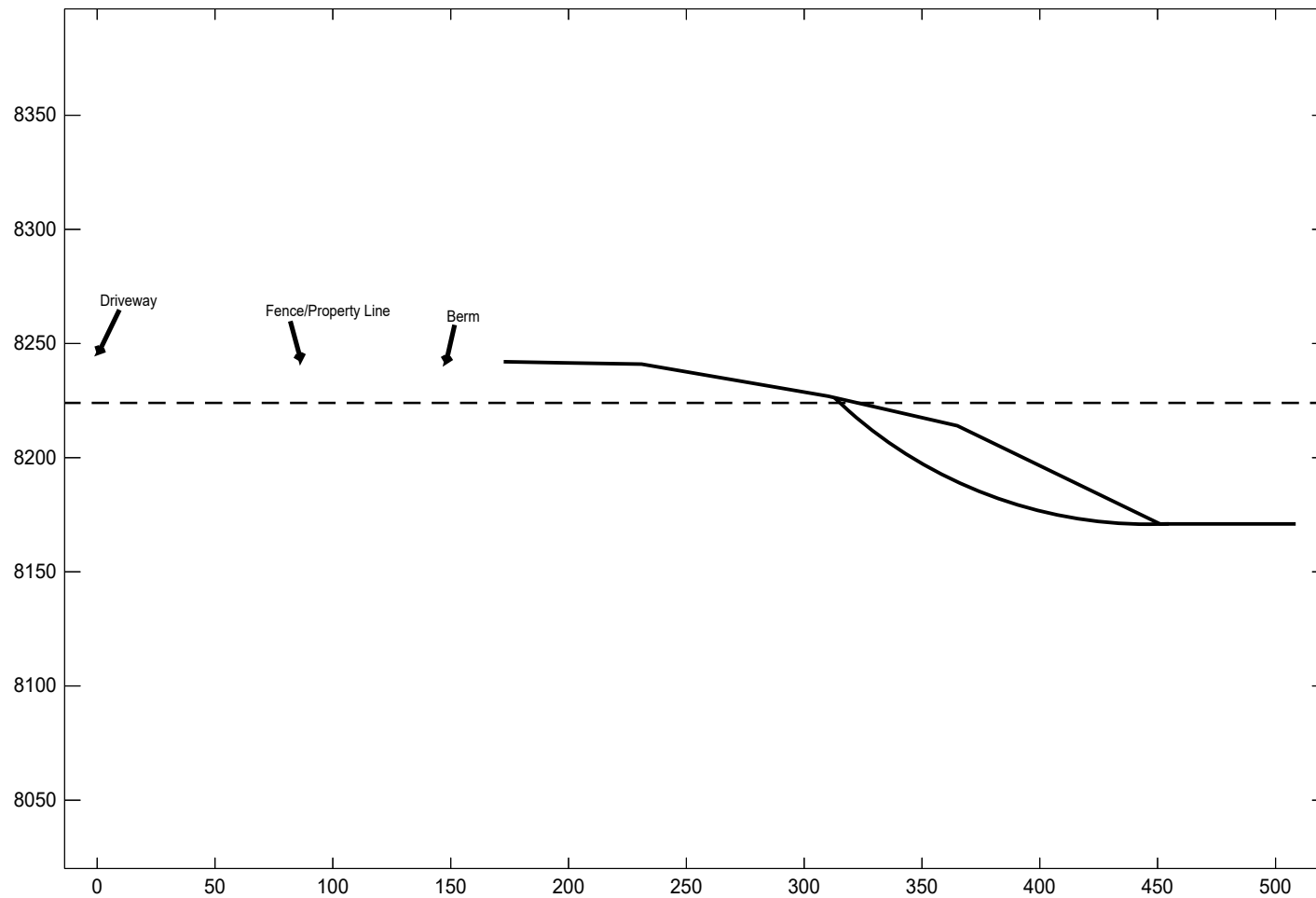
-----  
0.32

Path Length:

-----  
5.21

X-S Weight:

-----  
32.11



**GALENA** Version 7.2

Analysis 1

Single Stability Analysis  
Method: Bishop Simplified  
Surface: Circular

Results

Factor of Safety: 2.64

Edited: 12 Jan 2021 Processed: 12 Jan 2021

Project Peak Ranch Resource - Section 4  
Geotechnical Stability Analysis

File: G:\My Driv...\Peak Ranch 4 Ad DRMS.gmf

**Dept of the Interior - Office of Surface Mining**

Project: Peak Ranch Resource - Section 4  
 File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Peak Ranch M2020041\...\Peak Ranch 4 Ad DRMS.gmf  
 Processed: 12 Jan 2021 11:45:13

## DATA: Analysis 1 - Geotechnical Stability Analysis

## 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 (5 points) Material beneath: 2 - Loose sand, mixed grain size

|      |         |       |         |        |         |        |         |        |         |
|------|---------|-------|---------|--------|---------|--------|---------|--------|---------|
| 0.00 | 8245.81 | 99.23 | 8243.66 | 200.00 | 8241.47 | 300.00 | 8240.00 | 508.50 | 8236.52 |
|------|---------|-------|---------|--------|---------|--------|---------|--------|---------|

Profile: 2 (5 points) Material beneath: 1 - Sand and gravel, mixed grain size

|       |         |       |         |        |         |        |         |        |         |
|-------|---------|-------|---------|--------|---------|--------|---------|--------|---------|
| -0.03 | 8244.31 | 99.20 | 8242.16 | 199.97 | 8239.97 | 299.98 | 8238.50 | 508.48 | 8235.02 |
|-------|---------|-------|---------|--------|---------|--------|---------|--------|---------|

## Slope Surface (7 points)

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 172.48 | 8242.00 | 200.00 | 8241.47 | 231.03 | 8241.00 | 310.16 | 8226.93 | 365.00 | 8214.00 |
| 451.00 | 8171.00 | 508.50 | 8171.00 |        |         |        |         |        |         |

## Phreatic Surface (2 points)

|         |         |        |         |
|---------|---------|--------|---------|
| -200.00 | 8224.00 | 700.00 | 8224.00 |
|---------|---------|--------|---------|

## Failure Surface

Circular surface defined by: XL, XR, R

|                 |        |     |         |            |        |     |         |
|-----------------|--------|-----|---------|------------|--------|-----|---------|
| Intersects: XL: | 312.85 | YL: | 8226.30 | XR:        | 454.71 | YR: | 8171.00 |
| Centre: XC:     | 446.73 | YC: | 8360.13 | Radius: R: |        |     | 189.30  |

## RESULTS: Analysis 1 - Geotechnical Stability Analysis

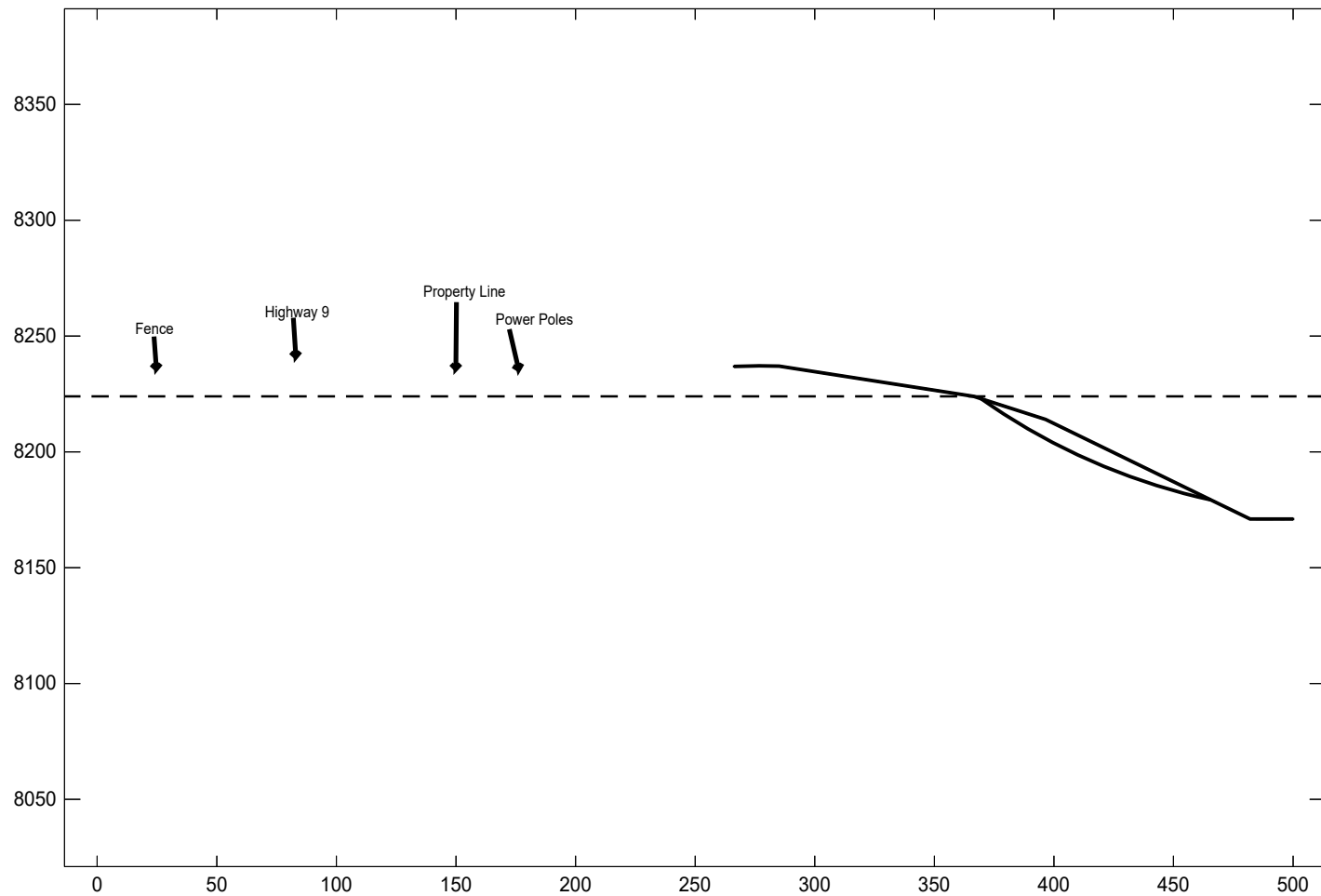
## Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 2.64

## Slice Geometry and Properties (39 slices)

| Slice | X-Left | X-S   | Area | Angle | Width | Length | Base | Matl | Cohesion | Phi    | Weight | PoreWater Force | Normal Stress | Test Factor |
|-------|--------|-------|------|-------|-------|--------|------|------|----------|--------|--------|-----------------|---------------|-------------|
| 1     | 312.85 | 2.07  | 43.8 | 2.40  | 3.32  | 1      | 0.00 | 45.0 | 227.94   | 0.00   | 69.74  | 1.02            |               |             |
| 2     | 315.25 | 10.72 | 43.8 | 3.56  | 4.93  | 1      | 0.00 | 45.0 | 1179.59  | 523.57 | 271.50 | 1.02            |               |             |

|           |         |              |      |        |             |   |           |      |          |          |         |      |
|-----------|---------|--------------|------|--------|-------------|---|-----------|------|----------|----------|---------|------|
| 3         | 318.81  | 20.83        | 41.3 | 3.78   | 5.03        | 1 | 0.00      | 45.0 | 2291.38  | 1589.47  | 533.75  | 1.00 |
| 4         | 322.59  | 18.14        | 41.3 | 2.42   | 3.22        | 1 | 0.00      | 45.0 | 1995.28  | 1563.05  | 753.65  | 1.00 |
| 5         | 325.00  | 29.54        | 38.8 | 3.21   | 4.12        | 1 | 0.00      | 45.0 | 3248.88  | 2608.09  | 967.74  | 0.98 |
| 6         | 328.22  | 35.40        | 38.8 | 3.21   | 4.12        | 1 | 0.00      | 45.0 | 3893.92  | 3272.41  | 1195.42 | 0.98 |
| 7         | 331.43  | 42.39        | 36.3 | 3.32   | 4.12        | 1 | 0.00      | 45.0 | 4662.80  | 3918.36  | 1425.15 | 0.97 |
| 8         | 334.76  | 47.89        | 36.3 | 3.32   | 4.12        | 1 | 0.00      | 45.0 | 5268.11  | 4546.03  | 1639.01 | 0.97 |
| 9         | 338.08  | 54.76        | 33.8 | 3.43   | 4.12        | 1 | 0.00      | 45.0 | 6023.43  | 5154.53  | 1856.85 | 0.96 |
| 10        | 341.51  | 59.84        | 33.8 | 3.43   | 4.12        | 1 | 0.00      | 45.0 | 6582.66  | 5743.95  | 2056.13 | 0.96 |
| 11        | 344.94  | 66.45        | 31.3 | 3.52   | 4.12        | 1 | 0.00      | 45.0 | 7309.86  | 6314.36  | 2261.05 | 0.95 |
| 12        | 348.46  | 71.07        | 31.3 | 3.52   | 4.12        | 1 | 0.00      | 45.0 | 7817.41  | 6865.05  | 2445.29 | 0.95 |
| 13        | 351.98  | 77.29        | 28.8 | 3.61   | 4.12        | 1 | 0.00      | 45.0 | 8502.02  | 7395.86  | 2636.30 | 0.94 |
| 14        | 355.60  | 81.39        | 28.8 | 3.61   | 4.12        | 1 | 0.00      | 45.0 | 8953.09  | 7906.91  | 2804.94 | 0.94 |
| 15        | 359.21  | 67.91        | 26.3 | 2.89   | 3.23        | 1 | 0.00      | 45.0 | 7469.84  | 6534.42  | 2964.83 | 0.94 |
| 16        | 362.11  | 70.07        | 26.3 | 2.89   | 3.23        | 1 | 0.00      | 45.0 | 7707.60  | 6822.35  | 3083.99 | 0.94 |
| 17        | 365.00  | 39.45        | 26.3 | 1.60   | 1.79        | 1 | 0.00      | 45.0 | 4339.39  | 3907.58  | 3168.11 | 0.94 |
| 18        | 366.60  | 92.29        | 23.8 | 3.77   | 4.12        | 1 | 0.00      | 45.0 | 10151.92 | 9315.62  | 3257.03 | 0.94 |
| 19        | 370.38  | 91.45        | 23.8 | 3.77   | 4.12        | 1 | 0.00      | 45.0 | 10059.72 | 9744.08  | 3351.73 | 0.94 |
| 20        | 374.15  | 91.88        | 21.3 | 3.84   | 4.12        | 1 | 0.00      | 45.0 | 10106.78 | 10150.52 | 3453.62 | 0.94 |
| 21        | 377.99  | 90.25        | 21.3 | 3.84   | 4.12        | 1 | 0.00      | 45.0 | 9927.89  | 10535.37 | 3529.56 | 0.94 |
| 22        | 381.83  | 89.66        | 18.8 | 3.90   | 4.12        | 1 | 0.00      | 45.0 | 9862.23  | 10899.57 | 3611.76 | 0.94 |
| 23        | 385.74  | 87.23        | 18.8 | 3.90   | 4.12        | 1 | 0.00      | 45.0 | 9594.93  | 11240.98 | 3668.46 | 0.94 |
| 24        | 389.64  | 85.58        | 16.3 | 3.96   | 4.12        | 1 | 0.00      | 45.0 | 9413.37  | 11560.58 | 3730.50 | 0.94 |
| 25        | 393.60  | 82.33        | 16.3 | 3.96   | 4.12        | 1 | 0.00      | 45.0 | 9056.14  | 11858.91 | 3767.53 | 0.94 |
| 26        | 397.55  | 79.62        | 13.8 | 4.00   | 4.12        | 1 | 0.00      | 45.0 | 8757.83  | 12134.09 | 3808.75 | 0.94 |
| 27        | 401.56  | 75.54        | 13.8 | 4.00   | 4.12        | 1 | 0.00      | 45.0 | 8309.58  | 12387.26 | 3825.86 | 0.94 |
| 28        | 405.56  | 71.77        | 11.3 | 4.04   | 4.12        | 1 | 0.00      | 45.0 | 7894.45  | 12617.83 | 3845.65 | 0.95 |
| 29        | 409.61  | 66.86        | 11.3 | 4.04   | 4.12        | 1 | 0.00      | 45.0 | 7355.09  | 12825.96 | 3842.45 | 0.95 |
| 30        | 413.65  | 62.05        | 8.8  | 4.07   | 4.12        | 1 | 0.00      | 45.0 | 6825.45  | 13011.28 | 3840.31 | 0.96 |
| 31        | 417.72  | 56.32        | 8.8  | 4.07   | 4.12        | 1 | 0.00      | 45.0 | 6195.41  | 13173.84 | 3816.54 | 0.96 |
| 32        | 421.80  | 50.50        | 6.3  | 4.10   | 4.12        | 1 | 0.00      | 45.0 | 5555.14  | 13313.38 | 3791.94 | 0.97 |
| 33        | 425.90  | 43.96        | 6.3  | 4.10   | 4.12        | 1 | 0.00      | 45.0 | 4836.08  | 13430.36 | 3747.35 | 0.97 |
| 34        | 429.99  | 37.19        | 3.8  | 4.11   | 4.12        | 1 | 0.00      | 45.0 | 4090.46  | 13523.85 | 3699.65 | 0.98 |
| 35        | 434.11  | 29.86        | 3.8  | 4.11   | 4.12        | 1 | 0.00      | 45.0 | 3284.39  | 13594.70 | 3634.14 | 0.98 |
| 36        | 438.22  | 22.19        | 1.3  | 4.12   | 4.12        | 1 | 0.00      | 45.0 | 2441.12  | 13642.35 | 3562.80 | 0.99 |
| 37        | 442.34  | 14.09        | 1.3  | 4.12   | 4.12        | 1 | 0.00      | 45.0 | 1549.78  | 13666.89 | 3475.97 | 0.99 |
| 38        | 446.47  | 5.69         | -1.2 | 4.53   | 4.54        | 1 | 0.00      | 45.0 | 626.17   | 15033.96 | 3375.01 | 1.01 |
| 39        | 451.00  | 0.14         | -1.2 | 3.71   | 3.71        | 1 | 0.00      | 45.0 | 15.34    | 12280.94 | 3311.35 | 1.01 |
| <hr/>     |         |              |      |        |             |   |           |      |          |          |         |      |
| X-S Area: | 2121.66 | Path Length: |      | 156.68 | X-S Weight: |   | 233382.50 |      |          |          |         |      |



**GALENA** Version 7.2

Project Peak Ranch Resource - Section 5  
Geotechnical Stability Analysis

File: G:\My Driv...\Peak Ranch 5 Ad DRMS.gmf

Analysis 1

Single Stability Analysis  
Method: Bishop Simplified  
Surface: Circular

Results

Factor of Safety: 2.20

Edited: 12 Jan 2021 Processed: 12 Jan 2021

**Dept of the Interior - Office of Surface Mining**

Project: Peak Ranch Resource - Section 5  
 File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Peak Ranch M2020041\...\Peak Ranch 5 Ad DRMS.gmf  
 Processed: 12 Jan 2021 11:47:27

## DATA: Analysis 1 - Geotechnical Stability Analysis

## 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 (20 points) Material beneath: 2 - Loose sand, mixed grain size

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 0.00   | 8237.87 | 28.05  | 8236.00 | 43.41  | 8236.00 | 61.02  | 8240.03 | 67.57  | 8240.63 |
| 82.57  | 8241.24 | 93.02  | 8241.05 | 106.53 | 8240.00 | 118.09 | 8238.00 | 132.18 | 8237.04 |
| 142.55 | 8236.00 | 176.21 | 8235.84 | 200.00 | 8236.43 | 234.28 | 8236.03 | 266.26 | 8236.89 |
| 276.76 | 8237.16 | 285.10 | 8237.01 | 386.71 | 8234.55 | 422.36 | 8233.52 | 500.00 | 8232.79 |

Profile: 2 (20 points) Material beneath: 1 - Sand and gravel, mixed grain size

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| -0.10  | 8236.38 | 28.00  | 8234.50 | 43.58  | 8234.50 | 61.26  | 8238.54 | 67.66  | 8239.14 |
| 82.59  | 8239.74 | 92.95  | 8239.55 | 106.35 | 8238.51 | 117.91 | 8236.51 | 132.05 | 8235.55 |
| 142.47 | 8234.50 | 176.23 | 8234.34 | 200.01 | 8234.93 | 234.29 | 8234.53 | 266.30 | 8235.39 |
| 276.76 | 8235.66 | 285.07 | 8235.51 | 386.67 | 8233.05 | 422.33 | 8232.02 | 500.00 | 8231.29 |

## Slope Surface (7 points)

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 266.26 | 8236.89 | 276.76 | 8237.16 | 285.10 | 8237.01 | 366.45 | 8224.00 | 396.53 | 8214.00 |
| 482.00 | 8171.00 | 500.00 | 8171.00 |        |         |        |         |        |         |

## Phreatic Surface (2 points)

|         |         |        |         |
|---------|---------|--------|---------|
| -200.00 | 8224.00 | 700.00 | 8224.00 |
|---------|---------|--------|---------|

## Failure Surface

Circular surface defined by: XL, XR, R

|                 |        |     |         |            |        |     |         |
|-----------------|--------|-----|---------|------------|--------|-----|---------|
| Intersects: XL: | 369.60 | YL: | 8222.95 | XR:        | 465.50 | YR: | 8179.30 |
| Centre: XC:     | 523.03 | YC: | 8432.86 | Radius: R: | 260.00 |     |         |

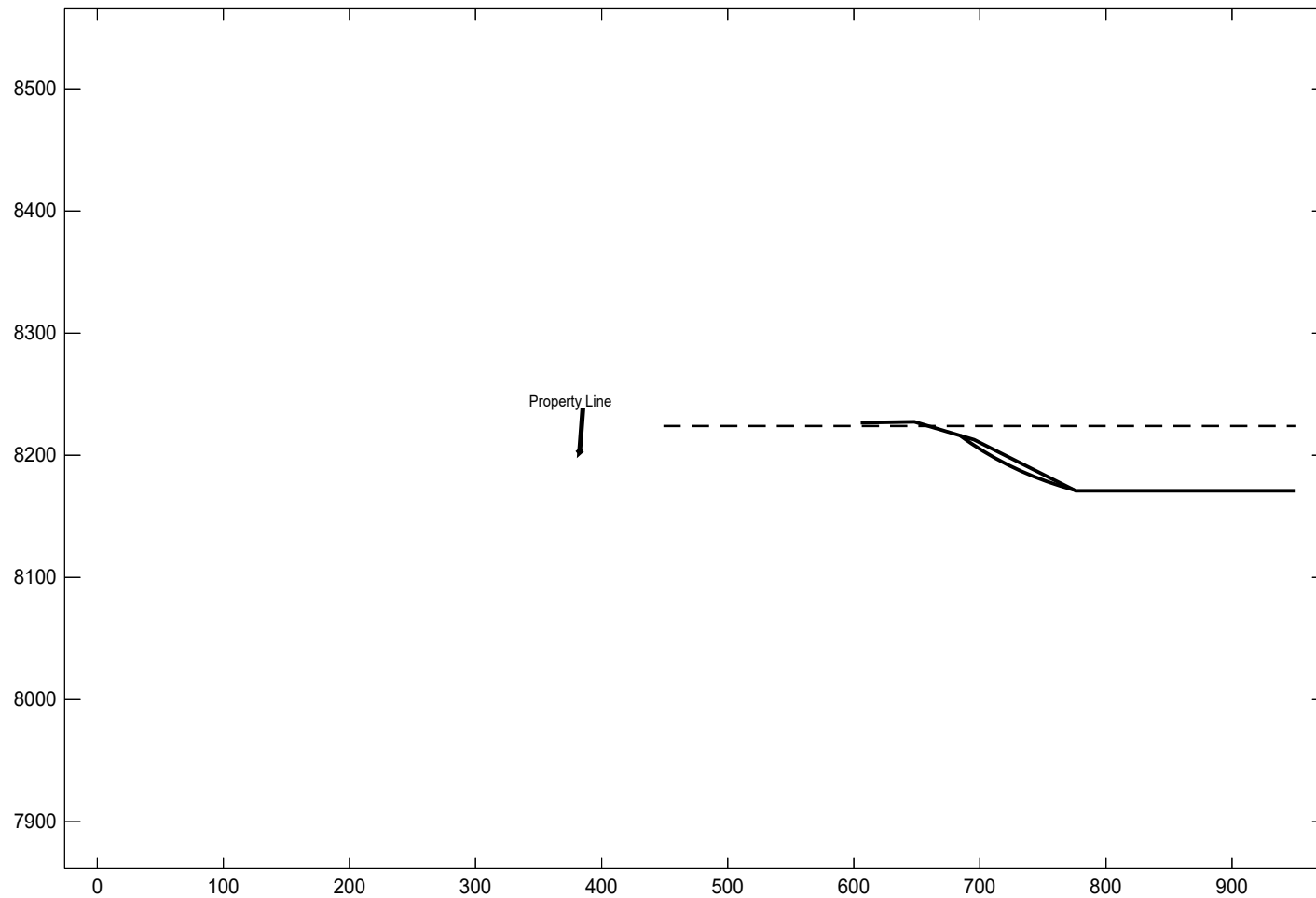
## RESULTS: Analysis 1 - Geotechnical Stability Analysis

## Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 2.20

Slice Geometry and Properties (39 slices)

| Slice     | X-Left | X-S Area | Angle        | Width | Base Length | Matl        | Cohesion | Phi      | Weight  | Porewater Force | Normal Stress | Test Factor |
|-----------|--------|----------|--------------|-------|-------------|-------------|----------|----------|---------|-----------------|---------------|-------------|
| 1         | 369.60 | 0.98     | 35.5         | 2.27  | 2.79        | 1           | 0.00     | 45.0     | 108.35  | 323.76          | 131.54        | 0.93        |
| 2         | 371.87 | 2.96     | 35.6         | 2.27  | 2.79        | 1           | 0.00     | 45.0     | 325.53  | 606.81          | 264.09        | 0.93        |
| 3         | 374.14 | 4.93     | 34.3         | 2.31  | 2.79        | 1           | 0.00     | 45.0     | 542.75  | 885.26          | 394.76        | 0.92        |
| 4         | 376.45 | 6.80     | 34.3         | 2.31  | 2.79        | 1           | 0.00     | 45.0     | 747.62  | 1159.55         | 522.32        | 0.92        |
| 5         | 378.76 | 8.71     | 33.1         | 2.34  | 2.79        | 1           | 0.00     | 45.0     | 958.44  | 1429.42         | 648.67        | 0.92        |
| 6         | 381.09 | 10.46    | 33.1         | 2.34  | 2.79        | 1           | 0.00     | 45.0     | 1150.66 | 1695.17         | 771.27        | 0.92        |
| 7         | 383.43 | 12.30    | 31.9         | 2.37  | 2.79        | 1           | 0.00     | 45.0     | 1353.50 | 1956.30         | 893.17        | 0.92        |
| 8         | 385.81 | 13.93    | 31.9         | 2.37  | 2.79        | 1           | 0.00     | 45.0     | 1531.81 | 2212.85         | 1010.43       | 0.92        |
| 9         | 388.18 | 15.68    | 30.6         | 2.40  | 2.79        | 1           | 0.00     | 45.0     | 1725.10 | 2465.41         | 1127.65       | 0.92        |
| 10        | 390.58 | 17.18    | 30.6         | 2.40  | 2.79        | 1           | 0.00     | 45.0     | 1890.00 | 2712.82         | 1239.87       | 0.92        |
| 11        | 392.98 | 13.60    | 29.4         | 1.77  | 2.04        | 1           | 0.00     | 45.0     | 1496.21 | 2132.08         | 1337.78       | 0.91        |
| 12        | 394.76 | 14.33    | 29.4         | 1.77  | 2.04        | 1           | 0.00     | 45.0     | 1576.08 | 2259.55         | 1415.57       | 0.91        |
| 13        | 396.53 | 10.96    | 29.4         | 1.32  | 1.51        | 1           | 0.00     | 45.0     | 1206.08 | 1760.09         | 1479.25       | 0.91        |
| 14        | 397.85 | 20.68    | 28.2         | 2.46  | 2.79        | 1           | 0.00     | 45.0     | 2274.78 | 3429.67         | 1549.77       | 0.91        |
| 15        | 400.31 | 20.87    | 28.2         | 2.46  | 2.79        | 1           | 0.00     | 45.0     | 2296.17 | 3658.57         | 1635.05       | 0.91        |
| 16        | 402.77 | 21.22    | 26.9         | 2.49  | 2.79        | 1           | 0.00     | 45.0     | 2334.65 | 3883.81         | 1720.64       | 0.91        |
| 17        | 405.26 | 21.26    | 26.9         | 2.49  | 2.79        | 1           | 0.00     | 45.0     | 2338.36 | 4104.27         | 1800.14       | 0.91        |
| 18        | 407.75 | 21.43    | 25.7         | 2.52  | 2.79        | 1           | 0.00     | 45.0     | 2357.15 | 4319.90         | 1879.77       | 0.91        |
| 19        | 410.26 | 21.29    | 25.7         | 2.52  | 2.79        | 1           | 0.00     | 45.0     | 2342.01 | 4530.88         | 1953.19       | 0.91        |
| 20        | 412.78 | 21.28    | 24.5         | 2.54  | 2.79        | 1           | 0.00     | 45.0     | 2341.14 | 4737.55         | 2026.82       | 0.91        |
| 21        | 415.32 | 20.97    | 24.5         | 2.54  | 2.79        | 1           | 0.00     | 45.0     | 2306.98 | 4938.42         | 2094.26       | 0.91        |
| 22        | 417.86 | 20.77    | 23.2         | 2.57  | 2.79        | 1           | 0.00     | 45.0     | 2285.16 | 5135.18         | 2161.70       | 0.91        |
| 23        | 420.43 | 20.29    | 23.3         | 2.57  | 2.79        | 1           | 0.00     | 45.0     | 2232.00 | 5328.05         | 2222.95       | 0.91        |
| 24        | 422.99 | 19.90    | 22.0         | 2.59  | 2.79        | 1           | 0.00     | 45.0     | 2188.95 | 5514.97         | 2284.14       | 0.91        |
| 25        | 425.58 | 19.24    | 22.0         | 2.59  | 2.79        | 1           | 0.00     | 45.0     | 2115.96 | 5696.91         | 2339.15       | 0.91        |
| 26        | 428.17 | 18.65    | 20.8         | 2.61  | 2.79        | 1           | 0.00     | 45.0     | 2050.98 | 5874.59         | 2393.89       | 0.91        |
| 27        | 430.78 | 17.80    | 20.8         | 2.61  | 2.79        | 1           | 0.00     | 45.0     | 1958.16 | 6047.12         | 2442.56       | 0.91        |
| 28        | 433.39 | 17.01    | 19.5         | 2.63  | 2.79        | 1           | 0.00     | 45.0     | 1870.78 | 6214.59         | 2490.74       | 0.91        |
| 29        | 436.02 | 15.98    | 19.6         | 2.63  | 2.79        | 1           | 0.00     | 45.0     | 1757.89 | 6377.77         | 2533.02       | 0.91        |
| 30        | 438.65 | 14.98    | 18.3         | 2.65  | 2.79        | 1           | 0.00     | 45.0     | 1647.89 | 6535.74         | 2574.48       | 0.92        |
| 31        | 441.30 | 13.77    | 18.3         | 2.65  | 2.79        | 1           | 0.00     | 45.0     | 1514.90 | 6688.18         | 2610.38       | 0.92        |
| 32        | 443.96 | 12.56    | 17.1         | 2.67  | 2.79        | 1           | 0.00     | 45.0     | 1381.70 | 6836.51         | 2644.96       | 0.92        |
| 33        | 446.62 | 11.17    | 17.1         | 2.67  | 2.79        | 1           | 0.00     | 45.0     | 1228.60 | 6979.09         | 2674.41       | 0.92        |
| 34        | 449.29 | 9.75     | 15.9         | 2.69  | 2.79        | 1           | 0.00     | 45.0     | 1072.27 | 7116.97         | 2702.03       | 0.92        |
| 35        | 451.98 | 8.17     | 15.9         | 2.69  | 2.79        | 1           | 0.00     | 45.0     | 898.58  | 7250.28         | 2724.86       | 0.92        |
| 36        | 454.66 | 6.54     | 14.6         | 2.70  | 2.79        | 1           | 0.00     | 45.0     | 719.13  | 7377.92         | 2745.42       | 0.92        |
| 37        | 457.37 | 4.77     | 14.6         | 2.70  | 2.79        | 1           | 0.00     | 45.0     | 524.99  | 7501.26         | 2761.65       | 0.92        |
| 38        | 460.07 | 2.93     | 13.4         | 2.72  | 2.79        | 1           | 0.00     | 45.0     | 322.55  | 7618.43         | 2775.02       | 0.93        |
| 39        | 462.78 | 0.98     | 13.4         | 2.72  | 2.79        | 1           | 0.00     | 45.0     | 107.52  | 7731.45         | 2784.48       | 0.93        |
| X-S Area: |        | 537.10   | Path Length: |       | 106.10      | X-S Weight: |          | 59081.42 |         |                 |               |             |



**GALENA** Version 7.2

Analysis 1  
 Single Stability Analysis  
 Method: Bishop Simplified  
 Surface: Circular

Results  
 Factor of Safety: 2.02

Edited: 12 Jan 2021 Processed: 12 Jan 2021

Project Peak Ranch Pit - Section 6  
 Geotechnical Slope Stability Exhibit

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**Dept of the Interior - Office of Surface Mining**

Project: Peak Ranch Pit - Section 6  
 File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Peak Ranch M2020041\...\Peak Ranch 6 Ad DRMS.gmf  
 Processed: 12 Jan 2021 11:51:51

## DATA: Analysis 1 - Geotechnical Slope Stability Exhibit

## 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 (20 points) Material beneath: 2 - Loose sand, mixed grain size

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 0.00   | 8256.23 | 21.28  | 8254.09 | 81.39  | 8251.40 | 82.90  | 8252.00 | 120.20 | 8248.00 |
| 154.65 | 8242.95 | 230.65 | 8238.00 | 270.29 | 8230.00 | 334.88 | 8210.00 | 347.20 | 8208.00 |
| 350.06 | 8206.00 | 361.41 | 8204.00 | 392.84 | 8204.04 | 421.35 | 8211.08 | 439.96 | 8222.00 |
| 443.16 | 8222.51 | 445.32 | 8224.00 | 677.75 | 8227.87 | 800.74 | 8228.00 | 945.03 | 8226.83 |

Profile: 2 (20 points) Material beneath: 1 - Sand and gravel, mixed grain size

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| -0.15  | 8254.73 | 21.17  | 8252.59 | 81.64  | 8249.89 | 83.11  | 8250.47 | 120.01 | 8246.51 |
| 154.50 | 8241.46 | 230.45 | 8236.51 | 269.92 | 8228.54 | 334.53 | 8208.54 | 346.62 | 8206.57 |
| 349.47 | 8204.58 | 361.28 | 8202.50 | 393.02 | 8202.54 | 421.92 | 8209.68 | 440.47 | 8220.56 |
| 443.73 | 8221.08 | 445.80 | 8222.51 | 677.76 | 8226.37 | 800.74 | 8226.50 | 945.02 | 8225.33 |

## Slope Surface (5 points)

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 605.52 | 8226.60 | 648.06 | 8227.37 | 695.45 | 8212.67 | 776.00 | 8171.00 | 950.37 | 8171.00 |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|

## Phreatic Surface (2 points)

|        |         |        |         |
|--------|---------|--------|---------|
| 450.00 | 8224.00 | 950.00 | 8224.00 |
|--------|---------|--------|---------|

## Failure Surface

Circular surface defined by: XL, XR, R

|             |     |        |     |         |         |        |        |         |
|-------------|-----|--------|-----|---------|---------|--------|--------|---------|
| Intersects: | XL: | 684.40 | YL: | 8216.10 | XR:     | 774.37 | YR:    | 8171.84 |
| Centre:     | XC: | 844.46 | YC: | 8427.92 | Radius: | R:     | 265.50 |         |

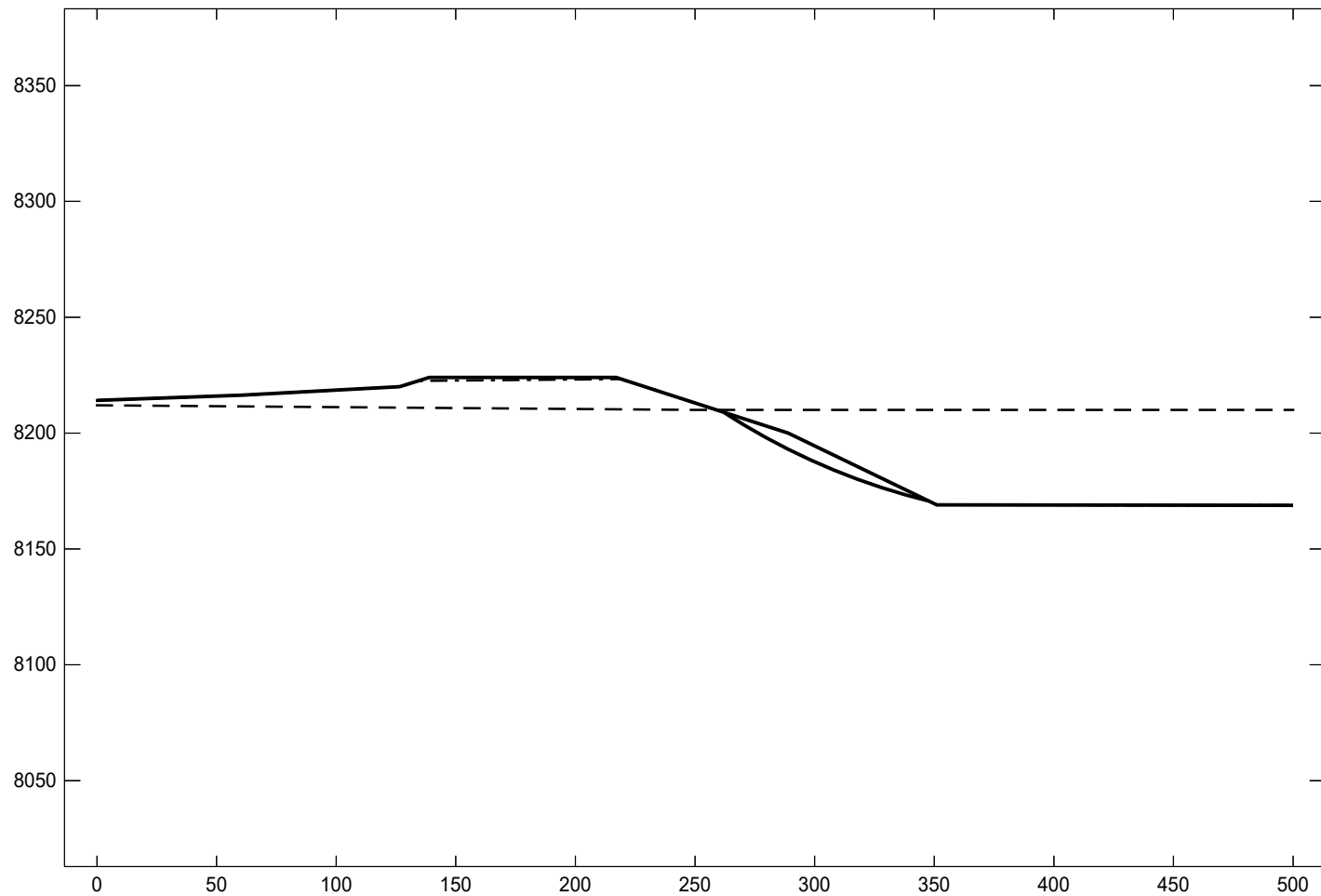
## RESULTS: Analysis 1 - Geotechnical Slope Stability Exhibit

## Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 2.02

Slice Geometry and Properties (38 slices)

| Slice     | X-Left | X-S Area | Angle        | Width | Base Length | Matl        | Cohesion | Phi      | Weight  | PoreWater Force | Normal Stress | Test Factor |
|-----------|--------|----------|--------------|-------|-------------|-------------|----------|----------|---------|-----------------|---------------|-------------|
| 1         | 684.40 | 0.98     | 36.5         | 2.13  | 2.65        | 1           | 0.00     | 45.0     | 107.73  | 1439.81         | 558.40        | 0.91        |
| 2         | 686.53 | 2.93     | 36.5         | 2.13  | 2.65        | 1           | 0.00     | 45.0     | 322.73  | 1701.21         | 688.78        | 0.91        |
| 3         | 688.67 | 4.91     | 35.4         | 2.16  | 2.65        | 1           | 0.00     | 45.0     | 539.76  | 1959.21         | 817.92        | 0.91        |
| 4         | 690.83 | 6.78     | 35.4         | 2.16  | 2.65        | 1           | 0.00     | 45.0     | 745.80  | 2213.82         | 944.32        | 0.91        |
| 5         | 693.00 | 9.85     | 34.2         | 2.45  | 2.97        | 1           | 0.00     | 45.0     | 1083.98 | 2769.72         | 1077.03       | 0.90        |
| 6         | 695.45 | 8.97     | 34.2         | 1.94  | 2.34        | 1           | 0.00     | 45.0     | 986.30  | 2406.25         | 1191.86       | 0.90        |
| 7         | 697.39 | 10.98    | 33.1         | 2.22  | 2.65        | 1           | 0.00     | 45.0     | 1207.25 | 2955.85         | 1290.91       | 0.90        |
| 8         | 699.61 | 11.64    | 33.1         | 2.22  | 2.65        | 1           | 0.00     | 45.0     | 1280.14 | 3195.14         | 1392.03       | 0.90        |
| 9         | 701.84 | 12.39    | 31.9         | 2.25  | 2.65        | 1           | 0.00     | 45.0     | 1362.82 | 3431.12         | 1492.75       | 0.90        |
| 10        | 704.09 | 12.93    | 31.9         | 2.25  | 2.65        | 1           | 0.00     | 45.0     | 1422.11 | 3663.71         | 1589.08       | 0.90        |
| 11        | 706.34 | 13.56    | 30.8         | 2.28  | 2.65        | 1           | 0.00     | 45.0     | 1491.54 | 3892.69         | 1684.97       | 0.90        |
| 12        | 708.62 | 13.97    | 30.8         | 2.28  | 2.65        | 1           | 0.00     | 45.0     | 1536.38 | 4116.93         | 1776.34       | 0.90        |
| 13        | 710.90 | 14.47    | 29.6         | 2.31  | 2.65        | 1           | 0.00     | 45.0     | 1591.77 | 4338.77         | 1867.41       | 0.90        |
| 14        | 713.21 | 14.75    | 29.6         | 2.31  | 2.65        | 1           | 0.00     | 45.0     | 1622.01 | 4556.18         | 1953.74       | 0.90        |
| 15        | 715.52 | 15.12    | 28.5         | 2.33  | 2.65        | 1           | 0.00     | 45.0     | 1662.92 | 4769.25         | 2039.95       | 0.90        |
| 16        | 717.85 | 15.26    | 28.5         | 2.33  | 2.65        | 1           | 0.00     | 45.0     | 1678.21 | 4979.91         | 2121.18       | 0.90        |
| 17        | 720.18 | 15.49    | 27.3         | 2.36  | 2.65        | 1           | 0.00     | 45.0     | 1703.72 | 5184.91         | 2202.32       | 0.90        |
| 18        | 722.54 | 15.48    | 27.3         | 2.36  | 2.65        | 1           | 0.00     | 45.0     | 1703.17 | 5386.67         | 2278.30       | 0.90        |
| 19        | 724.90 | 15.57    | 26.2         | 2.38  | 2.65        | 1           | 0.00     | 45.0     | 1712.52 | 5585.18         | 2354.19       | 0.90        |
| 20        | 727.28 | 15.42    | 26.2         | 2.38  | 2.65        | 1           | 0.00     | 45.0     | 1696.53 | 5778.75         | 2424.97       | 0.90        |
| 21        | 729.66 | 15.35    | 25.0         | 2.40  | 2.65        | 1           | 0.00     | 45.0     | 1688.98 | 5968.90         | 2495.56       | 0.90        |
| 22        | 732.07 | 15.06    | 25.1         | 2.40  | 2.65        | 1           | 0.00     | 45.0     | 1657.08 | 6155.47         | 2560.98       | 0.90        |
| 23        | 734.47 | 14.84    | 23.9         | 2.43  | 2.65        | 1           | 0.00     | 45.0     | 1632.20 | 6337.06         | 2626.14       | 0.90        |
| 24        | 736.90 | 14.40    | 23.9         | 2.43  | 2.65        | 1           | 0.00     | 45.0     | 1584.23 | 6515.72         | 2686.23       | 0.90        |
| 25        | 739.33 | 14.01    | 22.7         | 2.45  | 2.65        | 1           | 0.00     | 45.0     | 1541.41 | 6689.15         | 2745.79       | 0.90        |
| 26        | 741.78 | 13.43    | 22.8         | 2.45  | 2.65        | 1           | 0.00     | 45.0     | 1477.02 | 6859.85         | 2800.42       | 0.90        |
| 27        | 744.22 | 12.87    | 21.6         | 2.47  | 2.65        | 1           | 0.00     | 45.0     | 1415.93 | 7025.60         | 2854.31       | 0.90        |
| 28        | 746.69 | 12.13    | 21.6         | 2.47  | 2.65        | 1           | 0.00     | 45.0     | 1334.68 | 7187.52         | 2903.40       | 0.90        |
| 29        | 749.16 | 11.41    | 20.5         | 2.49  | 2.65        | 1           | 0.00     | 45.0     | 1254.91 | 7344.87         | 2951.50       | 0.90        |
| 30        | 751.65 | 10.52    | 20.5         | 2.49  | 2.65        | 1           | 0.00     | 45.0     | 1156.87 | 7499.10         | 2995.01       | 0.90        |
| 31        | 754.13 | 9.62     | 19.3         | 2.51  | 2.65        | 1           | 0.00     | 45.0     | 1058.34 | 7648.92         | 3037.22       | 0.90        |
| 32        | 756.64 | 8.58     | 19.3         | 2.51  | 2.65        | 1           | 0.00     | 45.0     | 943.30  | 7793.95         | 3075.11       | 0.90        |
| 33        | 759.14 | 7.51     | 18.2         | 2.52  | 2.65        | 1           | 0.00     | 45.0     | 825.65  | 7935.77         | 3111.33       | 0.91        |
| 34        | 761.67 | 6.30     | 18.2         | 2.52  | 2.65        | 1           | 0.00     | 45.0     | 693.29  | 8072.22         | 3143.45       | 0.91        |
| 35        | 764.19 | 5.06     | 17.0         | 2.54  | 2.65        | 1           | 0.00     | 45.0     | 556.35  | 8205.66         | 3173.57       | 0.91        |
| 36        | 766.73 | 3.70     | 17.0         | 2.54  | 2.65        | 1           | 0.00     | 45.0     | 406.65  | 8333.71         | 3199.89       | 0.91        |
| 37        | 769.26 | 2.28     | 15.9         | 2.55  | 2.65        | 1           | 0.00     | 45.0     | 250.40  | 8458.94         | 3223.81       | 0.91        |
| 38        | 771.82 | 0.76     | 15.9         | 2.55  | 2.65        | 1           | 0.00     | 45.0     | 83.38   | 8578.77         | 3244.30       | 0.91        |
| -----     |        |          |              |       |             |             |          |          |         |                 |               |             |
| X-S Area: |        | 409.26   | Path Length: |       | 100.87      | X-S Weight: |          | 45018.08 |         |                 |               |             |



**GALENA** Version 7.2

Analysis 1

Single Stability Analysis  
Method: Bishop Simplified  
Surface: Circular

Results

Factor of Safety: 2.23

Edited: 12 Jan 2021 Processed: 12 Jan 2021

Project

File: G:\My Driv...\Peak Ranch 7 Ad DRMS.gmf

**Dept of the Interior - Office of Surface Mining**

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Peak Ranch M2020041\...\Peak Ranch 7 Ad DRMS.gmf  
 Processed: 12 Jan 2021 11:54:05

## 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 8222.88 500.00 8227.21  
 Profile: 2 (2 points) Material beneath: 1 - Sand and gravel, mixed grain size  
 0.01 8221.38 500.01 8225.71

## Slope Surface (8 points)

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 0.00   | 8214.14 | 60.56  | 8216.39 | 126.58 | 8220.00 | 138.88 | 8224.00 | 217.02 | 8224.00 |
| 288.94 | 8200.00 | 351.06 | 8168.99 | 500.00 | 8168.80 |        |         |        |         |

## Phreatic Surface (3 points)

|      |         |        |         |        |         |
|------|---------|--------|---------|--------|---------|
| 0.00 | 8212.00 | 250.00 | 8210.00 | 500.00 | 8210.00 |
|------|---------|--------|---------|--------|---------|

## Failure Surface

Circular surface defined by: XL, XR, R

|             |     |        |     |         |         |        |        |         |
|-------------|-----|--------|-----|---------|---------|--------|--------|---------|
| Intersects: | XL: | 262.00 | YL: | 8208.99 | XR:     | 347.50 | YR:    | 8170.77 |
| Centre:     | XC: | 415.34 | YC: | 8437.27 | Radius: | R:     | 275.00 |         |

## RESULTS: Analysis 1

## Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 2.23

## Slice Geometry and Properties (39 slices)

| Slice | X-Left | X-S<br>Area | Angle | Width | Base<br>Length | Matl | Cohesion | Phi  | Weight | Porewater<br>Force | Normal<br>Stress | Test<br>Factor |
|-------|--------|-------------|-------|-------|----------------|------|----------|------|--------|--------------------|------------------|----------------|
| 1     | 262.00 | 0.69        | 33.4  | 2.07  | 2.48           | 1    | 0.00     | 45.0 | 76.43  | 261.39             | 117.89           | 0.92           |
| 2     | 264.07 | 2.08        | 33.4  | 2.07  | 2.48           | 1    | 0.00     | 45.0 | 229.29 | 471.78             | 227.53           | 0.92           |
| 3     | 266.14 | 3.47        | 32.3  | 2.09  | 2.48           | 1    | 0.00     | 45.0 | 381.66 | 679.63             | 335.88           | 0.92           |

|    |        |       |      |      |      |   |      |      |         |         |         |      |
|----|--------|-------|------|------|------|---|------|------|---------|---------|---------|------|
| 4  | 268.23 | 4.78  | 32.3 | 2.09 | 2.48 | 1 | 0.00 | 45.0 | 525.95  | 884.42  | 441.81  | 0.92 |
| 5  | 270.32 | 6.11  | 31.3 | 2.12 | 2.48 | 1 | 0.00 | 45.0 | 672.35  | 1086.18 | 546.60  | 0.92 |
| 6  | 272.44 | 7.34  | 31.3 | 2.12 | 2.48 | 1 | 0.00 | 45.0 | 807.58  | 1285.08 | 648.65  | 0.92 |
| 7  | 274.55 | 8.61  | 30.3 | 2.14 | 2.48 | 1 | 0.00 | 45.0 | 947.52  | 1480.79 | 749.93  | 0.92 |
| 8  | 276.69 | 9.76  | 30.3 | 2.14 | 2.48 | 1 | 0.00 | 45.0 | 1073.42 | 1674.13 | 848.03  | 0.92 |
| 9  | 278.83 | 10.96 | 29.2 | 2.16 | 2.48 | 1 | 0.00 | 45.0 | 1205.92 | 1863.84 | 945.61  | 0.92 |
| 10 | 280.99 | 12.02 | 29.2 | 2.16 | 2.48 | 1 | 0.00 | 45.0 | 1322.44 | 2050.98 | 1039.82 | 0.92 |
| 11 | 283.15 | 13.16 | 28.2 | 2.18 | 2.48 | 1 | 0.00 | 45.0 | 1447.38 | 2234.96 | 1133.77 | 0.91 |
| 12 | 285.34 | 14.12 | 28.2 | 2.18 | 2.48 | 1 | 0.00 | 45.0 | 1553.34 | 2415.76 | 1223.71 | 0.91 |
| 13 | 287.52 | 9.70  | 27.2 | 1.42 | 1.60 | 1 | 0.00 | 45.0 | 1067.29 | 1654.81 | 1298.68 | 0.91 |
| 14 | 288.94 | 10.38 | 27.2 | 1.49 | 1.68 | 1 | 0.00 | 45.0 | 1142.09 | 1813.93 | 1350.78 | 0.91 |
| 15 | 290.43 | 10.41 | 27.2 | 1.49 | 1.68 | 1 | 0.00 | 45.0 | 1145.47 | 1893.84 | 1399.38 | 0.91 |
| 16 | 291.92 | 15.52 | 26.2 | 2.22 | 2.48 | 1 | 0.00 | 45.0 | 1707.62 | 2940.58 | 1459.68 | 0.91 |
| 17 | 294.15 | 15.48 | 26.1 | 2.22 | 2.48 | 1 | 0.00 | 45.0 | 1702.94 | 3108.93 | 1527.06 | 0.91 |
| 18 | 296.37 | 15.52 | 25.1 | 2.24 | 2.48 | 1 | 0.00 | 45.0 | 1707.28 | 3274.72 | 1594.49 | 0.91 |
| 19 | 298.61 | 15.37 | 25.1 | 2.24 | 2.48 | 1 | 0.00 | 45.0 | 1690.52 | 3437.15 | 1657.42 | 0.91 |
| 20 | 300.85 | 15.29 | 24.1 | 2.26 | 2.48 | 1 | 0.00 | 45.0 | 1681.36 | 3596.52 | 1720.23 | 0.91 |
| 21 | 303.12 | 15.02 | 24.1 | 2.26 | 2.48 | 1 | 0.00 | 45.0 | 1651.99 | 3752.77 | 1778.62 | 0.91 |
| 22 | 305.38 | 14.81 | 23.1 | 2.28 | 2.48 | 1 | 0.00 | 45.0 | 1629.10 | 3905.91 | 1836.80 | 0.91 |
| 23 | 307.66 | 14.43 | 23.1 | 2.28 | 2.48 | 1 | 0.00 | 45.0 | 1587.24 | 4055.55 | 1890.69 | 0.91 |
| 24 | 309.93 | 14.10 | 22.0 | 2.30 | 2.48 | 1 | 0.00 | 45.0 | 1550.46 | 4202.08 | 1944.19 | 0.91 |
| 25 | 312.23 | 13.60 | 22.0 | 2.30 | 2.48 | 1 | 0.00 | 45.0 | 1495.46 | 4345.84 | 1993.31 | 0.91 |
| 26 | 314.53 | 13.13 | 21.0 | 2.31 | 2.48 | 1 | 0.00 | 45.0 | 1444.49 | 4486.15 | 2042.05 | 0.91 |
| 27 | 316.84 | 12.51 | 21.0 | 2.31 | 2.48 | 1 | 0.00 | 45.0 | 1376.56 | 4623.26 | 2086.56 | 0.91 |
| 28 | 319.15 | 11.92 | 20.0 | 2.33 | 2.48 | 1 | 0.00 | 45.0 | 1311.09 | 4757.35 | 2130.39 | 0.91 |
| 29 | 321.48 | 11.18 | 20.0 | 2.33 | 2.48 | 1 | 0.00 | 45.0 | 1229.95 | 4887.65 | 2170.18 | 0.91 |
| 30 | 323.81 | 10.45 | 18.9 | 2.34 | 2.48 | 1 | 0.00 | 45.0 | 1149.95 | 5015.12 | 2209.12 | 0.92 |
| 31 | 326.15 | 9.60  | 18.9 | 2.34 | 2.48 | 1 | 0.00 | 45.0 | 1055.46 | 5139.17 | 2244.08 | 0.92 |
| 32 | 328.49 | 8.73  | 17.9 | 2.36 | 2.48 | 1 | 0.00 | 45.0 | 960.56  | 5260.42 | 2277.97 | 0.92 |
| 33 | 330.85 | 7.75  | 17.9 | 2.36 | 2.48 | 1 | 0.00 | 45.0 | 852.84  | 5377.74 | 2308.20 | 0.92 |
| 34 | 333.21 | 6.75  | 16.9 | 2.37 | 2.48 | 1 | 0.00 | 45.0 | 742.94  | 5492.34 | 2336.98 | 0.92 |
| 35 | 335.58 | 5.65  | 16.9 | 2.37 | 2.48 | 1 | 0.00 | 45.0 | 621.75  | 5603.03 | 2362.33 | 0.92 |
| 36 | 337.95 | 4.52  | 15.8 | 2.38 | 2.48 | 1 | 0.00 | 45.0 | 496.80  | 5710.97 | 2385.95 | 0.92 |
| 37 | 340.33 | 3.29  | 15.8 | 2.38 | 2.48 | 1 | 0.00 | 45.0 | 362.04  | 5814.95 | 2406.38 | 0.92 |
| 38 | 342.71 | 2.02  | 14.8 | 2.39 | 2.48 | 1 | 0.00 | 45.0 | 222.10  | 5916.26 | 2424.76 | 0.92 |
| 39 | 345.11 | 0.67  | 14.8 | 2.39 | 2.48 | 1 | 0.00 | 45.0 | 73.95   | 6014.12 | 2440.31 | 0.92 |

X-S Area:

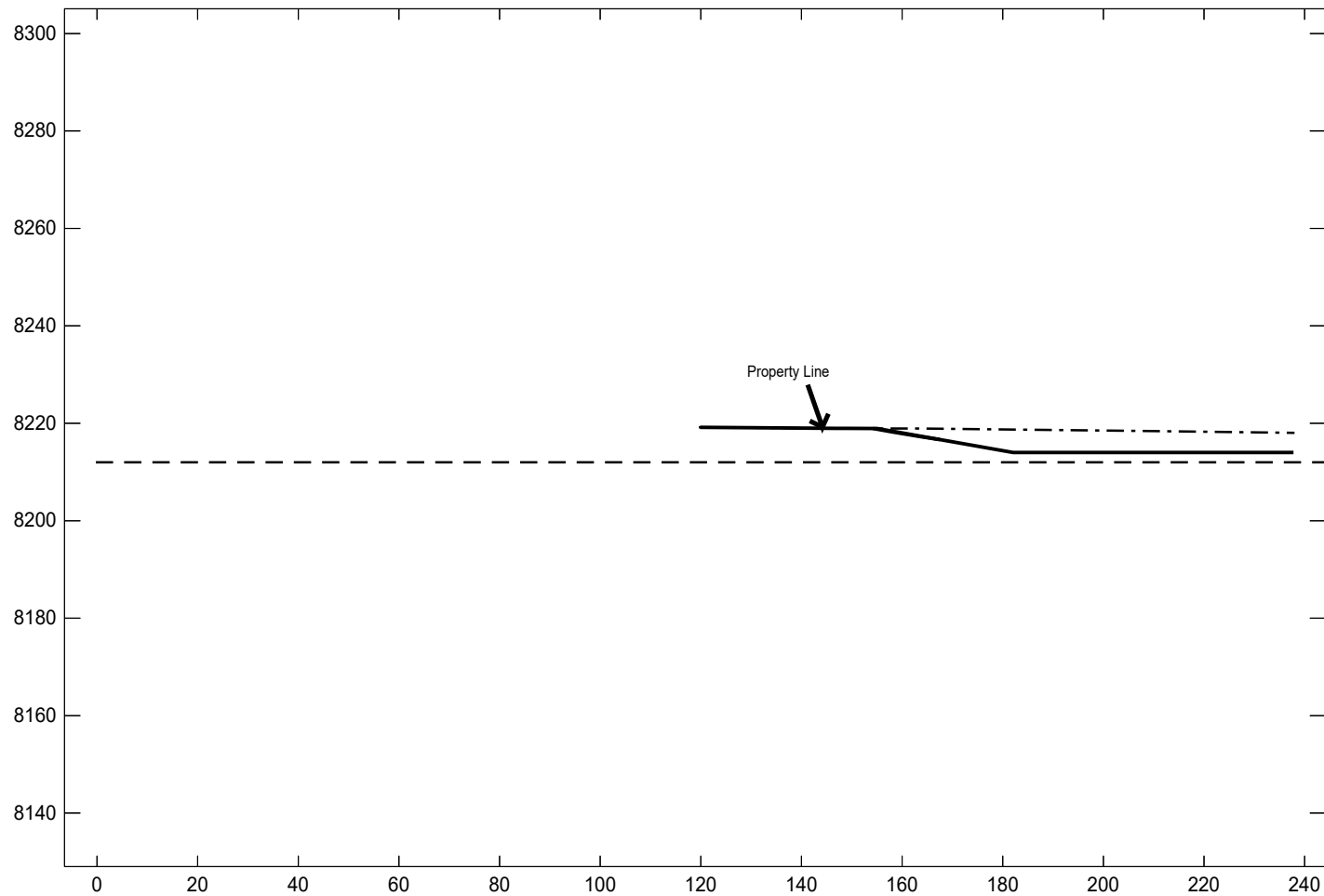
-----  
380.93

Path Length:

-----  
94.11

X-S Weight:

-----  
41902.57



**GALENA** Version 7.2

Analysis 1  
 Single Stability Analysis  
 Method: Bishop Simplified  
 Surface: Circular

Results  
 Factor of Safety: 4.25

Edited: 12 Jan 2021 Processed: 12 Jan 2021

Project Peak Ranch Resource - Section 3  
 Geotechnical Stability Analysis

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**Dept of the Interior - Office of Surface Mining**

Project: Peak Ranch Resource - Section 3  
 File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Peak Ranch M2020041\...\Peak Ranch 8 Ad DRMS.gmf  
 Processed: 12 Jan 2021 11:56:08

## DATA: Analysis 1 - Geotechnical Stability Analysis

## 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 (23 points) Material beneath: 2 - Loose sand, mixed grain size

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 0.00   | 8220.09 | 7.85   | 8220.00 | 14.76  | 8219.91 | 23.87  | 8219.80 | 33.20  | 8219.71 |
| 90.94  | 8219.22 | 100.48 | 8219.16 | 101.96 | 8219.15 | 104.22 | 8219.25 | 104.93 | 8219.25 |
| 109.69 | 8219.24 | 119.84 | 8219.19 | 142.71 | 8219.02 | 146.82 | 8218.97 | 148.69 | 8218.96 |
| 155.66 | 8218.93 | 159.10 | 8218.93 | 161.95 | 8218.93 | 163.41 | 8218.92 | 169.01 | 8218.87 |
| 182.03 | 8218.73 | 206.73 | 8218.44 | 237.74 | 8218.05 |        |         |        |         |

Profile: 2 (23 points) Material beneath: 1 - Sand and gravel, mixed grain size

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| -0.02  | 8218.59 | 7.83   | 8218.50 | 14.74  | 8218.41 | 23.85  | 8218.30 | 33.19  | 8218.21 |
| 90.93  | 8217.72 | 100.48 | 8217.66 | 101.99 | 8217.65 | 104.25 | 8217.75 | 104.93 | 8217.75 |
| 109.69 | 8217.74 | 119.83 | 8217.69 | 142.69 | 8217.52 | 146.81 | 8217.47 | 148.68 | 8217.46 |
| 155.66 | 8217.43 | 159.10 | 8217.43 | 161.95 | 8217.43 | 163.40 | 8217.42 | 168.99 | 8217.37 |
| 182.02 | 8217.23 | 206.72 | 8216.94 | 237.72 | 8216.55 |        |         |        |         |

## Slope Surface (6 points)

|        |         |        |         |        |         |        |         |        |         |
|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|
| 119.84 | 8219.19 | 146.82 | 8218.97 | 148.69 | 8218.96 | 155.05 | 8218.93 | 182.03 | 8214.00 |
| 237.74 | 8214.00 |        |         |        |         |        |         |        |         |

## Phreatic Surface (2 points)

|      |         |        |         |
|------|---------|--------|---------|
| 0.00 | 8212.00 | 500.00 | 8212.00 |
|------|---------|--------|---------|

## Failure Surface

Circular surface defined by: XL, XR, R

|                 |        |     |         |            |        |     |         |
|-----------------|--------|-----|---------|------------|--------|-----|---------|
| Intersects: XL: | 154.25 | YL: | 8218.93 | XR:        | 167.50 | YR: | 8216.66 |
| Centre: XC:     | 220.07 | YC: | 8562.03 | Radius: R: |        |     | 349.35  |

## RESULTS: Analysis 1 - Geotechnical Stability Analysis

## Bishop Simplified Method of Analysis - Circular Failure Surface

Factor of Safety: 4.25

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Slice Geometry and Properties (40 slices)

| Slice | X-S    | Base |       |       |        |      |          |      |        |                 |               |             |
|-------|--------|------|-------|-------|--------|------|----------|------|--------|-----------------|---------------|-------------|
|       | X-Left | Area | Angle | Width | Length | Matl | Cohesion | Phi  | Weight | Porewater Force | Normal Stress | Test Factor |
| 1     | 154.25 | 0.01 | 10.8  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 1.11   | 0.00            | 3.10          | 0.99        |
| 2     | 154.60 | 0.03 | 10.7  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 3.29   | 0.00            | 9.20          | 0.99        |
| 3     | 154.95 | 0.01 | 10.6  | 0.10  | 0.11   | 2    | 0.00     | 34.0 | 1.43   | 0.00            | 13.24         | 0.99        |
| 4     | 155.05 | 0.04 | 10.9  | 0.30  | 0.30   | 2    | 0.00     | 34.0 | 4.34   | 0.00            | 14.26         | 0.99        |
| 5     | 155.35 | 0.04 | 10.7  | 0.30  | 0.30   | 2    | 0.00     | 34.0 | 4.40   | 0.00            | 14.46         | 0.99        |
| 6     | 155.64 | 0.05 | 10.5  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.25   | 0.00            | 14.65         | 0.99        |
| 7     | 155.99 | 0.05 | 10.7  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.31   | 0.00            | 14.83         | 0.99        |
| 8     | 156.34 | 0.05 | 10.3  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.35   | 0.00            | 14.94         | 0.99        |
| 9     | 156.68 | 0.05 | 10.5  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.35   | 0.00            | 14.93         | 0.99        |
| 10    | 157.03 | 0.05 | 10.3  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.35   | 0.00            | 14.94         | 0.99        |
| 11    | 157.38 | 0.05 | 10.3  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.35   | 0.00            | 14.94         | 0.99        |
| 12    | 157.73 | 0.05 | 10.2  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.32   | 0.00            | 14.85         | 0.99        |
| 13    | 158.08 | 0.05 | 10.3  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.32   | 0.00            | 14.85         | 0.99        |
| 14    | 158.42 | 0.05 | 10.0  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.29   | 0.00            | 14.77         | 0.99        |
| 15    | 158.77 | 0.05 | 10.2  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.22   | 0.00            | 14.57         | 0.99        |
| 16    | 159.12 | 0.05 | 10.0  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.19   | 0.00            | 14.48         | 0.99        |
| 17    | 159.47 | 0.05 | 10.0  | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 5.09   | 0.00            | 14.20         | 0.99        |
| 18    | 159.82 | 0.05 | 9.9   | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 4.99   | 0.00            | 13.93         | 0.99        |
| 19    | 160.17 | 0.05 | 9.9   | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 4.89   | 0.00            | 13.64         | 0.99        |
| 20    | 160.52 | 0.05 | 9.7   | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 4.79   | 0.00            | 13.37         | 0.99        |
| 21    | 160.86 | 0.05 | 9.9   | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 4.65   | 0.00            | 12.98         | 0.99        |
| 22    | 161.21 | 0.05 | 9.7   | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 4.49   | 0.00            | 12.52         | 0.99        |
| 23    | 161.56 | 0.04 | 9.5   | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 4.35   | 0.00            | 12.15         | 0.99        |
| 24    | 161.91 | 0.04 | 9.5   | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 4.18   | 0.00            | 11.68         | 0.99        |
| 25    | 162.26 | 0.04 | 9.5   | 0.35  | 0.35   | 2    | 0.00     | 34.0 | 3.98   | 0.00            | 11.11         | 0.99        |
| 26    | 162.61 | 0.01 | 9.4   | 0.07  | 0.07   | 2    | 0.00     | 34.0 | 0.72   | 0.00            | 10.83         | 0.99        |
| 27    | 162.67 | 0.03 | 9.3   | 0.32  | 0.32   | 1    | 0.00     | 45.0 | 3.52   | 0.00            | 10.70         | 0.98        |
| 28    | 162.99 | 0.03 | 9.5   | 0.32  | 0.32   | 1    | 0.00     | 45.0 | 3.51   | 0.00            | 10.66         | 0.98        |
| 29    | 163.31 | 0.03 | 9.4   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 3.75   | 0.00            | 10.34         | 0.98        |
| 30    | 163.66 | 0.03 | 9.2   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 3.49   | 0.00            | 9.62          | 0.98        |
| 31    | 164.00 | 0.03 | 9.2   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 3.23   | 0.00            | 8.90          | 0.98        |
| 32    | 164.35 | 0.03 | 9.2   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 2.93   | 0.00            | 8.07          | 0.98        |
| 33    | 164.70 | 0.02 | 9.1   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 2.63   | 0.00            | 7.25          | 0.98        |
| 34    | 165.05 | 0.02 | 9.1   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 2.36   | 0.00            | 6.52          | 0.98        |
| 35    | 165.40 | 0.02 | 9.0   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 1.99   | 0.00            | 5.49          | 0.98        |
| 36    | 165.75 | 0.02 | 8.9   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 1.69   | 0.00            | 4.66          | 0.98        |
| 37    | 166.10 | 0.01 | 8.9   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 1.35   | 0.00            | 3.73          | 0.98        |
| 38    | 166.45 | 0.01 | 8.7   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 0.94   | 0.00            | 2.59          | 0.98        |
| 39    | 166.80 | 0.01 | 8.7   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 0.56   | 0.00            | 1.56          | 0.98        |
| 40    | 167.15 | 0.00 | 8.7   | 0.35  | 0.35   | 1    | 0.00     | 45.0 | 0.19   | 0.00            | 0.52          | 0.98        |

|           |      |              |       |             |        |
|-----------|------|--------------|-------|-------------|--------|
| X-S Area: | 1.46 | Path Length: | 13.45 | X-S Weight: | 147.11 |
|-----------|------|--------------|-------|-------------|--------|

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