



McCulley, Frick & Gilman, inc.
providing environmental consulting and engineering services



CONSTRUCTION COMPLETION REPORT

**CASH MINE /GOLD HILL MILL
TAILINGS POND EXPANSION
GOLD HILL, COLORADO**

December 22, 1998

Prepared for:

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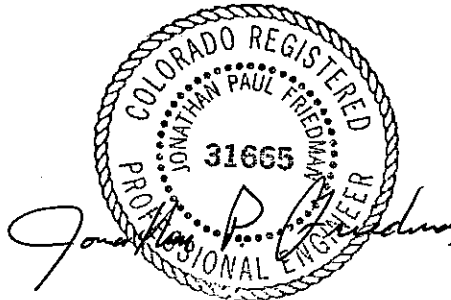
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MFG Project No. 5461

CERTIFICATION

I hereby certify that, to the best of my knowledge and based on observations and documentation provided, the construction of the tailings impoundment associated with the Gold Hill Mill, located approximately 0.5 miles east of Gold Hill, Colorado was performed in general accordance with the design plans and specifications and approved project changes as described in this report. No written or otherwise intended guarantee is provided for the integrity or performance of the tailings impoundment.



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Colorado Registered Professional Engineer
No. 31665

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1.0 INTRODUCTION

This Construction Report documents the construction activity completed at the Cash Mine Gold Hill Mill Tailings Storage Facility (Site), which is located approximately ½ mile east of Gold Hill, Colorado. The work was completed in general accordance with the Design Report prepared by McCulley Frick & Gilman, Inc. (MFG), dated August 5, 1998. Completed construction activities include:

- Excavation of the expanded tailings impoundment basin;
- Placement of biaxial geogrid reinforcement on existing tailings surface;
- Placement and compaction of fill for the embankment raise;
- Excavation and backfill of the geosynthetics anchor trench around Phase 1 area;
- Placement of a sand cushion layer over the entire basin and embankment face;
- Placement of composite Geo-synthetic Clay Liner (GCL) and 60 mil High Density Poly-Ethylene (HDPE) liner in Phase 1 area of impoundment;
- Excavation of 24 inches of existing tailing including all organic matter from original impoundment;
- Placement of 18 to 24 inches of granular material in the area in which the tailings and organics were removed;
- Excavation of a geosynthetics anchor trench around the Phase 2 area;
- Placement of biaxial geogrid reinforcement on remaining exposed tailing surface;
- Placement of buttressing fill on biaxial geogrid and exposed tailing surface;
- Placement of composite GCL and 60 mil HDPE liner in Phase 2 area of impoundment;
- Backfill of the geosynthetics anchor trench around Phase 2 area;
- Placement of erosion control silt fence at the downstream toe of the embankment and topsoil stock pile; and
- Installation of 8 ft wire mesh security/game fence around the tailing impoundment perimeter.

The objectives of this construction report are to document the construction activities and provide as-built drawings of the tailings impoundment facility.

The Gold Hill Mill Tailings Impoundment is located approximately 100 feet northeast of the mill building, as illustrated on the site plan, (Drawing 5461-C1A). The original impoundment encompassed approximately 18,000 ft². The expanded tailings impoundment encompasses a total of 48,680 ft².

Earthwork activities were implemented under the direction and oversight of ITEC. MFG coordinated field Quality Assurance (QA) of the earthwork. Colorado Lining International (CLI) was the geosynthetics lining contractor. The Colorado Department of Natural Resources Division of Mines Geology (DMG) was present at various times throughout the construction to provide input and address issues during the construction. The earthwork construction activities outlined in the design were performed by Lens Excavating, Inc. under contract to ITEC. Additional excavation and fill placement activities were performed by Max Yeager and KAS Pond & Lagoon, Inc., both under contract to ITEC. Surveying activities were conducted by Mountain Surveying & Mineral Services under contract to ITEC and under the direction of ITEC and MFG.

This Construction Report consists of four major sections. Section 2 presents the 1998 construction chronology. Section 3 presents a discussion of the construction activities completed and addresses modifications to the Design. Section 4 details the QA activities performed throughout the progress of the project.

2.0 CONSTRUCTION CHRONOLOGY

Construction activities associated with the Gold Hill Mill tailings impoundment expansion commenced August 17, 1998 and continued through November 23, 1998. Minor work such as security fencing, embankment slope dressing, and installation of erosion control fencing was completed by December 4, 1998. Construction of the upgradient diversion channel around the tailings impoundment was completed December 18, 1998. A chronology of activities conducted is presented in Table 1.

3.0 CONSTRUCTION ACTIVITIES

The construction activities completed at the Gold Hill Mill tailings impoundment expansion were conducted in general accordance with the design and approved field changes. The following sections highlight the activities conducted to complete the scope of work described in the Design Report.

3.1 Embankment Raise and Phase 1 Basin Excavation

The impoundment basin is divided into two parts referred to as Phase 1 and Phase 2. A divider dike or interim berm separates the two areas as illustrated on Drawing 5461-C2. Material used for the embankment raise was generated from the Phase 1 portion of the tailings impoundment basin.

Approximately 8915 cubic yards (cy) of soil and rock were excavated from the Phase 1 basin of which 1400 cy of topsoil were stockpiled for future reclamation purposes. The constructed embankment raise required approximately 7500 cy of fill.

Excavation of the Phase 1 impoundment area was accomplished with a Caterpillar D-10 dozer, ripping the subgrade to the extent that sufficient material was generated before being hauled and placed for the embankment. The loosened material was hauled to the area of placement, placed, spread and compacted with a CAT 966 front-end track loader. This process was repeated until the designed embankment was fully constructed. Quality control compaction testing and construction material laboratory testing was performed by HP Geotechnical, Inc under direction of MFG. Compaction/density conformance testing is presented in Appendix A.

The basin shape was governed by the excavatability of the underlying bedrock. A massive quartz vein trending approximately N 10° W was encountered in the northeast side of the basin, which precluded any further excavation in this direction due to the indurated nature of this material. A slight variation in the embankment alignment was necessary to maintain a safe working distance from overhead electric power lines. The re-alignment occurs at the southern end of the embankment where the crest shifts approximately 5 degrees to the southwest.

Two piezometers (P-1 and P-2) were installed at the locations shown on Drawing 5461-C2. The piezometers were installed approximately 12 feet into the embankment footprint from the upstream embankment toe and were manually advanced to the bottom of the existing pond floor. The piezometers were constructed of 1 inch diameter schedule 40 PVC tubing, with 1/8-inch wide slots cut into the bottom 2 feet. The end was capped and cotton mesh textile was loosely wrapped and secured with electrical tape around the slotted length to prevent clogging of the slotted openings. The as-constructed piezometers are illustrated on Drawing 5461-C7.

Water levels in the piezometers were read regularly to monitor the pore water pressure change in response to increase pressure developed by the overlying embankment fill. Water levels as recorded, are presented Table 2. A graphical representation of the water levels in each piezometer coupled with embankment elevation over time is presented in Figure 1. As illustrated, the water level rose in each piezometer due to the increased load of the embankment; however, over time pore water pressures within the tailings dissipated which is reflected in the decrease in the water level readings. The reduction in pore water pressure is indicative of pore pressure stabilization and increased shear strength of the tailings.

Two settlement plates (S-1 and S-2) were installed near P-1 and P-2, respectively, and surveyed to monitor the amount of consolidation settlement occurring over time due to the increased load of the overlying embankment fill. The location of the settlement plates is shown on Drawing 5461-C2. The settlement plates consisted of a 1.5' x 1.5' galvanized steel plate, with a 12 foot long, 1/4" diameter continuously threaded steel rod bolted on both sides of the plate through the center. A 10 foot length of 1 inch diameter Schedule 40 PVC casing was placed around the steel rod to reduce friction from the surrounding fill. The inner steel rod was continuously threaded to allow for extensions as necessary. The as-constructed settlement plates are illustrated on Drawing 5461-C7. Settlement plate monitoring readings are presented in Table 3.

3.2 Phase 1 Basin Preparation

The subgrade in the Phase 1 basin area was smoothed with the heavy equipment and manually cleared of loose rock fragments greater than 2 inches in diameter. A cushion layer consisting of a

medium to coarse sand was placed over the entire subgrade surface with a CAT IT28F rubber tired front end loader. The sand cushion layer thickness varied from 2 to 4 inches.

As part of the basin preparation, the geosynthetics anchor trench was excavated prior to the placement of the geosynthetic liners. The Phase 1 geosynthetics anchor trench was excavated using a backhoe excavator. In areas where more resistive material, i.e. massive quartz veins, were encountered, a skid steer mounted pneumatic chisel hammer was used to achieve the required anchor depth and width of 24 inches. The anchor trench was backfilled with the material that was excavated from the trench and compacted once the geosynthetic liners were installed.

3.3 Phase 1 Geosynthetics Installation

Deployment of the geosynthetics liner system consisted of the placement of a Bentofix geosynthetic clay liner (GCL) overlain by 60 mil High Density Poly-ethylene (HDPE) flexible membrane liner. The GCL was deployed from the anchor trench down into the basin. A rubber tired extend-a-load forklift equipped with a spreader bar was used to hold the respective roll of geosynthetic while the material was manually unrolled and placed. The spreader bar was required for ease in un-rolling/deploying the respective material. Once the material was placed as specified, (i.e.). with proper overlap), all seams were welded as per the technical specifications. Quality control, which was performed by CLI, consisted of destructive peel and shear tests on the welds and non-destructive air lance tests and/or vacuum box tests on all seams. Quality control documentation for the weld and seam testing as well as the 'as-constructed' geosynthetic panel layout is presented in Appendix B.

3.4 Phase 2 Basin Preparation

Prior to the placement of geosynthetics in the Phase 2 basin area, all vegetation, and deleterious materials, including tailings, were removed from the existing tailings surface to a maximum depth of 2 feet. Due to the potential upstream instability of the embankment raise as a result of the removal of this material, the biaxial geogrid was extended over the exposed tailings surface area and a minimum of 1.5 ft of granular fill was placed on top of the geogrid to act as a buttress for the embankment. Details

of the embankment buttress are discussed in more detail in Technical Revision No. 1, which is included as part of this report in Appendix C.

Instrumentation

Three settlement plates (S-3, S-4, and S-5) were installed and surveyed to monitor the amount of tailings consolidation occurring over time due to the load of the buttressing fill and subgrade materials. The location of these settlement plates are shown on Drawing 5461-C2. The settlement plates consisted of a 1.5' x 1.5' galvanized steel plate, with a 4 foot long, 1/4" diameter threaded steel rod bolted on both sides of the plate through the center. A 2 foot length of 1 inch diameter Schedule 40 PVC casing was placed around the steel rod to reduce friction from the surrounding fill. The inner steel rod was continuously threaded to allow for extensions as necessary. Details of the settlement plate construction and installation are shown on drawing 5461-C7. Settlement plate monitoring readings are presented in Table 3 and a graphical representation of settlement over time is presented in Figure 2.

Relocation and placement of excavated organic matter and tailings

The excavated tailings materials were transported to the Phase 1 area using the access road located along the south side of the impoundment in between the impoundment basin and the mill. Removal of the organic matter and upper 1.5 to 2 feet of existing tailings was accomplished with a track-mounted Link Belt 3400 excavator equipped with a 60 foot boom. The excavator operated from the embankment crest allowing the operator a more advantageous position. This material was then placed in the bucket of a track-mounted dozer which hauled the tailings around the southern edge of the impoundment, dumping the material at the southwest edge of the Phase 1 basin. This process was repeated until all required material was removed.

Due to excessive moisture caused by an early season snowstorm, a minor modification was made to the Phase 2 basin subgrade section. A detailed description of the field modification is presented in Appendix C. As a result of the discussion between ITEC, DMG and MFG representatives, a detached sheet of scrap of 60 mil HDPE was placed over two separate areas containing excessive moisture to provide a more suitable subgrade for the GCL composite liner.

3.5 Phase 2 Geosynthetics Installation

Prior to the commencement of geosynthetic installation activities, settlement plates S-1, S-2, S-3, S-4, and S-5 and piezometers P-1 and P-2 were decommissioned. Decommissioning entailed cutting the respective apparatus 6 inches below the finished subgrade surface, capping the PVC casing and backfilling to the surrounding subgrade surface.

Deployment of the geosynthetics liner within the Phase 2 area was performed in the same manner as in the Phase 1 area. The installation procedure is the same as described in Section 3.3. Quality control documentation for the weld and seam testing as well as the 'as constructed' geosynthetic panel layout for Phase 2 is presented in Appendix B.

On the afternoon of November 20, 1998, eight panels of geosynthetics averaging 75 feet in length had been deployed, welded and sand bagged by the day's end. Between the evening of November 20, 1998 and early morning of November 21, 1998 high winds lifted the working/leading edge of the geomembrane, forcing the 60 mil HDPE liner to pull out of the partially backfilled anchor trench and tear along the interim berm. None of the GCL panels were displaced. The HDPE material was creased and wrinkled beyond use and had to be cut into scrap pieces. The scrap pieces of HDPE were placed evenly and as flat as possible over the Phase 2 basin floor that had not yet been covered by the GCL. The remainder of the Phase 2 area was lined as designed. Placement of the GCL and HDPE continued without further incident.

3.6 Security/Game Fence

A security fence constructed of wooden and steel posts and wire mesh was erected and is located as shown on Drawing 5461-C2. Fence construction details are illustrated on drawing 5461-C5. The intention of the fence is to provide security as well as keep animals from entering the lined area.

3.7 Surface Water Diversion Ditch

In order to maintain positive drainage away from the tailings impoundment and minimize ponding of water on the placed tailings, a surface water run-on diversion channel was excavated around the western edge of the impoundment. Improvements were also made to the mill/impoundment access road to divert run-off away from the impoundment and mill building foundation area.

4.0 QUALITY CONTROL

Earthworks

Quality control of the embankment fill compaction was done by Hepworth Pawlak Geotechnical, Inc. under the direction of MFG. A total of 53 nuclear densometer tests and three sand cone reference density tests were performed on the embankment fill. Fill compaction frequency testing averaged 1 test per 140 cy placed compared to 1 test per 500 cy as specified in the earthwork specifications. A comparison of the specified test frequency and actual test frequency is summarized in the following table.

TESTING FREQUENCY

Material	Test Designations	Test Frequency (1 Per)	
		Specified	Actual
Embankment Random Fill	Particle Size Analysis	2,000 cy* or 1 per material type	2 per material type
	Moisture Content	2,000 cy or 1 per material type	1 per 140 cy
	Laboratory Compaction	2,000 cy or 1 per material type	2 per material type
	Field Density/Moisture	500 cy min. or the discretion of the field engineer	1 per 140 cy

*cy = cubic yard.

Field and laboratory data sheets for the embankment compaction verification tests are presented in Appendix A.

Geosynthetics

Installation reports for the geosynthetics, including field data sheets and the destructive and non-destructive QA testing of the 60 mil HDPE geomembrane liner, are presented in Appendix B. An 'As-Constructed' panel diagram for each Phase is also included as part of the installation report.

5.0 REFERENCES

Colorado Lining International, Inc., Quality Assurance Manual for the Installation of Flexible Membrane Lining Systems. Prepared by Colorado Lining International, Inc.

ITEC Environmental Colorado, Inc., Cash Mine / Gold Hill Mill, Gold Hill, Colorado, Tailings Pond Expansion and Site Development, Design Report. Prepared by McCulley, Frick & Gilman, Inc., August 5, 1998.

ITEC Environmental Colorado, Inc., Cash Mine Site Development, Gold Hill, Colorado, Tailings Pond Expansion, Technical Specifications. Prepared by McCulley, Frick & Gilman, Inc., September 2, 1998.

TABLES

TABLE 1
CONSTRUCTION CHRONOLOGY
GOLD HILL MILL TAILINGS IMPOUNDMENT EXPANSION
1998 CONSTRUCTION

ACTIVITY DESCRIPTION	DATES OF PERFORMANCE
Earthworks	
Mobilization/Preparatory Work for Primary Earthworks	August 17, 1998
Tailings Basin and Borrow Area Development	August 18 thru September 25, 1998
Embankment Fill Placement	August 18 thru September 25, 1998
Excavation of Phase 1 Area Anchor Trench	September 26, 27, 1998
Clean-up/Demobilization of Primary Earthwork Contractor	September 26, 1998
Excavation and Placement of Tailings in Phase 1 Impoundment	October 10, 1998
Excavation of Phase 2 Area Anchor Trench	November 12, 13, 1998
Geosynthetics	
Mobilization/Preparatory Work for Phase 1	September 28, 1998
Installation of GCL and HDPE Liners in Phase 1 Basin	September 29 thru October 2, 1998
Clean-up/Demobilization of Geosynthetics Contractor Phase 1	October 2, 1998
Mobilization/Preparatory Work for Phase 2	November 16, 1998
Installation of GCL and HDPE Liners in Phase 2 Basin	November 16 - November 23, 1998
Clean-up/Demobilization of Geosynthetics Contractor Phase 2	November 23, 1998

TABLE 2

**PIEZOMETER READING SUMMARY
GOLD HILL MILL TAILINGS IMPOUNDMENT EXPANSION**

Date	Depth to Top of Water Piezometer P-1 (ft)*	Depth to Top of Water Piezometer P-2 (ft)*	Comments
September 22, 1998	7.85	4.98	embankment construction over previous tailings surface commenced September 2, 1998
September 25, 1998	7.50	3.90	embankment construction completed September 25, 1998
October 3, 1998	7.50	6.05	
October 7, 1998	8.65	6.87	readings taken prior to the removal of organic matter
October 26, 1998	9.50	8.86	readings taken after organic matter removed
November 11, 1998	8.96	8.58	
November 16, 1998	8.95	8.55	piezometers decommissioned, Phase 2 geosynthetics installation commences November 16, 1998

* Note: Readings were measured from the top of the piezometer casing.

TABLE 3
SETTLEMENT PLATE SURVEY DATA
GOLD HILL MILL TAILINGS IMPOUNDMENT EXPANSION

Date Surveyed	Settlement Plate Displacement				
	S-1 (feet)	S-2 (feet)	S-3 (inches)	S-4 (inches)	S-5 (inches)
September 14, 1998	8417.22	8417.60	-	-	-
September 21, 1998	8417.52	8417.54	-	-	-
October 27, 1998	-	-	0.0	0.0	0.0
October 28, 1998	-	-	0.0	0.0	0.0
October 29, 1998	-	-	-1.00	0.25	0.0
October 30, 1998	-	-	-1.00	0.25	0.25
October 31, 1998	-	-	-1.00	0.0	0.0
November 1, 1998	-	-	-1.00	0.0	0.0
November 2, 1998	-	-	-1.00	0.0	0.0
November 3, 1998	-	-	-1.00	0.0	-0.125
November 4, 1998	-	-	-1.125	0.0	0.125
November 5, 1998	-	-	-1.125	-0.125	0.0
November 6, 1998	-	-	-1.125	-0.125	0.0
November 7, 1998	-	-	-1.125	-0.125	0.0
November 16, 1998	8416.76	8417.31	-1.25	-0.25	-0.125
Net Settlement (inches)	-5.52	-3.48	-1.25	-0.25	-0.125

Notes: Negative Settlement values indicate downward movement.
 Settlement readings for S-3, S-4 and S-5 are relative.

FIGURES

Figure 1: A line graph showing the relationship between two variables. The x-axis is labeled 'X' and the y-axis is labeled 'Y'. The data points are connected by a solid line, showing a positive correlation. The line starts at the origin (0,0) and rises to a peak at (10,10), then descends to a trough at (20,0), and finally rises again to (30,10). The line is labeled 'Line 1'.

Figure 2: A bar chart showing the distribution of data across five categories. The x-axis is labeled 'Category' and the y-axis is labeled 'Value'. The bars are colored red, blue, green, yellow, and purple. The values are 10, 20, 30, 40, and 50 respectively. The chart is labeled 'Bar Chart'.

Figure 3: A pie chart showing the distribution of data across five categories. The chart is divided into five segments of equal size, each representing 20% of the total. The segments are colored red, blue, green, yellow, and purple. The chart is labeled 'Pie Chart'.

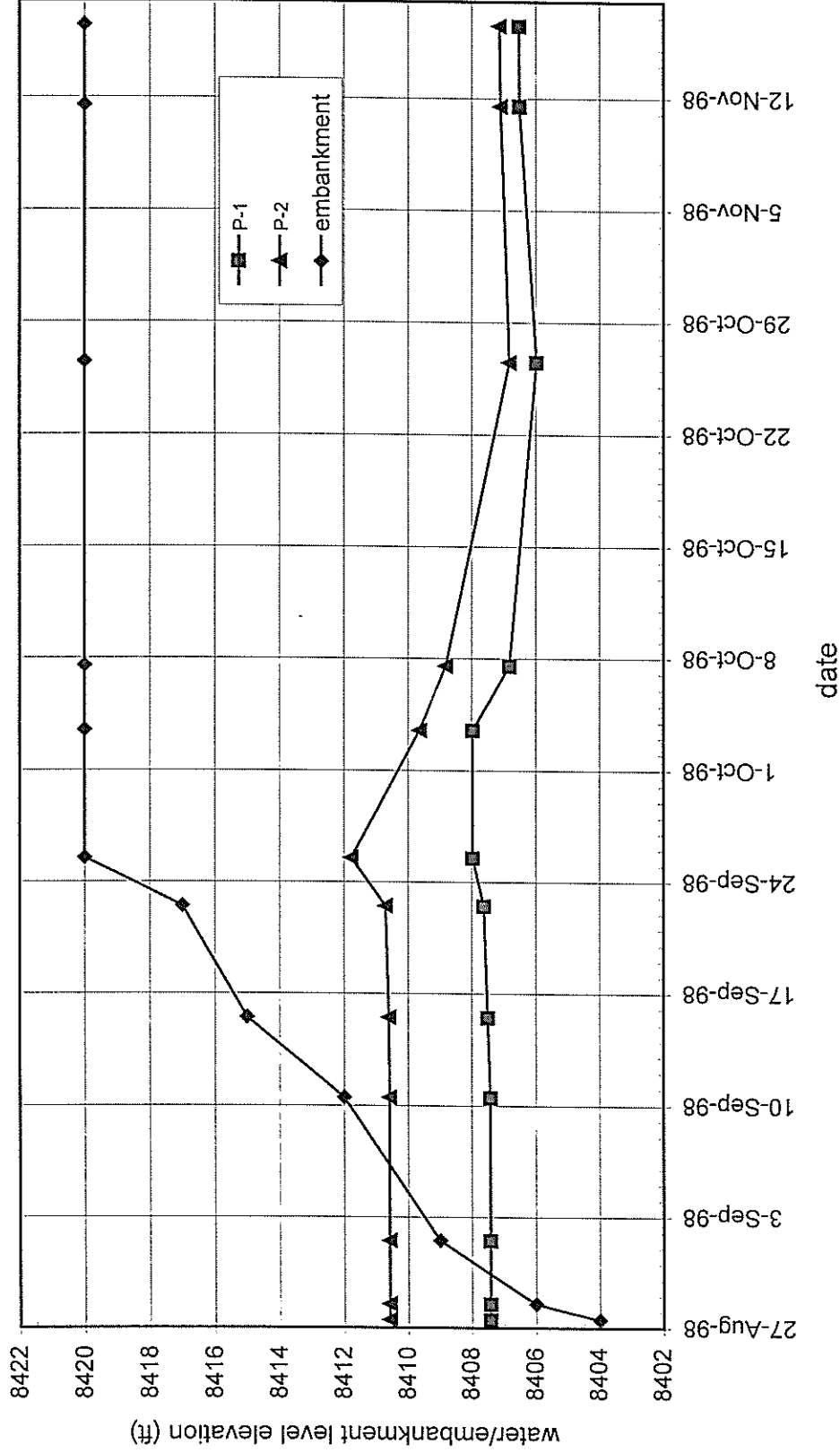
Figure 4: A scatter plot showing the relationship between two variables. The x-axis is labeled 'X' and the y-axis is labeled 'Y'. The data points are scattered around a central point, showing a weak positive correlation. The points are labeled 'Scatter Plot'.

Figure 5: A line graph showing the relationship between two variables. The x-axis is labeled 'X' and the y-axis is labeled 'Y'. The data points are connected by a dashed line, showing a negative correlation. The line starts at (0,10) and descends to (10,0). The line is labeled 'Line 2'.

Figure 6: A bar chart showing the distribution of data across five categories. The x-axis is labeled 'Category' and the y-axis is labeled 'Value'. The bars are colored red, blue, green, yellow, and purple. The values are 5, 10, 15, 20, and 25 respectively. The chart is labeled 'Bar Chart'.

FIGURES

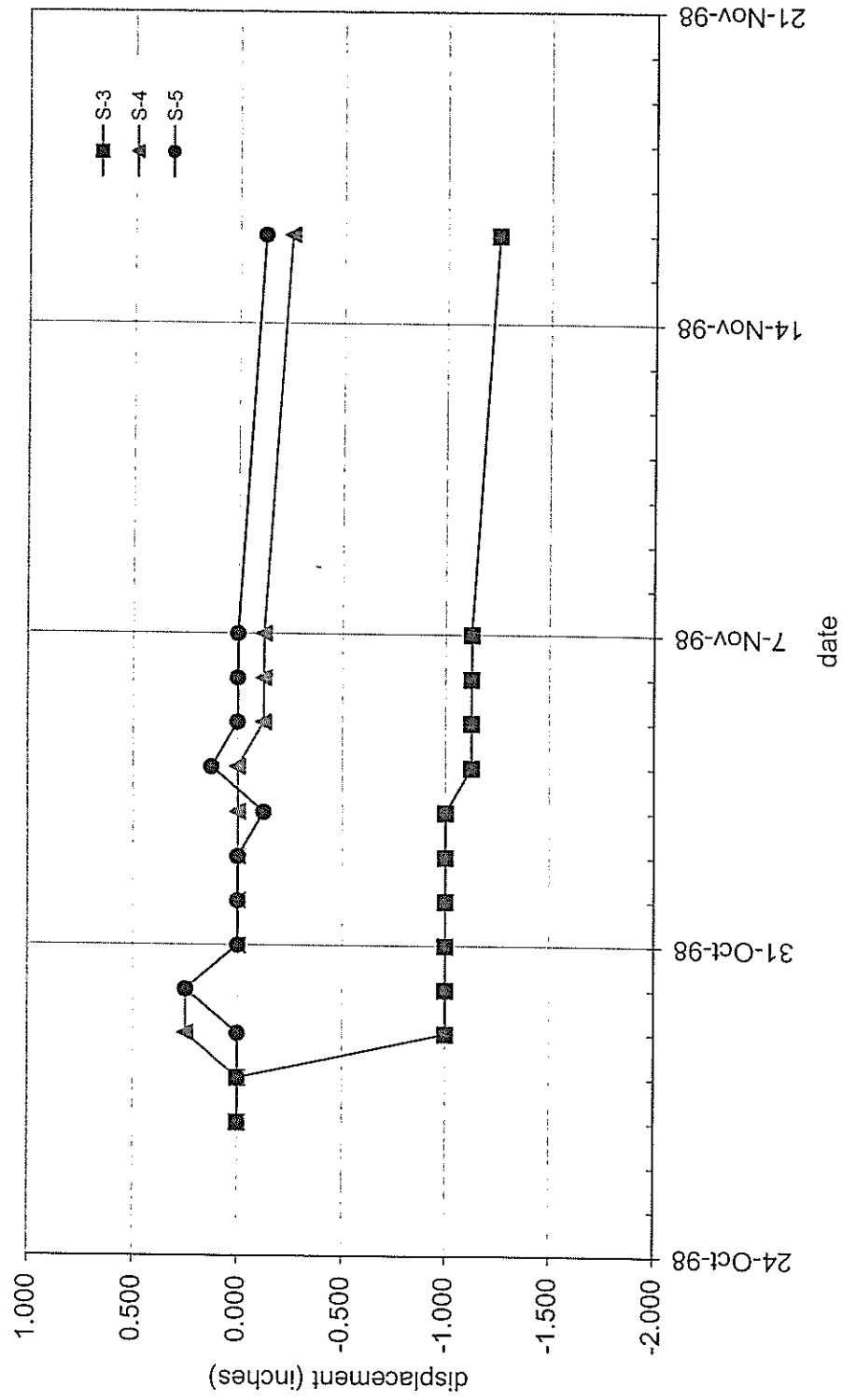
Piezometer Phreatic Level vs Time



the total length of piezometer P-1 was 13.17 ft
the elevation at the top of P-1 casing was 8415.47 ft
the bottom of the existing tailings basin at P-1 is 8402.30 ft

the total length of piezometer P-2 was 14.33 ft
the elevation at the top of P-2 casing was 8415.68 ft
the bottom of the existing tailings basin at P-2 is 8401.35 ft

Settlement Plate Vertical Displacement vs Time



top of tailings surface 0.0
 settlement plates were positioned on top of tailings surface
 tailings depth in areas of settlement plates is estimated to be between 4 and 6 feet

DRAWINGS

DRAWINGS

ITEC - Environmental Colorado Incorporated

CASH MINE SITE DEVELOPMENT GOLD HILL, COLORADO

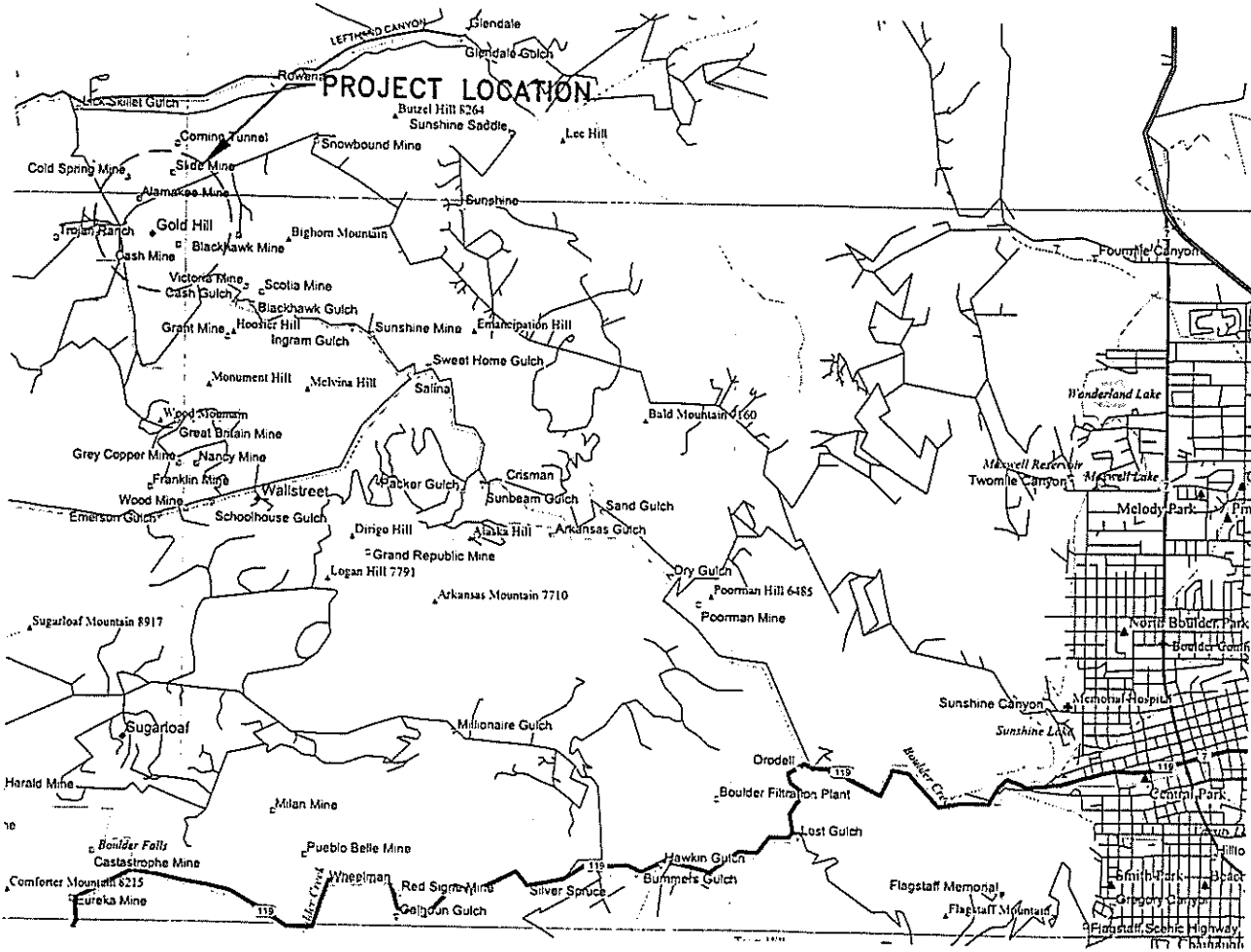
DRAWING LIST

<u>TITLE</u>	<u>NUMBER</u>
Title Page, Drawing List and Vicinity Map	5461-G1
Site Plan	5461-C1A
Tailings Impoundment Plan	5461-C2
Tailings Impoundment Sections	5461-C4A
Tailings Impoundment Details	5461-C5
Piezometer and Settlement Plate Configuration Details	5461-C7



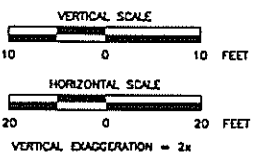
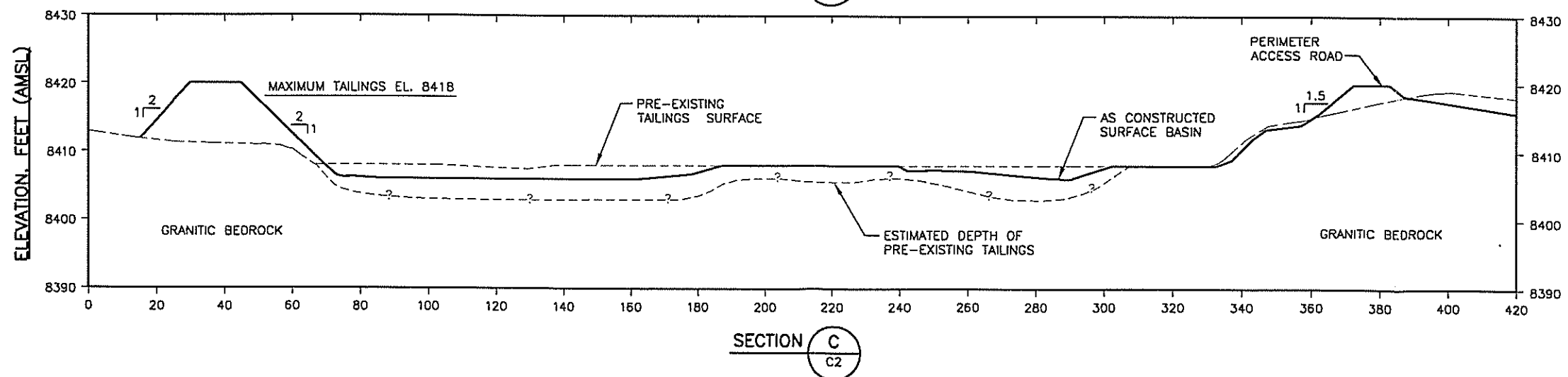
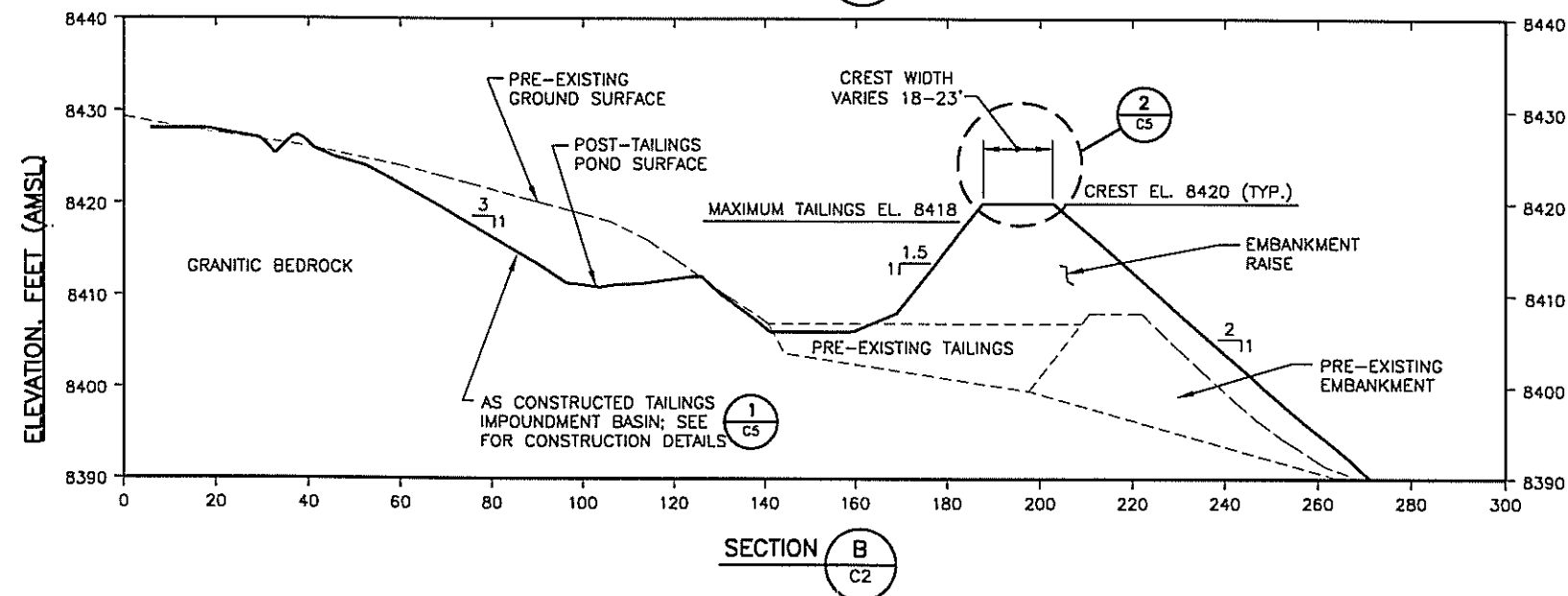
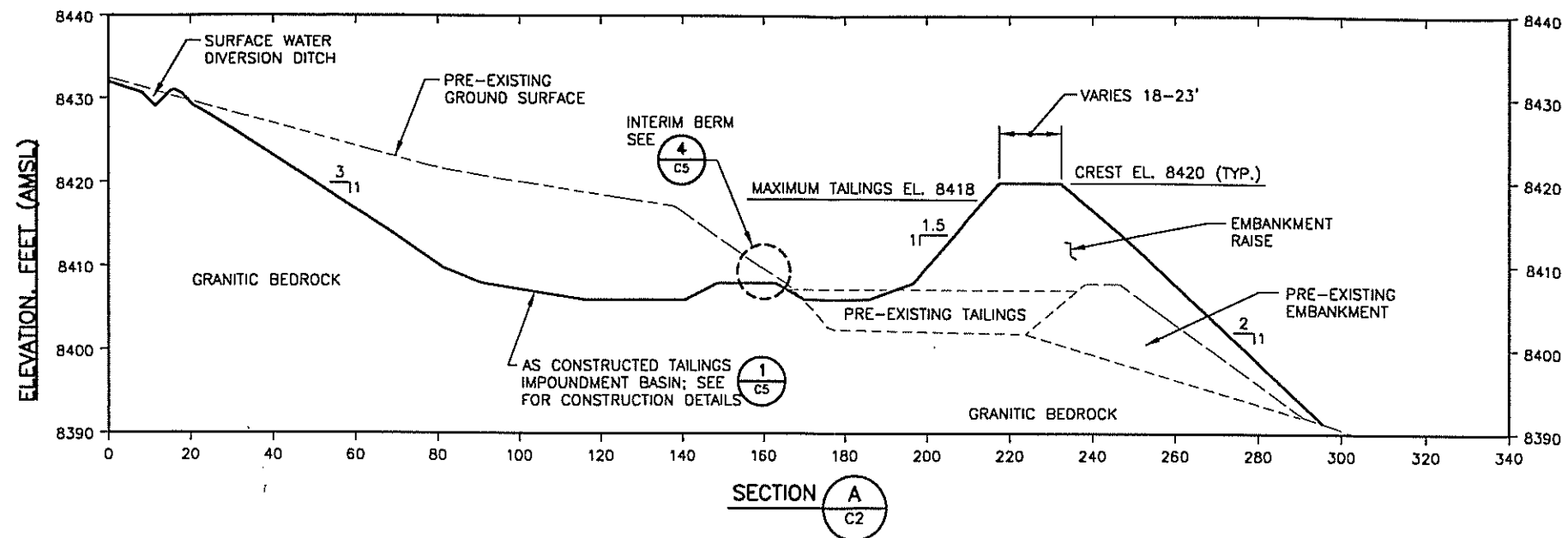
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consulting and
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Frick &
Gilman, Inc.



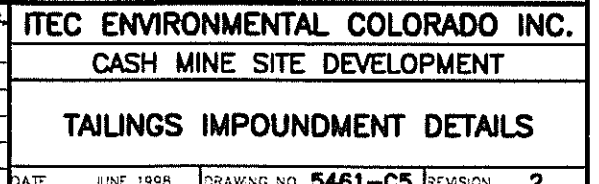
Vicinity Map
Scale: 1 inch = Approx. 1.2 miles

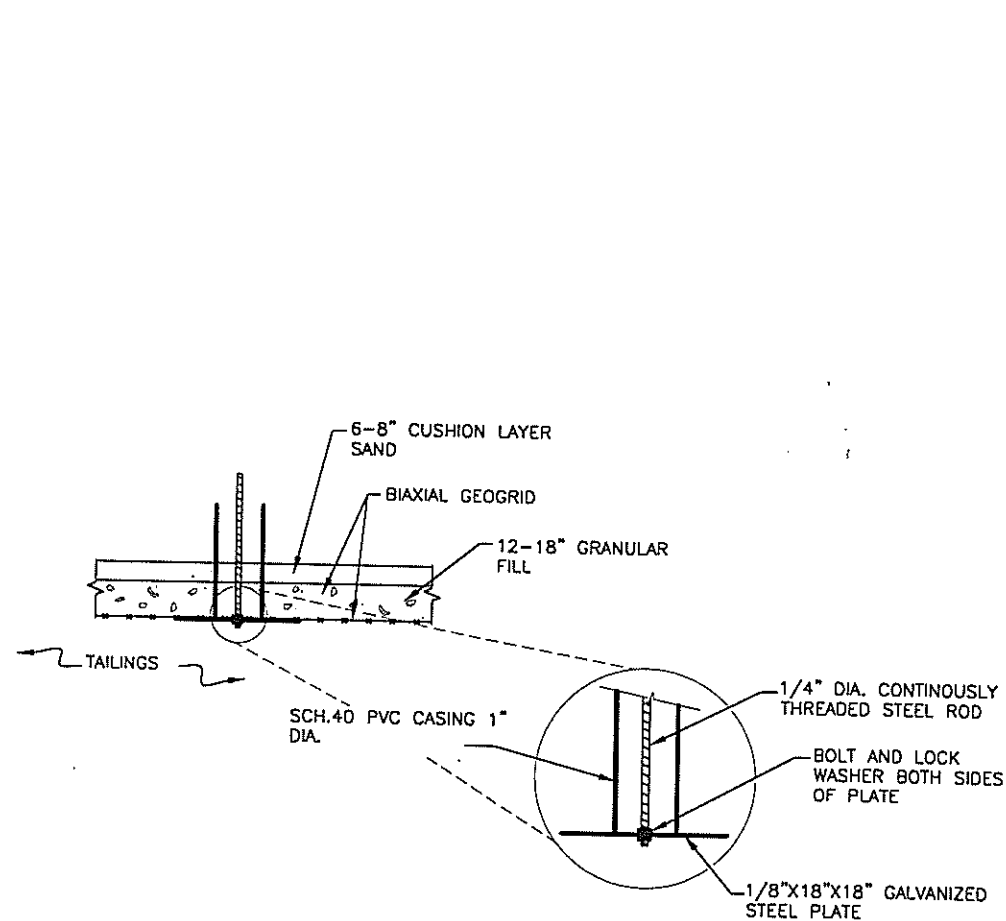
Issue For As Built
5461-G1



REFERENCE	NO.	REVISIONS	BY	DATE	NO.	REVISIONS	BY	DATE	McCulley, Frick & Gilman, Inc. providing environmental consulting and engineering services	ITEC ENVIRONMENTAL COLORADO INC.
									DESIGNED BY: JPF	CASH MINE SITE DEVELOPMENT
									DRAWN BY: SCG/PRM	TAILINGS IMPOUNDMENT
									CHECKED BY: DJH	SECTIONS
									APPROVED BY: JPF	
									FILE NAME: D:\5461\5461-15A.DWG	DATE: JUNE 1998
										DRAWING NO. 5461-C4A
										REVISION 0



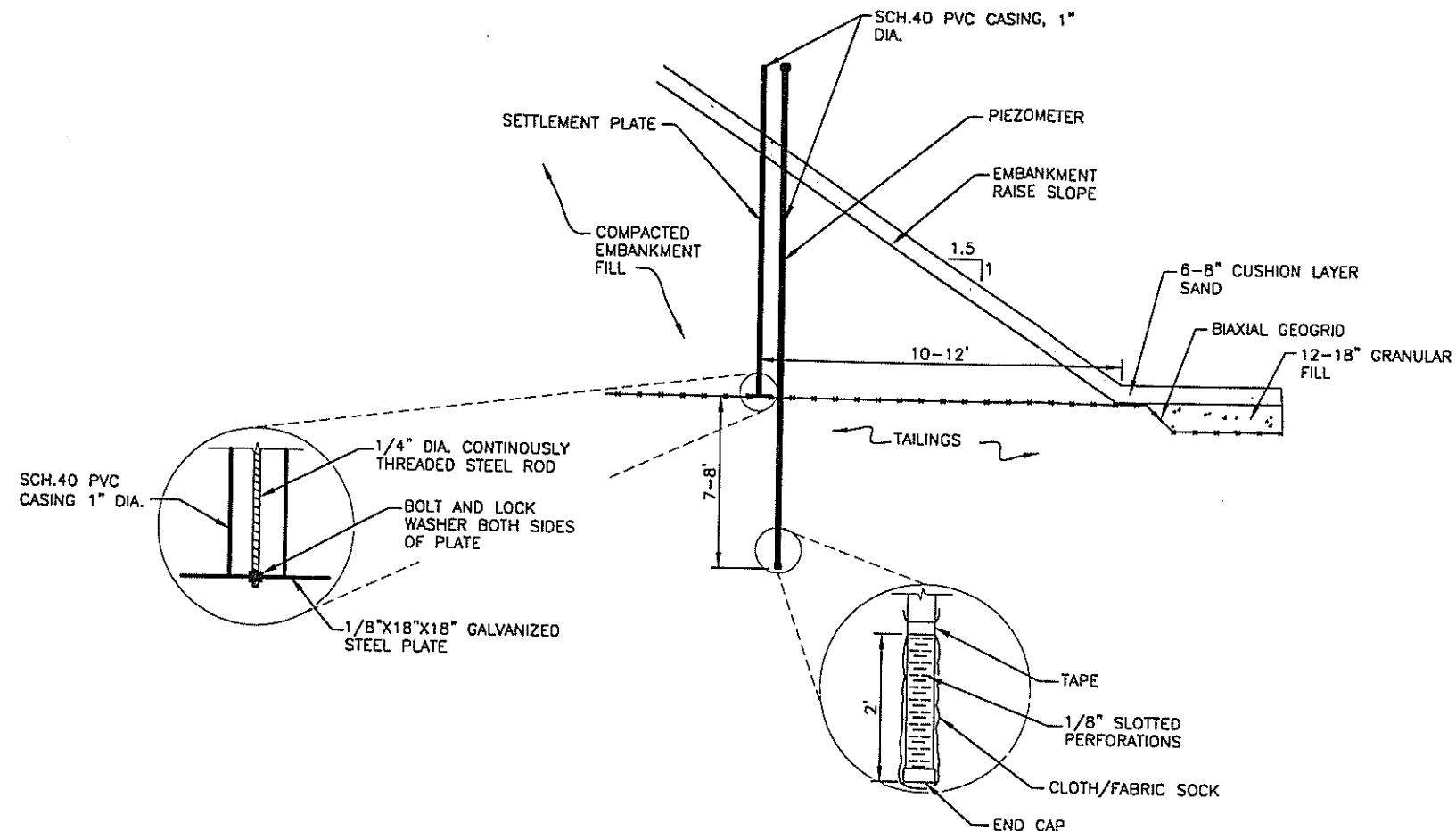




TYPICAL EMBANKMENT BUTTRESS SETTLEMENT
CONFIGURATION (SETTLEMENT PLATES S-3, S-4, & S-5)

NOT TO SCALE

1
C2



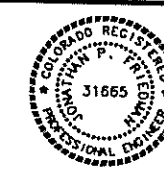
TYPICAL EMBANKMENT PIEZOMETER AND
SETTLEMENT PLATE CONFIGURATION
(PIEZOMETER P-1, P-2 & SETTLEMENT PLATES S-1, S-2)

NOT TO SCALE

2
C2



REFERENCE	NO.	REVISIONS	BY	DATE	NO.	REVISIONS	BY	DATE	DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:	FILE NAME:	DATE	DRAWING NO.	REVISION
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ITEC ENVIRONMENTAL COLORADO INC.
CASH MINE SITE DEVELOPMENT
BUTTRESS & PIEZOMETER SETTLEMENT
PLATE CONFIGURATION DETAILS



1

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APPENDIX A

Geotechnical Field & Laboratory Quality Control Data Sheets

HEPWORTH-PAWLAK GEOTECHNICAL, Inc.

10214 South Progress Ln.
Parker, CO 80134

Fax 303 841-7556
Phone 303 841-7119

September 3, 1998

ITEC Environmental Colorado Inc.
c/o McCulley, Frick, and Gilman
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80303

Dear Mr. Friedman:

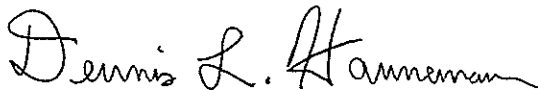
Enclosed are daily field report numbers 1 through 6 for nuclear density testing performed on the raise to the existing tailings embankment at the Cash Mine Redevelopment. The criteria established for the fill are a minimum dry density exceeding 90% of the maximum Modified Proctor (ASTM D1557) within 2 percent of optimum moisture content.

Results of the Modified Proctor and gradation testing are presented on Figures 1 and 2. Because of local variations in the fill beneath nuclear density test locations, both rock corrected and uncorrected maximum dry density and moisture content values have been used. Our field technician determines which values to use depending on visual observation of the soils beneath the nuclear gage to the probe depth.

If you have any questions, please call.

Sincerely,

HEPWORTH-PAWLAK GEOTECHNICAL, Inc.

A handwritten signature in cursive script that reads "Dennis L. Hanneman".

Dennis L. Hanneman, P.E.

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 8/24/98
DAILY REPORT # 1
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Required

METHOD OF ADDING MOISTURE: Natural

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, $\pm 2\%$ OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
1	85' S.W., 17' N.W.	8394	137.1	5.8	124.0	5.7	90	90	Silty Gravelly Sand
2	At power pole, 16' N.W.	8393	130.4	7.7	119.9	5.6	92	90	Silty Gravelly Sand
3	91' N.E., 14' N.W.	8395	137.1	5.8	130.3	4.3	95	90	Silty Gravelly Sand

PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Bill, Len, & Jon (* preliminary)

PROGRESS REPORT:

At the time of our site visit (9:00), Len's Excavating was excavating for the expansion of the Tailings Pond. A lift of fill was in place on the first bench of the embankment.

We tested the first lift of embankment fill for in-place moisture-density and obtained a sample of the embankment fill for moisture-density relationships (Modified Proctor) and classification, shown on attached Figures 1 and 2. All locations were referenced from the power pole.

* Note: Verbal preliminary results were given in the field, based on standard Proctor test performed by Knight Piesold & Co., Project #5451.1, 6/8/98.

We discussed the construction schedule with Bill Hamling (Cash Mine), Len Cole (Len's Excavating), and Jon Friedman (MFG). We recommended that the surface of the first lift of embankment fill be watered prior to placement of the next lift. It was agreed that we return on 8/25/98 to test the second lift of embankment fill.

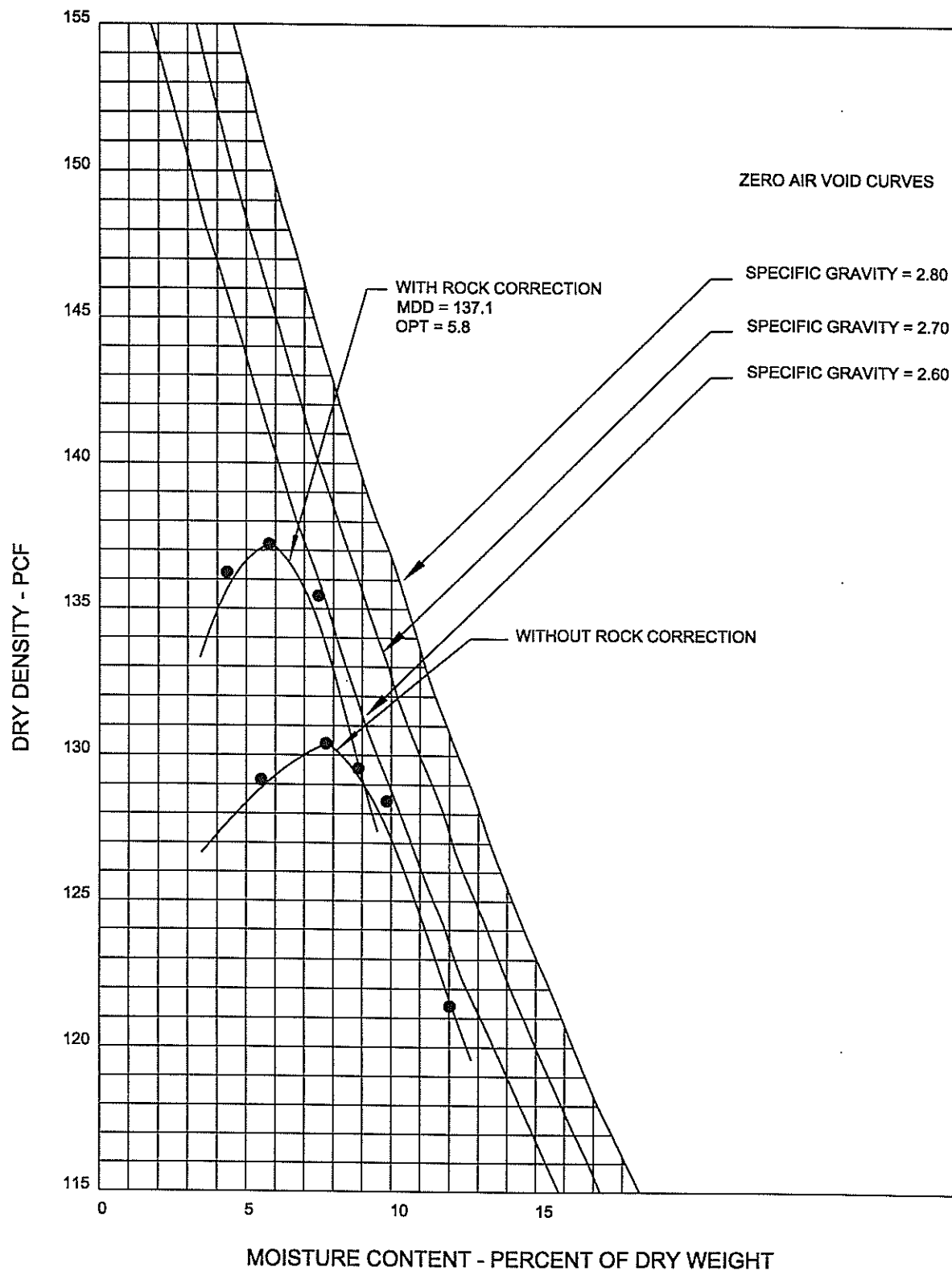
COPIES:

Jim Riley

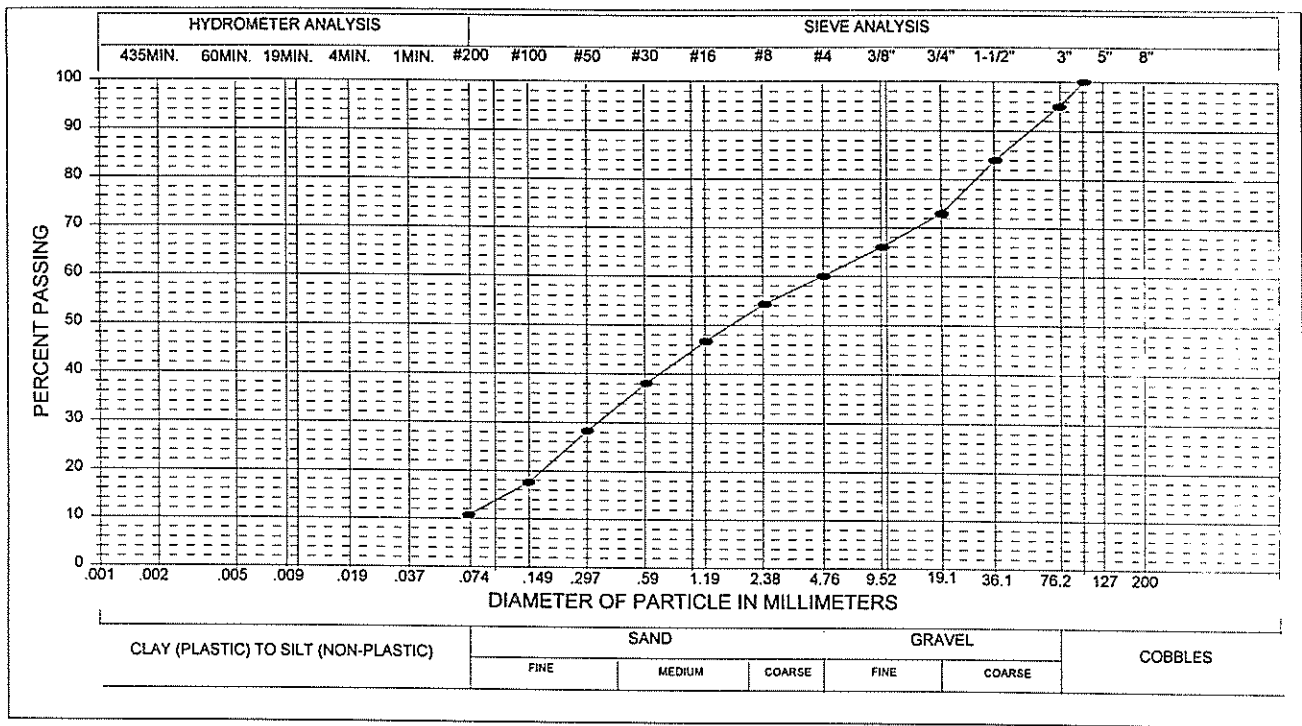
FIELD OBSERVER

Dennis Hanneman, P.E.

REVIEWED BY



LOCATION : Tailings Pond, SE embankment expansion.	MOISTURE-DENSITY RELATIONSHIPS	
(Sample No. 1)		
SOIL DESCRIPTION : Silty Gravelly Sand	HEPWORTH-PAWLAK GEOTECHNICAL, Inc.	
MAX. DRY DENSITY : 130.4 PCF OPT. MOIST. CONTENT : 7.7 %	PROCEDURE : ASTM D1557-91 METHOD C	
LIQUID LIMIT :		



HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 8/25/98
DAILY REPORT #2
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, $\pm 2\%$ OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
4	110' N.E., 40' N.W.	8397	137.1	5.8	131.9	5.9	96	90	Silty Gravelly Sand
5	16' N.E., 24' N.W.	8395	"	"	127.0	5.8	93	90	Silty Gravelly Sand
6	57' S.W., 20' N.W.	8396	"	"	126.9	6.2	93	90	Silty Gravelly Sand

ART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

RELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Len's Excavating

PROGRESS REPORT: Tests were taken in the tailings pond embankment fill. All locations were referenced from the power pole.

COPIES:

Dave Cassidy

Jim Riley

FIELD OBSERVER

REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
 c/o McCulley, Frick & Gilman, Inc.
 Attn: Jon Friedman
 4900 Pearl East Circle, Suite 300w
 Boulder, CO 80301

JOB NO. 298 187
 DATE: 8/26/98
 DAILY REPORT # 3
 PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: 1'

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, $\pm 2\%$ OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
7	75' N.E., 22' N.W.	8400	130.4	7.7	128.3	7.0	98	90	Silty Gravelly Sand
8	20' N.E., 24' N.W.	8398	"	"	123.8	6.9	95	90	Silty Gravelly Sand
9	30' S.W., 22' N.W.	8399	"	"	124.5	7.5	96	90	Silty Gravelly Sand
10	88' S.W., 26' N.W.	8400	137.1	5.8	130.0	7.7	95	90	Silty Gravelly Sand

ART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Len's Excavating

PROGRESS REPORT: The tests were taken in the tailings pond embankment fill. All tests were referenced off the power pole.

Len informed us that his lift thickness was one foot, minus and that the cut areas were watered prior to placement of fill.

COPIES:

Dave Cassidy
 FIELD OBSERVER

Jim Riley
 REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 8/27/98
DAILY REPORT # 4
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating.

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, $\pm 2\%$ OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
11	120' N.E., 40' N.W.	8404	130.4	7.7	122.5	7.1	94	90	Silty Gravelly Sand
12	100' N.E., 40' N.W.	8402	"	"	123.0	7.0	94	90	Silty Gravelly Sand
13	48' N.E., 38' N.W.	8403	137.1	5.8	130.4	7.2	95	90	Silty Gravelly Sand
14	30' N.E., 42' N.W.	8404	"	"	129.3	7.6	94	90	Silty Gravelly Sand
15	36' N.W. of power pole	8402	130.4	7.7	123.2	7.0	95	90	Silty Gravelly Sand
16	45' S.W., 38' N.W.	8404	"	"	127.3	7.4	98	90	Silty Gravelly Sand
17	60' S.W., 38' N.W.	8402	"	"	126.8	7.1	97	90	Silty Gravelly Sand
18	105' S.W., 38' N.W.	8404	130.4	7.7	127.4	7.1	98	90	Silty Gravelly Sand

ART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO:

PROGRESS REPORT: The tests were taken in the tailing pond embankment fill, all test locations were referenced off the power pole.

COPIES:

Dave Cassidy

FIELD OBSERVER

Jim Riley

REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 8/28/98
DAILY REPORT #5
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating.

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, $\pm 2\%$ OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
19	130' N.E., 42' N.W.	8406	137.1	5.8	131.5	4.4	96	90	Silty Gravelly Sand
20	115' N.E., 40' N.W.	8404	"	"	130.4	4.5	95	90	Silty Gravelly Sand
21	65' N.E., 39' N.W.	8405	"	"	136.7	3.7	100	90	Silty Gravelly Sand
22	45' N.E., 40' N.W.	8406	"	"	124.5	4.6	91	90	Silty Gravelly Sand
23	20' N.W., 40' N.W.	8406	"	"	136.9	5.1	100	90	Silty Gravelly Sand
24	40' N.W. of power pole	8406	"	"	127.9	5.7	93	90	Silty Gravelly Sand
25	30' S.W., 40' N.W.	8404	"	"	130.3	5.7	95	90	Silty Gravelly Sand
26	50' S.W., 42' N.W.	8406	137.1	5.8	127.8	5.8	93	90	Silty Gravelly Sand
27	80' S.W., 42' N.W.	8406	130.4	7.7	125.8	6.1	97	90	Silty Gravelly Sand
28	110' S.W., 42' N.W.	8406	"	"	123.6	5.8	95	90	Silty Gravelly Sand

FULL TIME/PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Len's Excavating

PROGRESS REPORT: Tests were taken in the tailings pond embankment fill, all tests were referenced to the power pole.

COPIES:

Dave Cassidy

FIELD OBSERVER

Jim Riley

REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 9/1/98
DAILY REPORT # 6
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, $\pm 2\%$ OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
29	115' N.E., 48' N.W.	8410	130.4	7.7	119.7	8.5	92	90	Silty Gravelly Sand
30	45' N.E., 50' N.W.	8406	"	"	125.9	8.0	97	90	Silty Gravelly Sand
31	50' N.W. of power pole	8409	137.1	5.8	129.5	7.3	94	90	Silty Gravelly Sand
32	38' S.W., 49' N.W.	8409	"	"	131.2	7.6	96	90	Silty Gravelly Sand
33	95' S.W., 50' N.W.	8410	"	"	131.6	7.2	96	90	Silty Gravelly Sand

FULL TIME/PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

RELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/ Len/s Excavating

PROGRESS REPORT: Tests were taken in the tailing pond embankment fill, all the locations were referenced to the power pole.

COPIES:

Dave Cassidy

Jim Riley

FIELD OBSERVER

REVIEWED BY

HEPWORTH-PAWLAK GEOTECHNICAL, Inc.

10214 South Progress Ln.
Parker, CO 80134

Fax 303 841-7556
Phone 303 841-7119

October 5, 1998

ITEC Environmental Colorado Inc.
c/o McCulley, Frick, and Gilman
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80303

Dear Mr. Friedman:

Enclosed are daily field report numbers 7 through 12 for nuclear density testing performed on the raise to the existing tailings embankment at the Cash Mine Redevelopment. The criteria established for the fill are a minimum dry density exceeding 90% of the maximum Modified Proctor (ASTM D1557) within 2 percent of optimum moisture content. Nuclear gage density testing indicates that the tested fill meets the compaction and moisture specifications.

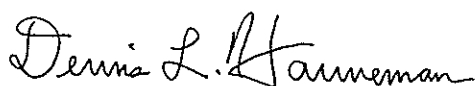
Results of additional Modified Proctor and gradation testing are presented on Figures 3 and 4. Three sand cone tests were performed on September 25th as requested. The sand cone test results correlate well with the nuclear gage results, considering the relatively large maximum particle size of the fill.

We appreciate the opportunity to have provided construction materials testing services for the Cash Mine Project and look forward to the possibility of working with McCulley, Frick, and Gilman on future projects. With four offices throughout Colorado in Parker, Glenwood Springs, Silverthorne, and Colorado Springs, we are capable of meeting your needs regardless of the project location.

If you have any questions, please call.

Sincerely,

HEPWORTH-PAWLAK GEOTECHNICAL, Inc.



Dennis L. Hanneman, P.E.

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF CONSTRUCTION ACTIVITIES

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick, and Gilman, Inc
4900 Pearl East Circle, Suite 300w
Boulder, CO 80303

JOB NO. 298 187
DATE: 9/3/98
DAILY REPORT #7
SHEET 1 OF 1

PROJECT: Cash Mine Redevelopment near Gold Hill, Co (Raise existing tailings embankment)

WEATHER CONDITIONS AND TEMPERATURE: Sunny +70°s

CONTRACTORS CONSTRUCTION ACTIVITIES:

MAJOR EQUIPMENT:

HP GEOTECH'S SITE ACTIVITIES:

We made a site visit as scheduled to provide compaction tests on the embankment fill, there was not enough fill in place to require testing. We obtained a sample of the embankment fill to return to our laboratory for moisture-density relationships (Modified Proctor) and classification, the results are shown on attached Figures 3 and 4.

VERBAL COMMUNICATION WITH CONTRACTOR, ENGINEER, ARCHITECT, OWNER:

We spoke with Len with Lens Excavating, he stated that it would take him two days to place a lift of embankment fill before he would be in need of compaction testing. Len stated that he would be placing fill over geo grid throughout the day and there was no compaction specifications for this.

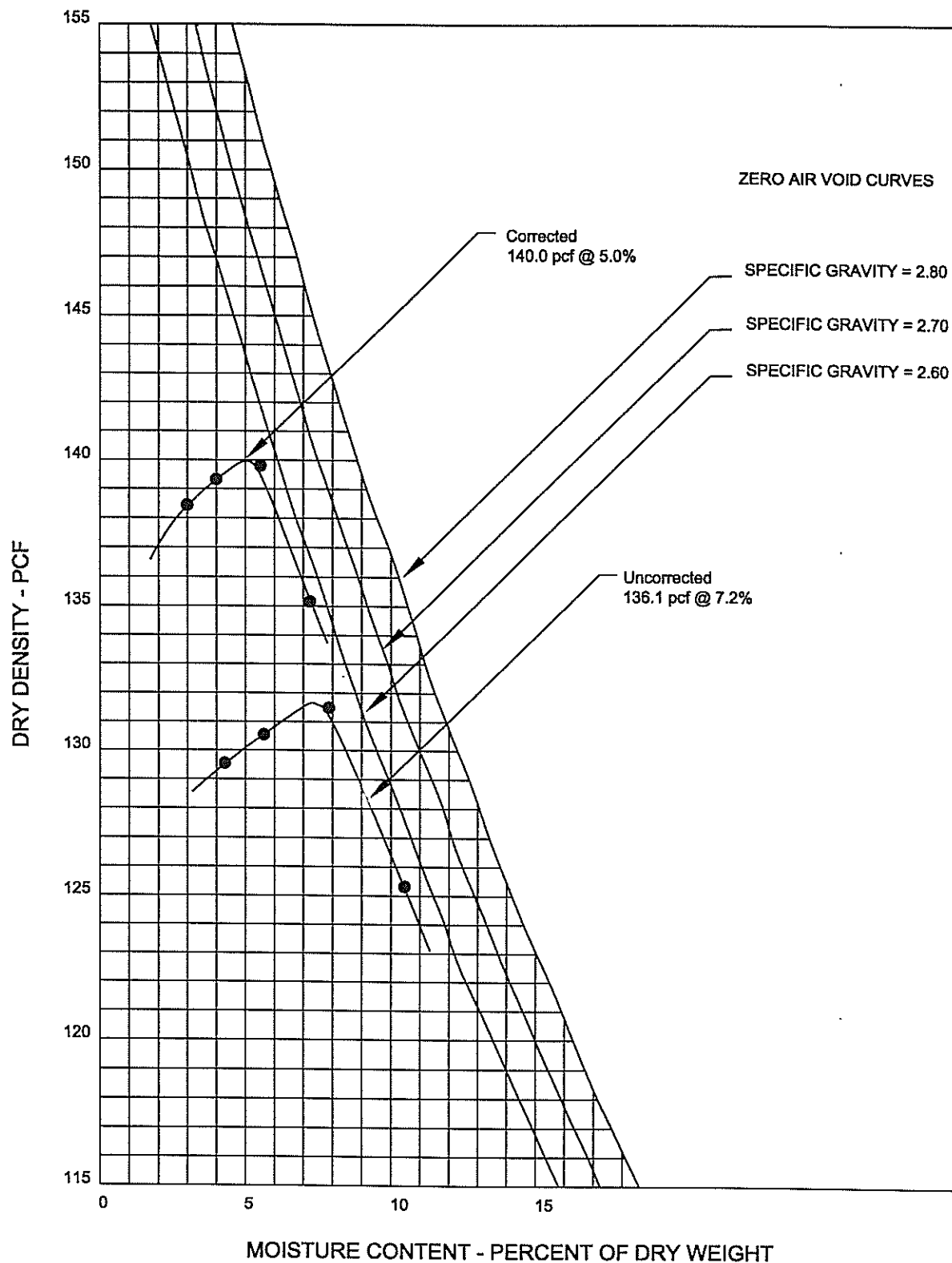
COPIES:

Dave Cassidy

FIELD OBSERVER

Jim Riley

REVIEWED BY



LOCATION : Tailings Pond Embankment Fill (Sample No. 2)

**MOISTURE-DENSITY
RELATIONSHIPS**

SOIL DESCRIPTION : Silty Gravel and Sand

HEPWORTH-PAWLAK GEOTECHNICAL, Inc.

MAX. DRY DENSITY : PCF OPT. MOIST. CONTENT : %

PROCEDURE : ASTM D1557 METHOD C

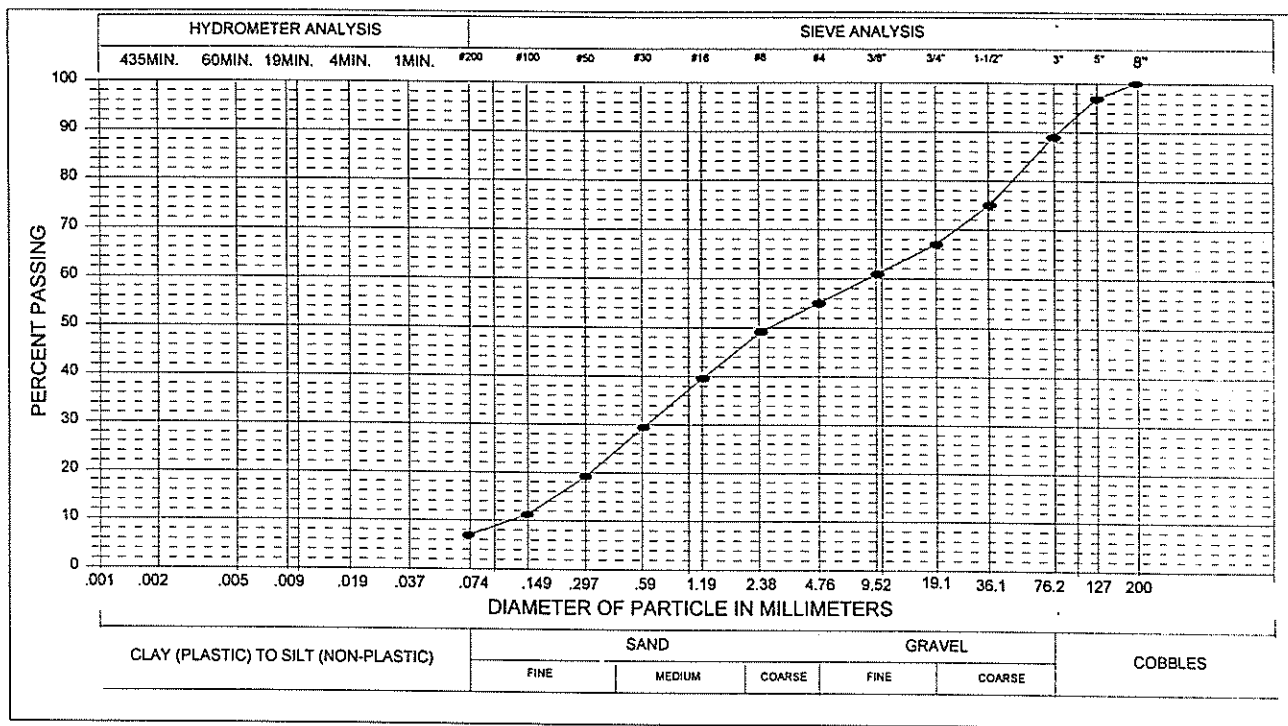
LIQUID LIMIT : PLASTICITY INDEX : NP

JOB NO. : 298 187

GRAVEL : 45 % SAND : 48 % SILT AND CLAY (-200) : 7 %

DATE : 9/3/98

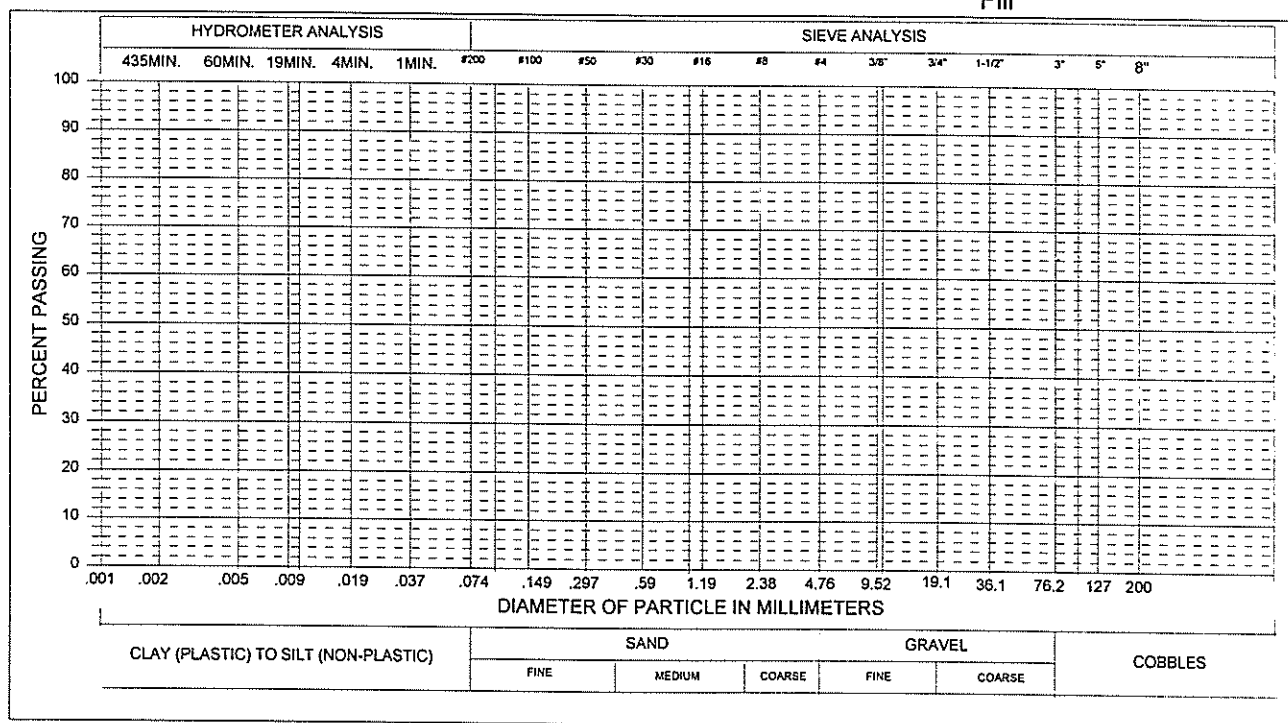
FIG. 3



GRAVEL: 45 % SAND: 48 % SILT AND CLAY: 7 %

LIQUID LIMIT: PLASTICITY INDEX: NP

SAMPLE OF : Silty Gravel & Sand FROM : Tailings Pond Embankment Fill



GRAVEL: % SAND: % SILT AND CLAY: %

LIQUID LIMIT: PLASTICITY INDEX: .

SAMPLE OF : FROM :

HEPWORTH - PAWLAK GEOTECHNICAL, INC..

REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 9/10/98
DAILY REPORT #8
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, $\pm 2\%$ OMC

TEST NO.	LOCATION FROM POWER POLE	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
34	110' N.E., 50' N.W.	8412	137.1	5.8	123.7	5.9	90	90	Silty Gravelly Sand
35	65' N.E., 52' N.W.	8412	"	"	125.8	6.0	92	90	Silty Gravelly Sand
36	52' N.W. of Power Pole	8412	140.0	5.0	130.1	5.2	93	90	Silty Gravel & Sand
37	58' S.W., 51' N.W.	8412	137.1	5.8	126.1	5.6	92	90	Silty Gravelly Sand
38	90' S.W., 52' N.W.	8412	140.0	5.0	146.9	4.6	100	90	Silty Gravel & Sand

ART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Lens Excavating

PROGRESS REPORT: The tests were taken in the tailings pond embankment fill, the locations were referenced to the power pole. The dozer was down for repairs. Len stated that he would be setting up a screening plant most of the day and that he would call us if needed on 9/14/98.

COPIES:

Dave Cassidy
FIELD OBSERVER

Jim Riley
REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 9/15/98
DAILY REPORT #9
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, $\pm 2\%$ OMC

TEST NO.	LOCATION REFERENCED FROM POWER POLE	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
39	110' N.E., 55' N.W.	8415	140.0	5.0	141.1	4.9	100+	90	Silty Gravel & Sand
40	50' N.E., 56' N.W.	8415	137.1	5.8	128.7	6.7	94	90	Silty Gravelly Sand
41	57' N.W. of Power Pole	8415	"	"	126.0	5.2	92	90	Silty Gravelly Sand
42	43' S.W., 55' N.W.	8415	"	"	132.5	4.3	97	90	Silty Gravelly Sand
43	90' S.W., 56' N.W.	8415	"	"	132.8	4.9	97	90	Silty Gravelly Sand

FULL TIME/PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Lens Excavating

PROGRESS REPORT: Tests were taken in tailings pond embankment fill, all locations were referenced off the power pole.

COPIES:

Dave Cassidy
FIELD OBSERVER

Jim Riley
REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF CONSTRUCTION ACTIVITIES

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick, and Gilman, Inc
4900 Pearl East Circle, Suite 300w
Boulder, CO 80303

JOB NO. 298 187
DATE: 9/18/98
DAILY REPORT #10
SHEET 1 OF 1

PROJECT: Cash Mine Redevelopment near Gold Hill, Co (Raise existing tailings embankment)

WEATHER CONDITIONS AND TEMPERATURE: Sunny - 70°F.

CONTRACTORS CONSTRUCTION ACTIVITIES:

MAJOR EQUIPMENT:

GEOTECH'S SITE ACTIVITIES:

VERBAL COMMUNICATION WITH CONTRACTOR, ENGINEER, ARCHITECT, OWNER:

We arrived at the job site as scheduled, upon arrival Len informed us that they had canceled the compaction for today, we had not been informed of this. Len requested that we return on 9/22/98 for compaction testing, he stated that he would inform us if there is a change.

COPIES:

Dave Cassidy
FIELD OBSERVER

Jim Riley
REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 9/22/98
DAILY REPORT # 11
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer; (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, $\pm 2\%$ OMC

TEST NO.	LOCATIONS REFERENCED FROM POWER POLE	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
44	103' N.E., 60' N.W.	8417	140.0	5.0	139.1	7.1	99	90	Silty Gravel & Sand
45	65' N.E., 62' N.W.	8418	137.1	5.8	130.0	7.8	95	90	Silty Gravelly Sand
46	63' N.W.	8417	"	"	129.5	7.1	95	90	Silty Gravelly Sand
47	50' S.W., 64' N.W.	8417	"	"	132.9	7.5	97	90	Silty Gravelly Sand
48	110' S.W., 62' N.W.	8417	"	"	128.5	5.5	94	90	Silty Gravelly Sand

ART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

RELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Len's Excavating

PROGRESS REPORT: Tests were taken in the tailings pond embankment fill. The the test locations were referenced off the lower pole.

COPIES:

Dave Cassidy

FIELD OBSERVER

Jim Riley

REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
 c/o McCulley, Frick & Gilman, Inc.
 Attn: Jon Friedman
 4900 Pearl East Circle, Suite 300w
 Boulder, CO 80301

JOB NO. 298 187
DATE: 9/25/98
DAILY REPORT #12
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, $\pm 2\%$ OMC

TEST NO. & PROBE DEPTH	LOCATIONS REFERENCE FROM POINT ON CREST PERPENDICULAR TO POWER POLE	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
49 (12")	148' N.E., 2' S.E. OF c.l.	8420	137.1	5.8	137.0	7.3	100	90	Silty Gravelly Sand
49 (6")	" "	"	"	"	134.6	7.7	100+	90	Silty Gravelly Sand
49 SC	" "	"	"	"	137.1	8.0	100	90	Silty Gravelly Sand
50 (12")	60' N.E., 6' N.W. of c.l.	"	"	"	127.6	4.2	93	90	Silty Gravelly Sand
50 (6")	" "	"	"	"	128.7	3.9	94	90	Silty Gravelly Sand
51 (12")	16' S.W., on c.l.	"	"	"	134.5	4.9	98	90	Silty Gravelly Sand
51 (6")	" "	"	"	"	131.8	5.1	96	90	Silty Gravelly Sand
51 SC	" "	"	"	"	132.0	4.7	96	90	Silty Gravelly Sand
52 (12")	93' S.W., S.E. Rt.	"	"	"	133.1	4.1	97	90	Silty Gravelly Sand
52 (6")	" "	"	"	"	126.4	4.4	92	90	Silty Gravelly Sand
53 (12")	157' S.W., 6' N.E. of c.l., S.E. on S.E. embankment curve	"	"	"	130.1	4.7	95	90	Silty Gravelly Sand
53 (6")	" "	"	"	"	124.4	4.8	91	90	Silty Gravelly Sand
53 SC	" "	"	"	"	121.2	4.5	88*	90	Silty Gravelly Sand

ART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS. THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017. PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Jon Friedman & Len Cole

PROGRESS REPORT: At the time of our testing, embankment fill was placed to near grade elevation. Chritina L. Kamnikar with the State of Colorado Division of Minerals and Geology observed the field testing.

A coarse sized gravel was left in the sidewall of test hole 53 SC, which may have resulted in a somewhat lower calculated density compared to the nuclear gauge test.

S.C. = Sand Cone

Jim Riley

FIELD OBSERVER

Dennis Hanneman

REVIEWED BY

APPENDIX B

APPENDIX B

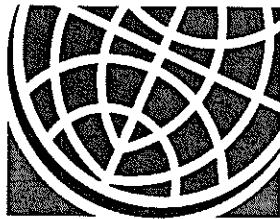
Geosynthetics Quality Control Data Sheets

Colorado Lining International

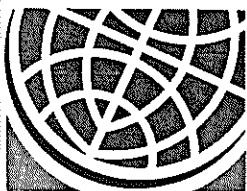
Installation Reports

for the

Gold Hill Mill Tailings Impoundment Expansion, Phases 1 & 2



Colorado Lining
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Y r Inside Line On Containment

December 4, 1998

Mr. Jon Friedman
McCulley, Frick & Gilman, Inc.
4900 Pearl East Circle, Suite 300W
Boulder, CO 80301

Re: Gold Hill Mill, Tailings Impoundment - 60 mil HDPE & GCL Installation

Dear Jon:

This letter shall serve as certification that the 60 mil High Density Polyethylene (LLDPE) liner and GCL Colorado Lining International (CLI) provided to Gold Hill Mill, met design specifications for this project.

In addition, this liner was installed and tested in accordance with the provided design specifications. The installation and quality assurance testing also met or exceeded documented industry guidelines and standards.

We are providing you with the associated field documentation to support this certification.

On behalf of our dedicated installation team and management staff, we would like to thank you for giving us the opportunity to successfully complete this project for you.

If you have any further requests, please do not hesitate to contact me.

Sincerely,

Michael S. Bair
Vice President

CORPORATE OFFICE

1062 Singing Hills Road Parker, Colorado 80138 303-841-2022 800-524-8672 Fax 303-841-5780 www.coloradolining.com



Colorado Lining
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Subgrade Inspection

Date: 9-29-98

Project:

CO

Owner:

Engineer:

Contractor:

Installation Supervisor:

Material:

Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder,

ITEC Environmental Colorado, Inc.

McCulley, Frick & Gilman

Pat Elliott

GCL under 60 mil HDPE-Smooth

Colorado Lining International (CLI) is not responsible for subsurface conditions, which may affect lining performance.

Is surface is acceptable for placement of geomembranes? Yes ☒ No ☐

Comments

With the placement of minimum 2"
of sand cushion layer and the GCL under liner,
subgrade ~~is~~ ~~is~~ is suitable for primary 60 mil HDPE.

Date Sept. 29, 1998

Accepted By Representative of Owner
(Signature)

Jon Friedman

Print Name/Title

Jon Friedman - Project Engineer / McCulley,
Frick & Gilman
Inc.

Company

Accepted By Representative of CLI
(Signature)

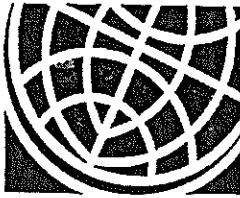
Pat Elliott

Print Name/Title

Pat Elliott Installation Supervisor

CORPORATE OFFICE

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Panel Placement Log

Page 1 of 2

Project: Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Panel No.	Roll Number	Date	Material Type	Width	Length	Seam No.
1	231734	9-29-98	60	22	40	
2	231734	9-29-98	60	6	17	
3	231734	9-29-98	60	8	13	
4	231734	9-29-98	60	22	34	
5	231734	9-29-98	60	20	54	
6	231734	9-29-98	60	7	15	
7	231734	9-29-98	60	22	52	
8	231734	9-29-98	60	22	61	
9	231734	9-29-98	60	22	83	
10	231593	9-29-98	60	22	102	
11	231593	9-29-98	60	22	128	
12	231736	9-30-98	60	22	138	
13	231736	9-30-98	60	22	100	
14	231736	9-30-98	60	22	81	
15	231736	9-30-98	60	22	40	
16	231740	9-30-98	60	22	100	
17	231740	9-30-98	60	22	149	
18	231740	9-30-98	60	22	158	
19	231736	9-30-98	60	22	40	
20	231593	9-30-98	60	22	154	
21	231737	9-30-98	60	22	45	
22	231737	9-30-98	60	22	44	
23	231737	9-30-98	60	22	40	
24	231737	9-30-98	60	22	36	
25	231737	9-30-98	60	22	51	
Total Number of Rolls this Page			Total Square Footage this Page			



Panel Placement Log

Project: Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

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Colorado Lining
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"Your Inside Line On Containment"

Daily Installation Report

Date: 9-28-98

Project: Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO

Owner: ITEC Environmental Colorado, Inc.

Engineer: McCulley, Frick & Gilman

Contractor:

Installation Supervisor: Pat Elliott

Material: GCL under 60 mil HDPE-Smooth

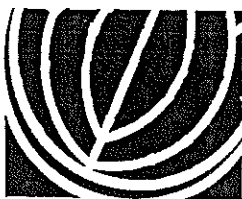
Weather Conditions Nice and warm fairly gusty

Roll Numbers Installed Today

N/A			

Problems Encountered/Comments

Arrived around 11:00 am. We filled bags and
fixed 1 hot shoe and got all three set up and
ready to go. Subgrade still in bad shape. State Rep is
going to show up late this afternoon and approve or
dissapprove subgrade.



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Daily Installation Report

Date: 9-29-98

Project:

Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO

Owner:

ITEC Environmental Colorado, Inc.

Engineer:

McCulley, Frick & Gilman

Contractor:

Installation Supervisor:

Pat Elliott

Material:

GCL under 60 mil HDPE-Smooth

Weather Conditions Nice cool, partly cloudy, Afternoon Heavy cloud and rain at 4:30

Roll Numbers Installed Today

231734	statof 23593	4 rolls of GCL	

Problems Encountered/Comments

Arrived around 6:40. Got set up and Ready to pull liner by 7:45 because Key to Forklift was in office and they don't arrive till 7:30. 2 new GCL inner bars that are 17 feet long are to short and chains keep falling off, also core on GCL are smashed so very slow and difficult to hook up. We couldn't start till state showed up and they were late so we stood around till 8:20 on them. Then the wouldn't improve N corner till 9:45 were we could start, 4 chx and 5 labor picked rocks for 15 min we got 3 rolls of GCL out and covered by 1:00 took late lunch. When we got back we put out 4 more rolls of GCL and got them covered just in time for rain to start. 2 more gen went down.

CORPORATE OFFICE

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"Your Inside Line On Containment"

Daily Installation Report

Date: 9-30-98

Project: Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO

Owner: ITEC Environmental Colorado, Inc.

Engineer: McCulley, Frick & Gilman

Contractor:

Installation Supervisor: Pat Elliott

Material: GCL under 60 mil HDPE-Smooth

Weather Conditions Over cast and cold

Roll Numbers Installed Today

<u>finished 231593</u>	<u>231736</u>	<u>231740</u>	231741
<u>231737</u>			

Problems Encountered/Comments

Arrived at 6:30 and Rain last night didn't affect us much, but had to wait till 8:20 to start because subgrade was wet and they had to approve it. 3 labor 7:30 and 2 more at 9:00. Moly Arrived at 9:30. Slow going because of roll staging but we got slot in by lunch and we were beating weather so things went good till 3:30. (check sheet Attached) They held us up 6:30 on there ditch and subgrade on wall so that set us back but we still beat the weather got to seam run, by 6:30. Had some more problem with generators and extruders but extruded by the light of a flashlight just to get us off floor area wait till tomorrow and see if we can't do tie in and wall patches and destructs and UBox.

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Daily Installation Report

Date: 10-1-98

Project: Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO

Owner: ITEC Environmental Colorado, Inc.

Engineer: McCulley, Frick & Gilman

Contractor:

Installation Supervisor: Pat Elliott

Material: GCL under 60 mil HDPE-Smooth

Weather Conditions Foggy, wet and cold

Roll Numbers Installed Today

<u>N/A</u>			

Problems Encountered/Comments

Arrived at 8:00 we were going to try and
wait out storm by picking up trash and cleaning up
sight. Moving rolls measuring 2nd part. Getting things
ready, waited till 11:00 and decided to try again
tomorrow.



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"Your Inside Line On Containment"

Daily Installation Report

Date: 10-2-98

Project: Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO

Owner: ITEC Environmental Colorado, Inc.

Engineer: McCulley, Frick & Gilman

Contractor:

Installation Supervisor: Pat Elliott

Material: GCL under 60 mil HDPE-Smooth

Weather Conditions Cold, breezy and partly cloudy

Roll Numbers Installed Today

N/A			

Problems Encountered/Comments

I arrived at 6:30 to make call
on work or not and, got the crew up here by 8:00 and
got started. We were going to start on tie in but they held
us up till around 10:30 because they didn't know if they were
going to have to access that dike or not, to move sludge.
but by 2:00 all patching and tie in was done. Finished
on tie in scrap, paper work, V-Boxing.



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"Your Inside Line On Containment"

Quality Control Air Testing

Page 1 of 2

Project: Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Type of Air Test: Pressurization X Vacuum Box _____ Air Lance _____
25-30 psi 3-5 inches of Hg 55 psi

Date of Test	Time of Test	Seam No.	Length of Seam	Welder No.	Operator	Test Results Pass/Fail
9-30-98	10:40	1	17			PASS
9-30-98	10:50	2	14			PASS
9-30-98	11:00	3	38			PASS
9-30-98	11:05	4	45			PASS
9-30-98	11:15	5	17			PASS
9-30-98	11:20	6	55			PASS
9-30-98	11:10	7	53			PASS
9-30-98	11:25	8	61			PASS
9-30-98	11:30	9	82			PASS
9-30-98	1:30	10	105			PASS
9-30-98	1:35	11	39			PASS
9-30-98	1:40	12	115			PASS
9-30-98	1:50	13	50			PASS
9-30-98	5:00	14	133			PASS
9-30-98	5:10	15	43			PASS
9-30-98	5:20	16	22'			PASS
9-30-98	5:30	17	140'			PASS
9-30-98	5:35	18	146'			PASS
9-30-98	5:45	19	148'			PASS
9-30-98	5:55	20	154'			PASS
9-30-98	6:05	21	42'			PASS
9-30-98	6:15	22	37			PASS
9-30-98	6:25	23	43			PASS
9-30-98	6:35	24	15			PASS
9-30-98	6:45	25	14			PASS
9-30-98	6:55	26	17			PASS

Page 2 of 2

Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO

Pressurization ~~25-30 psi~~

Vacuum Box _____
3-5 inches of Hg

Air Lance _____
55 psi

1062 Singing Hills Road Parker, Colorado 80138 CORPORATE OFFICE
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"Your Inside Line On Containment"

Seam Strength Test

Date:

9-29-98

Project:

Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO

Owner:

ITEC Environmental Colorado, Inc.

Engineer:

McCulley, Frick & Gilman

Contractor:

Pat Elliott

Material:

GCL under 60 mil HDPE-Smooth

Fusion Weld

Y

Extrusion Weld

Unit Type & No.

H5-202-H5236

[illegible]

Welding Technician:

Arnon Unruh, Mike Collins

Quality Control Supervisor: Pat Elliott

Comments:



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Seam Strength Test

Date: 9-30-98

Project:

Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO

Owner:

ITEC Environmental Colorado, Inc.

Engineer:

McCulley, Frick & Gilman

Contractor:

Installation Supervisor:

Pat Elliott

Material:

GCL under 60 mil HDPE-Smooth

Fusion Weld +

Extrusion Weld +

Unit Type & No. _____

Date of Test	Time of Test	Ambient Air Temp.	Unit Temp.	Pre-Heat Temp.	Unit Speed	Peel Value Inside/Outside	Shear Value	Welding Tech.	Pass/Fail
36 9-30	7:10	66°	750°	—	10.5	124/120	146	V.D	Pass
—	—	—	—	—	—	118/121	162	V.D	Pass
—	—	—	—	—	—	120/120	—	V.D	Pass
208 9-30	7:15	66°	700°	—	10-5	125/138	190	A.U	Pass
—	—	—	—	—	—	142/151	192	A.U	Pass
—	—	—	—	—	—	121/124	—	A.U	Pass
201 9-30	4:00	70°	700°	—	10.5	125/121	162	M.I	Pass
—	—	—	—	—	—	120/124	168	M.I	Pass
—	—	—	—	—	—	131/130	—	M.I	Pass
9-30	6:10	40°	350°	500°	—	108	160	A.U	Pass
—	—	—	—	—	—	106	181	A.U	Pass
—	—	—	—	—	—	112	—	A.U	Pass
—	—	—	—	—	—	/	—	—	—
—	—	—	—	—	—	/	—	—	—
—	—	—	—	—	—	/	—	—	—
—	—	—	—	—	—	/	—	—	—
—	—	—	—	—	—	/	—	—	—
—	—	—	—	—	—	/	—	—	—
—	—	—	—	—	—	/	—	—	—
—	—	—	—	—	—	/	—	—	—
—	—	—	—	—	—	/	—	—	—

Welding Technician: _____

Quality Control Supervisor: Pat Elliott

Comments: _____



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Field Seam Destructive Test

Date: 10-2-98

Project:

Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO

Owner:

ITEC Environmental Colorado, Inc.

Engineer:

McCulley, Frick & Gilman

Contractor:

Installation Supervisor:

Pat Elliott

Material:

GCL under 60 mil HDPE-Smooth

Unit Type & No.: <u>H.S. # 201 & 202</u>						Ambient Air Temp.:
Welder Temp. Setting: <u>750°</u>			Pre-Heat Temp Setting:			Speed: <u>11.5</u>
Date of Test	Time of Test	Destruct Sample No.	Specimen No.	Peel Value Inside/Outside	Shear Value	Action Taken (Pass/Fail)
10-2	8:40	1	1	110/125		PASS
10-2	8:40	1	2 & 4	115/140	176	PASS
10-2	8:40	1	3 & 5	125/142	176	PASS
10-2	8:50	2	1	120/123		PASS
10-2	8:50	2	2 & 4	117/115	152	PASS
10-2	8:50	2	3 & 5	102/110	155	PASS
10-2	9:00	3	1	113/115		PASS
10-2	9:00	3	2 & 4	137/145	170	PASS
10-2	9:00	3	3 & 5	131/125	170	PASS

Welding Technician:

Arnon V. E. Molte I.

Quality Control Supervisor: Pat Elliott

Comments: _____



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Geomembrane Installation Approval

Date: _____

Project: Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth (Phase I)

The Geomembrane on this project has been installed, inspected and tested in accordance with Industry Standards and Manufacturer recommendations.

Date

10-2-98

Accepted By
(Signature)

Bill Hamling

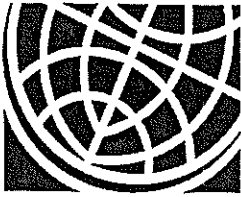
Print Name/Title

BILL HAMLING MNG.

Company

ITEC ENVIRONMENTAL

All warranties to begin on the date of acceptance.
Warranties to be issued upon receipt of final payment



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Material Inventory Log

Page ___ of ___

Date: 9-28-98

Project:

Gold Hill Mill Tailings Pond Expansion-Phase 1, Boulder, CO

Owner:

ITEC Environmental Colorado, Inc.

Engineer:

McCulley, Frick & Gilman

Contractor:

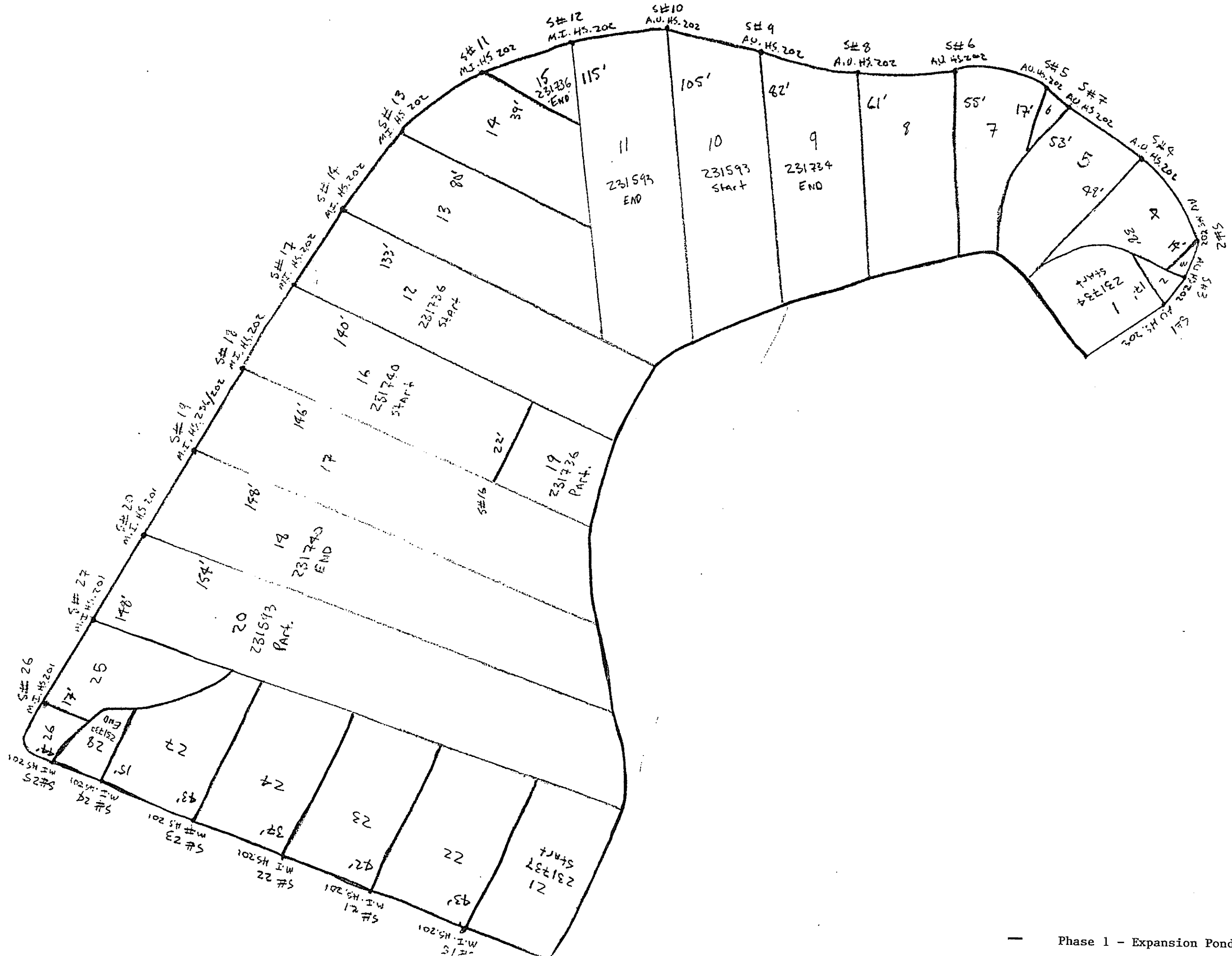
Installation Supervisor:

Pat Elliott

Material:

GCL under 60 mil HDPE-Smooth

	Roll Number	Width	Length	Material Condition	Return (Factory or CLI)
1	231753	22.5	470	Good	Used on pond 1
2	231786	22.5	470	Good	Used on pond 1
3	231593	22.5	470	Good	27
4	231737	22.5	470	Good	99'
5	231734	22.5	470	Good	51'
6	231740	22.5	470	Good	Used on pond 1
7	231748	22.5	470	Good	
8					
9	GCL 11 rolls	15	150		left for 2nd phase
10					
11					
12					
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30					





AGRU / AICA, INC.

Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231737** Lot # **H051253** Liner Type: **SMOOTH**

		METRIC	ENGLISH	Thickness	1.5mm	60mil	
Measurement	MIN:	1.531 mm	60 mil	Length	128	m	420 feet
ASTM D-751/5199	MAX:	1.578 mm	62 mil	Width	6.86	m	22.5 feet
	AVE:	1.551 mm	61 mil				

A/A'S DATA
SHEET TEST
RESULTS

Specific Gravity	Density	g/cc	.948	.947
ASTM D-792				

MFI ASTM D-1238

COND. E	Melt Flow Index 190°C /2160 g - g /10 min	.28	.23
GRADE: chevron 9638			

Carbon Black Content	Range	%	2-3	2.93
ASTM D-1603/4218				

Carbon Black Dispersion	Category	1,2	1
ASTM D-5596			

Tensile Strength	Yield M.D.	psi	2200	2,484
ASTM D-638	Yield T.D.	psi	2200	2,572

2 inches / minute)	Break M.D.	psi	4000	4,312
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	Break T.D.	psi	4000	5,169
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Elongation	Yield M.D.	%	13	17.92
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ASTM D - 638 Modified	Yield T.D.	%	13	17.15
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2 inches / minute)	Break M.D.	%	700	737.9
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σ = 1.3" Yield	Break T.D.	%	700	969.2
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Lo = 2.0" Break				
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Dimensional Stability	M.D.	%	±1	-.06
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ASTM D-1204	T.D.	%	±1	.03
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tear Resistance	M.D.	lbs	45	50.340
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ASTM D-1004	T.D.	lbs	45	47.890
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Puncture Resistance	Load	lbs	80	96.192
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RMS 101 Method 2065				
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Puncture Resistance	Load	lbs		134.000
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ASTM D-4833				
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ESCR	Minimum Hrs w / o Failures	hrs	3,000	ONGOING
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ASTM D - 1693				
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Notched Constant Tensile Load	pass / fail @ 30%	hrs	200	ongoing
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ASTM D - 5397				
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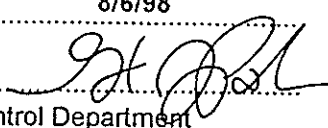
CUSTOMER: Colorado Lining Co.

P.O.#: CLI 98/2

DESTINATION: Parker, CO

Form SM60AA.FRM

Date: 8/6/98

Signature: 
Quality Control Department



AGRU / A. JICA, INC.

Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231593** Lot # **H051283** Liner Type: **SMOOTH**

		METRIC	ENGLISH	Thickness	1.5mm	60mil	
Measurement	MIN:	1.529 mm	60 mil	Length	128	m	420 feet
ASTM D-751/5199	MAX:	1.598 mm	63 mil	Width	6.86	m	22.5 feet
	AVE:	1.566 mm	62 mil				

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity	Density			
ASTM D-792		g/cc	.948	.949

MFI ASTM D-1238				
COND. E				
GRADE: chevron 9638	Melt Flow Index 190°C /2160 g - g /10 min	.28		.23

Carbon Black Content	Range	%	2-3	2.44
ASTM D-1603/4218				

Carbon Black Dispersion	Category		1,2	1
ASTM D-5596				

Tensile Strength	Yield M.D.	psi	2200	2,540
ASTM D-638	Yield T.D.	psi	2200	2,652

(2 inches / minute)	Break M.D.	psi	4000	4,423

	Break T.D.	psi	4000	5,263

Elongation	Yield M.D.	%	13	18

ASTM D - 638 Modified	Yield T.D.	%	13	16

(2 inches / minute)	Break M.D.	%	700	742

Lo = 1.3" Yield	Break T.D.	%	700	963

Lo = 2.0" Break				

Dimensional Stability	M.D.	%	±1	-.37

ASTM D-1204	T.D.	%	±1	+.22

Tear Resistance	M.D.	lbs	45	50.911

ASTM D-1004	T.D.	lbs	45	47.532

Puncture Resistance	Load	lbs	80	102.760

ASTM 101 Method 2065				

Puncture Resistance	Load	lbs		122.140

ASTM D-4833				

ESCR	Minimum Hrs w / o Failures	hrs	3,000	ONGOING

ASTM D - 1693				

Notched Constant Tensile Load	pass / fail @ 30%	hrs	200	ongoing

ASTM D -5397				

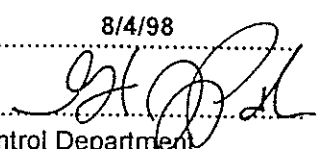
CUSTOMER: Colorado Lining Co.				

P.O.#: CLI 98/2				

DESTINATION: Parker, CO				

Form SM60AA.FRM				

Date: 8/4/98

Signature: 
Quality Control Department



AGRU / AICA, INC.

Schsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231740** Lot # **H051253** Liner Type: **SMOOTH**

		METRIC	ENGLISH	Thickness	1.5mm	60mil	
Measurement	MIN:	1.523 mm	60 mil	Length	128	m	420 feet
ASTM D-751/5199	MAX:	1.576 mm	62 mil	Width	6.86	m	22.5 feet
	AVE:	1.552 mm	61 mil				

		A/A'S DATA SHEET	TEST RESULTS
Specific Gravity	Density		
STM D-792		g/cc .948	.947

		Melt Flow Index 190°C /2160 g - g /10 min	
MFI ASTM D-1238		.28	.23
COND. E			
GRADE: chevron 9638			

		%	
Carbon Black Content	Range	2-3	2.93
STM D-1603/4218			

Carbon Black Dispersion	Category	1,2	1
STM D-5596			

		psi	
Tensile Strength	Yield M.D.	2200	2,484
STM D-638	Yield T.D.	2200	2,572
(2 inches / minute)	Break M.D.	4000	4,312
	Break T.D.	4000	5,169

		%	
Elongation	Yield M.D.	13	17.92
ASTM D - 638 Modified	Yield T.D.	13	17.15
(2 inches / minute)	Break M.D.	700	737.9
Lo = 1.3" Yield	Break T.D.	700	969.2
Lo = 2.0" Break			

		%	
Dimensional Stability	M.D.	±1	-.06
ASTM D-1204	T.D.	±1	.03

		lbs	
Tear Resistance	M.D.	45	50.340
ASTM D-1004	T.D.	45	47.890

		lbs	
Puncture Resistance	Load	80	96.192
MS 101 Method 2065			

		lbs	
Puncture Resistance	Load		134.000
STM D-4833			

		hrs	
ESCR	Minimum Hrs w / o Failures	3,000	ONGOING
ASTM D - 1693			

		hrs	
Notched Constant Tensile Load	pass / fail @ 30%	200	ongoing
ASTM D -5397			

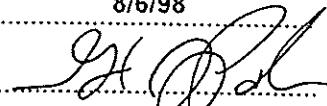
CUSTOMER: Colorado Lining Co.

P.O.#: CLI 98/2

DESTINATION: Parker, CO

Form SM60AA.FRM

Date: 8/6/98

Signature: 
Quality Control Department

ROLL # **231736** Lot # **H051253** Liner Type: **SMOOTH**

		METRIC	ENGLISH	Thickness	1.5mm	60mil	
Measurement	MIN:	1.521 mm	60 mil	Length	128	m	420 feet
ASTM D-751/5199	MAX:	1.597 mm	63 mil	Width	6.86	m	22.5 feet
	AVE:	1.553 mm	61 mil				

A/A'S DATA SHEET TEST RESULTS

Specific Gravity	Density	g/cc	.948	.947
ASTM D-792				

MFI ASTM D-1238	Melt Flow Index 190°C /2160 g - g /10 min	.28	.23
COND. E			
GRADE: chevron 9638			

Carbon Black Content	Range	%	2-3	2.93
ASTM D-1603/4218				

Carbon Black Dispersion	Category	1,2	1
ASTM D-5596			

Tensile Strength	Yield M.D.	psi	2200	2,484
ASTM D-638	Yield T.D.	psi	2200	2,572

(2 inches / minute)	Break M.D.	psi	4000	4,312
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	Break T.D.	psi	4000	5,169
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Elongation	Yield M.D.	%	13	17.92
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ASTM D - 638 Modified	Yield T.D.	%	13	17.15
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(2 inches / minute)	Break M.D.	%	700	737.9
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Lo = 1.3" Yield	Break T.D.	%	700	969.2
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Lo = 2.0" Break				
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Dimensional Stability	M.D.	%	±1	-.06
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ASTM D-1204	T.D.	%	±1	.03
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Tear Resistance	M.D.	lbs	45	50.340
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ASTM D-1004	T.D.	lbs	45	47.890
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Puncture Resistance	Load	lbs	80	96.192
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ASTM MS 101 Method 2065				
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Puncture Resistance	Load	lbs		134.000
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ASTM D-4833				
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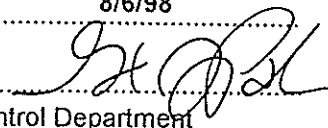
ESCR	Minimum Hrs w / o Failures	hrs	3,000	ONGOING
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ASTM D - 1693				
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Notched Constant Tensile Load	pass / fail @ 30%	hrs	200	ongoing
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ASTM D -5397				
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CUSTOMER: Colorado Lining Co.	Date: 8/6/98
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P.O.#: CLI 98/2	Signature: 
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DESTINATION: Parker, CO	Quality Control Department
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Form SM60AA.FRM



AGRU / A. ICA, INC.

Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231734** Lot # **H051253** Liner Type: **SMOOTH**

		METRIC	ENGLISH	Thickness	1.5mm	60mil	
Measurement	MIN:	1.521 mm	60 mil	Length	128	m	420 feet
ASTM D-751/5199	MAX:	1.585 mm	62 mil	Width	6.86	m	22.5 feet

AVE: 1.563 mm 62 mil

A/A'S DATA SHEET TEST RESULTS

Specific Gravity Density g/cc .948 .947

ASTM D-792

MFI ASTM D-1238

COND. E Melt Flow Index 190°C /2160 g - g /10 min .28 .23

GRADE: chevron 9638

Carbon Black Content Range % 2-3 2.76

ASTM D-1603/4218

Carbon Black Dispersion Category 1,2 1

ASTM D-5596

Yield M.D. psi 2200 2,439

Tensile Strength Yield T.D. psi 2200 2,526

ASTM D-638

(2 inches / minute) Break M.D. psi 4000 4,331

Break T.D. psi 4000 5,355

Elongation Yield M.D. % 13 19.73

ASTM D - 638 Modified Yield T.D. % 13 17.60

(2 inches / minute) Break M.D. % 700 725.5

Lo = 1.3" Yield Break T.D. % 700 998.0

Lo = 2.0" Break

Dimensional Stability M.D. % ±1 -.06

ASTM D-1204 T.D. % ±1 .03

Car Resistance M.D. lbs 45 49.959

ASTM D-1004 T.D. lbs 45 47.617

Puncture Resistance Load lbs 80 98.956

ASTM 101 Method 2065

Puncture Resistance Load lbs 133.040

ASTM D-4833

ESCR Minimum Hrs w / o Failures hrs 3,000 ONGOING

ASTM D - 1693

Notched Constant Tensile Load pass / fail @ 30% hrs 200 ongoing

ASTM D -5397

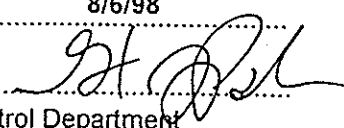
CUSTOMER: Colorado Lining Co.

P.O.#: CLI 98/2

DESTINATION: Parker, CO

Form SM60AA.FRM

Date: 8/6/98

Signature: 
Quality Control Department

Phase II





Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Daily Installation Report

Date: 11-16-98

Project:

Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder, CO

Owner:

ITEC Environmental Colorado, Inc.

Engineer:

McCulley, Frick & Gilman

Contractor:

Installation Supervisor:

Jason Tapp

Material:

GCL under 60 mil HDPE-Smooth

Weather Conditions Sunny, 58°

Roll Numbers Installed Today

231737		roll bentafix	

Problems Encountered/Comments

Arrived on site to find subgrade not ready. Standing water, Ice, excessive rocks present. Road along east side gave way to fork lift causing us an hour & 1/2 delay. Used labor to pick rocks, sweep ice, remove sand bags. Finally deployed 2 sheets of bentafix & 1 sheet of ~~60 mil~~ 80' A 4' section became saturated when Ice melted. That section will be cut out & replaced.

2X 6.5 hrs. 10 Labor X 4 hrs.

CORPORATE OFFICE

1062 Singing Hills Road Parker, Colorado 80138 800 524 8672 303 841 2022 Fax 303 841 5780 www.coloradolining.com



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Daily Installation Report

Date: 11-17-98

Project:

Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder, CO

Owner:

ITEC Environmental Colorado, Inc.

Engineer:

McCulley, Frick & Gilman

Contractor:

Installation Supervisor:

Jason Tapp

Material:

GCL under 60 mil HDPE-Smooth

Weather Conditions Sunny 53°

Roll Numbers Installed Today

217430			

Problems Encountered/Comments

Labor didn't arrive until 9:30am, 5 from Aurora left at 10:30am,
Leaving me with only 4 laborers. Vinnie arrived at 10:30am,
& I used Carl & John to help deploy GCL. we were able to
Install 5 rolls of GCL & 1 roll of 60mil. liner.
after lunch slowed deployment down considerably, along
with being short handed.

J.T. & N.L. x 10.5 hrs. V.D. x 7 hrs



Colorado Lining
INTERNATIONAL
"Your Inside Line On Containment"

Daily Installation Report

Date: 11/16/96

Project: Gold Hill mill Tailings pond expansion, Boulder, CO

Owner: ITEC Colorado

Engineer: MFG

Contractor:

Installation Supervisor: Ryan Heath

Material: GCL under 60 HDS

Weather Conditions High Wind

Roll Numbers Installed Today

Problems Encountered/Comments

No Labor, Extreme wind could not
work on Liner

CORPORATE OFFICE

1062 Singing Hills Road Parker, Colorado 80138 800 524 8672 303 841 2022 Fax 303 841 5780 www.coloradolining.com



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Daily Installation Report

Date: 11/19/98

Project: Gold Hill mill Tailings pond expansion, Boulder, CO

Owner: ITEC Colorado

Engineer: MFG

Contractor:

Installation Supervisor: Ryan Heath

Material: GCL under 60 HDS

Weather Conditions overcast & snowing

Roll Numbers Installed Today

Problems Encountered/Comments

State wouldn't allow us to deploy because
of snow on subgrade.

CORPORATE OFFICE

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Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Daily Installation Report

Date: 11/20/98

Project: Gold Hill mill Tailings pond expansion, Boulder, CO

Owner: ITEC Colorado

Engineer: MFG

Contractor:

Installation Supervisor: Ryan Heath

Material: GCL under 60 HDS

Weather Conditions Cold windy

Roll Numbers Installed Today

Problems Encountered/Comments

Forklift wouldn't start needed to replace starter. All patching finished on plastic that Jason Tapp deployed also Did Tie in to Existing liner. Forklift part arrived sometime in evening.



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Daily Installation Report

Date: 11/21/95

Project: Gold Hill mill Tailings pond expansion, Boulder, CO

Owner: ITEC Colorado

Engineer: MFG

Contractor:

Installation Supervisor: Ryan Heath

Material: GCL under 60 HDS

Weather Conditions Extreme wind 60 mph

Roll Numbers Installed Today

231753 .	3 Rolls GCL		
224214 .			
started 231749			

Problems Encountered/Comments

Arrived on-site to find all of the material
deployed for phase #1 Destroyed. Wind
Ripped plastic out of the trench
and tore the entire Tie in seam.
Wind calmed around 11:30am Berried old
liner. Deployed liner beyond existing
liner and did Tie in.

CORPORATE OFFICE

1062 Singing Hills Road Parker, Colorado 80138 800 524 8672 303 841 2022 Fax 303 841 5780 www.coloradolining.com



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Daily Installation Report

Date: 11/22/98

Project: Gold Hill mill Tailings pond expansion, Boulder, CO

Owner: ITEC Colorado

Engineer: MFG

Contractor:

Installation Supervisor: Ryan Heath

Material: GCL under 60 HDS

Weather Conditions Cool windy

Roll Numbers Installed Today

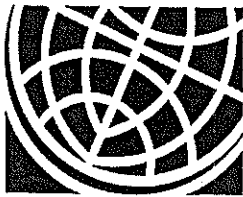
231749	2015 GCL		

Problems Encountered/Comments

Ran out of Benolix. Had to wait
till monday to finish pond
all ~~material~~ material pulled all testing
finished.

CORPORATE OFFICE

1062 Singing Hills Road Parker, Colorado 80138 800 524 8672 303 841 2022 Fax 303 841 5780 www.coloradolining.com



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Quality Control Air Testing

Page 1 of 1

Project: Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder, CO
 Owner: ITEC Environmental Colorado, Inc.
 Engineer: McCulley, Frick & Gilman
 Contractor:
 Installation Supervisor: Jason Tapp
 Material: GCL under 60 mil HDPE-Smooth

Type of Air Test: Pressurization X Vacuum Box _____ Air Lance _____
 25-30 psi 3-5 inches of Hg 55 psi

Date of Test	Time of Test	Seam No.	Length of Seam	Welder No.	Operator	Test Results Pass/Fail
11-22-98	10:36	#1	72'	#131	Jason Austin	pass
11-22-98	10:45	#2	78'	#103	Matt Alfred	pass
11-22-98	10:42	3	78'	131	JA	pass
11-22-98	10:51	4	22'	103	MA	pass
11-22-98	11:02	5	22'	131	JA	pass
11-22-98	10:44	6	68'	103	MA	pass
11-22-98	10:55	7	70'	131	JA	pass
11-22-98	11:10	8	69'	103	MA	pass
11-22-98	11:20	9	66'	103	MA	pass
11-22-98	11:20	10	67'	131	JA	pass
11-22-98	11:30	11	67'	103	MA	pass
11-22-98	11:32	12	67'	131	JA	pass
11-22-98	11:33	13	69'	103	MA	pass
11-22-98	11:33	14	68'	131	JA	pass
11-23-98	11:34	15	15'	103	Nick Lavin	pass
11-23-98	11:35	16	32'	103	NL	pass
11-23-98	11:45	17	30'	103	NL	pass
11-23-98	11:05	18	66'	103	NL	pass
11-23-98		19*	360'	103	Matt Alfred	pass

* Tie in Vacuum Box



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Seam Strength Test

Project: Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder, Co
Owner: ITEC Enviromental Colorado
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Jason Tapp
Material: GCL under 60 mil HDPE-Smooth

Fusion Weld X Extrusion Weld _____ Unit Type & No. #131

Date of Test	Time of Test	Ambient Air Temp.	Unit Temp.	Pre-Heat Temp.	Unit Speed	Peel Value Inside/Outside	Shear Value	Welding Tech.	Pass/Fail
11/21/98	9:00 am	50°	450°	✓	11 Fpm	91/95	136	Jason Austin	pass
11/21/98	9:00 am	50°	450°	✓	11 Fpm	93/96	142	JA	pass
11/21/98	9:00 am	50°	450°	✓	11 Fpm	92/99		JA	pass
						/			
11/22/98	9:45	45°	450°	✓	11 Fpm	110/112	146	JA	pass
11/22/98	9:45	45°	450°	✓	11 Fpm	98/111	149	JA	pass
11/22/98	9:45	45°	450°	✓	11 Fpm	99/101		JA	pass
						/			
11/23/98	9:00 am	45°	450°	✓	11 Fpm	113/121	146	Nick Lavin	pass
11/23/98	9:00 am	45°	450°	✓	11 Fpm	114/120	152	NL	pass
11/23/98	9:00 am	45°	450°	✓	11 Fpm	109/121		NL	pass
						/			
						/			
						/			
						/			
						/			
						/			
						/			
						/			

Welding Technician: Jason ~~Austin~~ Austin + Nick Lavin
Quality Control Supervisor:

Comments: Good weld!



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

Seam Strength Test

Project: Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder, Co
Owner: ITEC Enviromental Colorado
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Jason Tapp
Material: GCL under 60 mil HDPE-Smooth

Fusion Weld X Extrusion Weld X Unit Type & No. #5#103 UTR#005

Date of Test	Time of Test	Ambient Air Temp.	Unit Temp.	Pre-Heat Temp.	Unit Speed	Peel Value Inside/Outside	Shear Value	Welding Tech.	Pass/Fail
11/21/98	900	50°	450°	—	11.0 FPM	112/199	156	MA	PASS
11/21/98	900	50°	460°	—	11.0 FPM	104/105	147	MA	PASS
11/21/98	900	50°	450°	—	11.0 FPM	115/102		MA	PASS
						/			
11/22/98	945	45°	450°	—	11.0 FPM	101/198	149	MA	PASS
↓	↓	↓	↓	—	↓	105/102	146	MA	PASS
↓	↓	↓	↓	—	↓	101/102		MA	PASS
						/			
11/23/98	900	45°	450°	—	11.0 FPM	99/199	151	MA	PASS
↓	↓	↓	↓	—	↓	106/109	141	MA	PASS
↓	↓	↓	↓	—	↓	99/103		MA	PASS
						/			
						/			
11/22/98	10:00	45°	450°	350°	—	126/121	161	RG	PASS
↓	↓	↓	↓	↓	—	119/118	152	RG	PASS
↓	↓	↓	↓	↓	—	121/126		RG	PASS
						/			
11/23/98	10:05	45°	450°	350°	—	131/140	159	RG	PASS
↓	↓	↓	↓	↓	—	129/137	162	RG	PASS
↓	↓	↓	↓	↓	—	136/134		RG	PASS

Welding Technician:

Quality Control Supervisor:

Matt Alred + Ryan Goodyear

Comments:



Colorado Lining
INTERNATIONAL

"Your Inside Line On Containment"

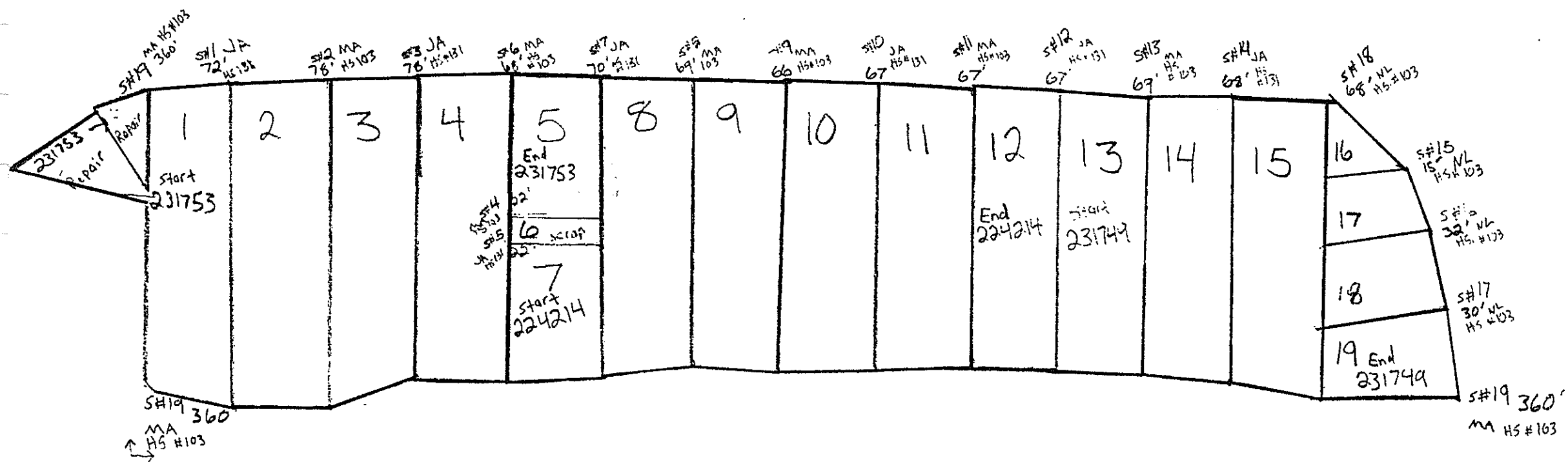
Geomembrane Installation Approval

Date: _____
Project: Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor: _____
Installation Supervisor: Jason Tapp
Material: GCL under 60 mil HDPE-Smooth

The Geomembrane on this project has been installed, inspected and tested in accordance with Industry Standards and Manufacturer recommendations.

Date: Nov. 25, 1998
Accepted By (Signature): Jon Friedman
Print Name/Title: Jon Friedman
Company: McCulley, Frick & Gilman

All warranties to begin on the date of acceptance.
Warranties to be issued upon receipt of final payment





AGRU / A. JICA, INC.

Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231753** Lot # **H051253** Liner Type: **SMOOTH**

		METRIC	ENGLISH	Thickness	1.5mm	60mil	
Measurement	MIN:	1.533 mm	60 mil	Length	128	m	420 feet
ASTM D-751/5199	MAX:	1.587 mm	62 mil	Width	6.86	m	22.5 feet
	AVE:	1.56 mm	61 mil				

A/A'S DATA
SHEETTEST
RESULTS

Specific Gravity	Density	g/cc	.948	.947
ASTM D-792				

MFI ASTM D-1238

COND. E	Melt Flow Index 190°C /2160 g - g /10 min	.28	.23
GRADE: chevron 9638			

Carbon Black Content	Range	%	2-3	2.68
ASTM D-1603/4218				

Carbon Black Dispersion	Category		1,2	1
ASTM D-5596				

Tensile Strength	Yield M.D.	psi	2200	2,550
ASTM D-638	Yield T.D.	psi	2200	2,606

(2 inches / minute)	Break M.D.	psi	4000	4,783
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	Break T.D.	psi	4000	5,048
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Elongation	Yield M.D.	%	13	17.67
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ASTM D - 638 Modified	Yield T.D.	%	13	16.51
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(2 inches / minute)	Break M.D.	%	700	798.6
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Lo = 1.3" Yield	Break T.D.	%	700	937.1
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Lo = 2.0" Break		%	±1	-.06
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Dimensional Stability	M.D.	%	±1	.03
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ASTM D-1204	T.D.	%	±1	.03
-------------	------	---	----	-----

Tear Resistance	M.D.	lbs	45	51.738
-----------------	------	-----	----	--------

ASTM D-1004	T.D.	lbs	45	49.144
-------------	------	-----	----	--------

Puncture Resistance	Load	lbs	80	106.960
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TMS 101 Method 2065				
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Puncture Resistance	Load	lbs		124.760
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ASTM D-4833				
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ESCR	Minimum Hrs w / o Failures	hrs	3,000	ONGOING
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ASTM D - 1693				
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Notched Constant Tensile Load	pass / fail @ 30%	hrs	200	ongoing
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ASTM D - 5397				
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CUSTOMER: Colorado Lining Co.				
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P.O.#: CLI 98/2				
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DESTINATION: Parker, CO				
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Form SM60AA.FRM				
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Date: 8/6/98

Signature:

Quality Control Department



AGRU / A. JICA, INC.

Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **224214** Lot # **H031325** Liner Type: **SMOOTH**

		METRIC	ENGLISH	Thickness	1.5mm	60mil	
Measurement	MIN:	1.455 mm	57 mil	Length	128	m	420 feet
ASTM D-751/5199	MAX:	1.563 mm	62 mil	Width	6.86	m	22.5 feet
	AVE:	1.53 mm	60 mil				

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity	Density	g/cc	.948	.948
ASTM D-792				

MFI ASTM D-1238				
COND. E	Melt Flow Index 190°C /2160 g - g /10 min	.28		.23
GRADE:				

Carbon Black Content	Range	%	2-3	2.47
ASTM D-1603/4218				

Carbon Black Dispersion	Category		1,2	1
ASTM D-5596				

Tensile Strength	Yield M.D.	psi	2200	2,557
ASTM D-638	Yield T.D.	psi	2200	2,638

(2 inches / minute)	Break M.D.	psi	4000	4,566
	Break T.D.	psi	4000	4,540

Elongation	Yield M.D.	%	13	18.6
ASTM D - 638 Modified	Yield T.D.	%	13	17.1

(2 inches / minute)	Break M.D.	%	700	764
Lo = 1.3" Yield	Break T.D.	%	700	823.9

Lo = 2.0" Break	M.D.	%	±1	-.69
	T.D.	%	±1	.08

Dimensional Stability	M.D.	%	±1	-.69
ASTM D-1204	T.D.	%	±1	.08

ear Resistance	M.D.	lbs	45	50.7
ASTM D-1004	T.D.	lbs	45	49.2

Puncture Resistance	Load	lbs	80	96.8
TMS 101 Method 2065				

Puncture Resistance	Load	lbs		133.9
ASTM D-4833				

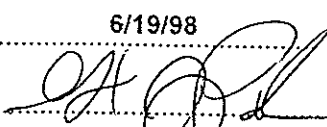
ESCR	Minimum Hrs w / o Failures	hrs	3,000	ONGOING
ASTM D - 1693				

Notched Constant Tensile Load	pass / fail @ 30%	hrs	200	200
ASTM D -5397				

CUSTOMER:	Colorado Lining Co.			
P.O.#:	Reno Cell 1C			

DESTINATION:	Hutchinson, KS			
Form SM60AA.FRM				

Date: 6/19/98

Signature: 
Quality Control Department

CERTIFICATE OF CONFORMITY

ROLL # **231749** Lot # **H051253** Liner Type: **SMOOTH**

		METRIC	ENGLISH	Thickness	1.5mm	60mil	
Measurement	MIN:	1.522 mm	60 mil	Length	128	m	420 feet
ASTM D-751/5199	MAX:	1.609 mm	63 mil	Width	6.86	m	22.5 feet
	AVE:	1.569 mm	62 mil				

		Density	g/cc	A/A'S DATA SHEET	TEST RESULTS
Specific Gravity					
STM D-792			.948		.947

		Melt Flow Index 190°C /2160 g - g /10 min	
MFI ASTM D-1238			
OND. E			
GRADE: chevron 9638		.28	.23

		Range	%	
Carbon Black Content				
STM D-1603/4218			2-3	2.73

		Category	
Carbon Black Dispersion			
STM D-5596			1,2 1

			psi	
Tensile Strength	Yield M.D.		2200	2,550
STM D-638	Yield T.D.		2200	2,610
(2 inches / minute)	Break M.D.		4000	4,564
	Break T.D.		4000	4,971

			%	
Elongation	Yield M.D.		13	19.32
ASTM D - 638 Modified	Yield T.D.		13	17.96
(2 inches / minute)	Break M.D.		700	772.3
Lo = 1.3" Yield	Break T.D.		700	922.4
Lo = 2.0" Break				

			%	
Dimensional Stability	M.D.		±1	-.06
ASTM D-1204	T.D.		±1	.03

			lbs	
Tear Resistance	M.D.		45	51.341
ASTM D-1004	T.D.		45	48.849

			lbs	
Puncture Resistance	Load		80	106.060
TMS 101 Method 2065				

			lbs	
Puncture Resistance	Load			129.120
STM D-4833				

			hrs	
ESCR	Minimum Hrs w / o Failures		3,000	ONGOING
ASTM D - 1693				

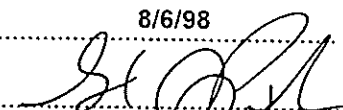
			hrs	
Notched Constant Tensile Load	pass / fail @ 30%		200	ongoing
ASTM D -5397				

CUSTOMER: Colorado Lining Co.

P.O.#: CLI 98/2

DESTINATION: Parker, CO

Form SM60AA.FRM

Date: 8/6/98
 Signature: 
 Quality Control Department

GCL

BENTOFIX TECHNOLOGIES, INC.

BENTOFIX MANUFACTURING CERTIFICATION

CUSTOMER: FLUID SYSTEMS

SHIP DATE: 09/11/98

PROJECT: GOLD HILL MILL TAILINGS

NO. ROLLS/B.O.L. NO20/000085

ORDER NUMBER: 8V72110

PRODUCT TYPE: NSL

Bentofix technologies, inc. hereby certifies that the Bentofix Geosynthetic clay liner purchased and shipped for the above referenced project meets or exceeds Bentofix Technologies, Inc.'s specifications for Bentofix.

The Bentofix product has been continuously inspected for the presence of needles and is certified to be needle free.

The tests listed for the bentonite component have been performed on each batch of bentonite. The tests listed for the finished geocomposite product have been performed on at least every 40,000sq. ft. (3,716 sq.MT) for the Mass Per Unit Area according to method ASTM D5261 and for the Grab Tensile according to method ASTM D4632. The tests listed for the finished geocomposite product have been performed on at least every 9,290 sq. Mt. (100,000 sq. ft.) for the geotextile component and the finished geocomposite water permeability according to method GRI GCL-2.

The lot and roll numbers for this project are as follows:

LOT# R8081503 _____

ROLL# 425,483,484 _____

LOT# R8081803 _____

ROLL# 501 _____

LOT# R8082503 _____

ROLL# 735,736,779,780 _____

LOT# R8082603 _____

ROLL# 804,805,827,851 _____

LOT# R8082903 _____

ROLL# 895,938,939 _____

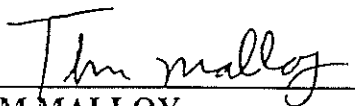
RECEIVED SEP 16 1998

LOT# R8090203 _____

ROLL# 1033 _____

LOT# R8090803 _____

ROLL# 1272,1331,1332 _____



TIM MALLOY
QUALITY CONTROL MANAGER

9/11/98

DATE

BTI 000085

SEAL NO

ORDER NO.

10-Sep-98

NAME OF CARRIER

DATE _____

SHIPPER	GOLD HILL MILL TAILINGS	FROM	BENTOFIX TECHNOLOGIES (USA), INC.
SHIP TO	1 M.E. OF GOLD HILL W. OF	STREET	300 PARR BLVD.
DESTINATION	BOULDER, SUNSHINGOLD HILL, CO 80302	ORIGIN	RENO, NV 89512 (702) 333-1003

NO. SHIPPING UNITS	* HM	KIND OF PACKAGING, DESCRIPTION OF ARTICLES SPECIAL MARKS AND EXCEPTIONS	WEIGHT (SUBJECT TO CORRECTION)	SQ. FEET
20 rolls		Bentofix Material	44618	44950

ID NO.	SIZE		SF	WT	ID NO.	SIZE		SF	WT
	LENGTH	WIDTH				LENGTH	WIDTH		
	Site Contact	JOHN HEAP (800) 524-8672							
	CALL 24 HOURS PRIOR TO DELIVERY TO SCHEDULE UNLOADING								
	ALL FLATBED LOADS MUST BE TARPED								

TO BE DELIVERED: 11-Sep-98

ADDITIONAL ITEMS

C.O.D. TO: ADDRESS		COD Amt: \$		C.O.D. FEE: PREPAID ☐ \$ COLLECT ☐	
Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.		This is to certify that the above-named articles are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.		Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.	
I agree or declared value of the property is hereby specifically stated by the shipper to be not exceeding \$ _____ per _____		Signature _____		TOTAL CHARGES: \$ FREIGHT CHARGES FREIGHT PREPAID ☐ Check box if charges are prepaid when	

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party, at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.

Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

ER	BENTOFIX TECHNOLOGIES (USA), INC.	CARRIER	Chrisco #316
ER		PER	
		DATE	

ACCOUNTING A/P

Date:09/10/98

PAGE 1

BENTOFIX TECHNOLOGIES, INC.

=====

BOL # : 000085

Shipment Date: 09/10/98

Roll #

Length

Width

Lot #: R8081503

=====

425

150.00

15.5

483

100.00

15.5

484

100.00

15.5

* Subtotal [ft]

350.00

Lot #: R8081803

=====

501

139.99

15.5

* Subtotal [ft]

139.99

Lot #: R8082503

=====

735

150.00

15.5

736

150.00

15.5

779

150.00

15.5

780

150.00

15.5

Subtotal [ft]

600.00

Lot #: R8082603

=====

804

150.00

15.5

805

150.00

15.5

827

150.00

15.5

851

150.00

15.5

Subtotal [ft]

600.00

Lot #: R8082903

=====

895

150.00

15.5

938

150.00

15.5

939

150.00

15.5

* Subtotal [ft]

450.00

Lot #: R8090203

=====

1033

150.00

15.5

Subtotal [ft]

150.00

Date:09/10/98

BENTOFIX TECHNOLOGIES, INC.

PAGE 2

=====

BOL # : 000085

Shipment Date: 09/10/98

Roll #

Length

Width

Lot #: R8090803

=====

1272

150.00

15.5

1331

150.00

15.5

1332

150.00

15.5

* Subtotal [ft]

450.00

* Total [ft]

2739.99

BENTOFIX®**Thermal Lock "NSL" Geosynthetic Clay Liner****• Technical Bulletin •**

Bentofix Thermal Lock "NSL" is a needlepunch reinforced GCL comprised of a uniform layer of granular sodium bentonite encapsulated between a slit-film woven and a virgin staple fiber nonwoven geotextile. The needlepunched fibers are thermally fused to the woven geotextile to enhance the reinforcing bond.

GEOTEXTILE PROPERTIES	TEST METHOD	MINIMUM TEST FREQUENCY	VALUE - ENGLISH -	VALUE - SI -
Cap Nonwoven Mass/Unit Area	ASTM D 5261	1/200,000 sq. ft (1/20,000 sq. m)	6.0 oz./yd ² MARV	200 g / m ² MARV
Woven Scrim Mass/Unit Area	ASTM D 5261	1/200,000 sq. ft (1/20,000 sq. m)	3.1 oz./yd ² MARV	105 g / m ² MARV

BENTONITE PROPERTIES	TEST METHOD	MINIMUM TEST FREQUENCY	VALUE - ENGLISH -	VALUE - SI -
Swell Index	ASTM D 5890	1/100,000 lbs. (50,000 kg)	24 ml / 2g min.	24 ml / 2g min.
Moisture Content	ASTM D 4643	1/100,000 lbs. (50,000 kg)	12 % max.	12 % max.
Fluid Loss	ASTM D 5891	1/100,000 lbs. (50,000 kg)	18 ml max.	18 ml max.

FINISHED GCL PROPERTIES	TEST METHOD	MINIMUM TEST FREQUENCY	VALUE - ENGLISH -	VALUE - SI -
Bentonite Mass per Unit Area ¹	ASTM D 5993	1/40,000 sq. ft (1/4,000 sq. m)	0.75 lb. / sq. ft MARV	3.66 kg / m ² MARV
Tear Strength ²	ASTM D 4632	1/40,000 sq. ft (1/4,000 sq. m)	95 lbs MARV	422 N MARV
Tear Elongation ²	ASTM D 4632	1/40,000 sq. ft (1/4,000 sq. m)	150 % Typical	150 % Typical
Peel Strength ³	ASTM D 4632	1/40,000 sq. ft (1/4,000 sq. m)	15 lbs. min.	66 N
Permeability ⁴	ASTM D 5084	1/100,000 sq. ft (1/10,000 sq. m)	5 x 10 ⁻⁹ cm/sec max	5 x 10 ⁻⁹ cm/sec max
Index Flux ⁴	ASTM D 5887	1/Week	1 x 10 ⁻⁸ m ³ /m ² /sec max	1 x 10 ⁻⁸ m ³ /m ² /sec max
Internal Shear Strength ⁵	ASTM D 5321	Periodic	500 psf Typical	24 kPa Typical

DIMENSIONS	TEST METHOD	MINIMUM TEST FREQUENCY	VALUE - ENGLISH -	VALUE - SI -
Width x Length	nominal	Every Roll	15.5 x 150 ft	4.7 x 45.72 m
Area per Roll	nominal	Every Roll	2325 ft ²	216 m ²
Packaged Weight	typical	Every Roll	2600 lbs	1179 kg

- Oven-dried measurement. Equates to 0.84 lbs when indexed to a 12% moisture content.
- Measured at maximum peak, in the weakest principal direction.
- Modified to use a 4 inch wide grip. The maximum peak of five specimens averaged.
- De-Aired Tap Water @ 5 psi maximum effective confining stress and 2 psi head.
- Typical peak value for specimen hydrated for 24 hr and sheared under a 200 psf normal stress.

Information regarding the physical properties of Bentofix Thermal Lock products, including the information contained in this specification sheet, is to the best of our knowledge, information and belief, representative of Bentofix Thermal Lock products. All information, data, suggestions, opinions and recommendations are offered without guarantee or warranty of any kind. The final determination as to the appropriateness or suitability of any Bentofix product in any particular application rests with the user and is the user's sole responsibility. All rights are reserved to alter, change or modify the Bentofix products and product specifications at any time without notice. Please consult with your sales or technical representative to ensure that specifications are current. Bentofix is a registered trademark of Prime Geosynthetic, GmbH. (10-98 Bentofix NSL24)

BENTOFIX TECHNOLOGIES, INC.
QUALITY CONTROL CERTIFICATE

LOT# ROLL# DATE
R8081503 425 09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00 ft x 15.5 ft
45.72 m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

MASS(lb/ft ²)	TENSILE (LB)		ELONGATION (%)		PERMEABILITY, K(cm/s)	MOISTURE CONTENT(%)
	LENGTH	CROSS	LENGTH	CROSS		
.940	101	237	72	40	<5E-9	9.4

2. TOP LAYER TYPE: NON WOVEN
LAYER # MASS(lb/ft²)
980713205B-1 0.050

3. BOTTOM LAYER TYPE : WOVEN
LAYER# MASS(lb/ft²)
7378903 0.023

4. BENTONITE TYPE : 30 MESH

SHIPMENT#	%MONTMORILLONITE	SWELL INDEX(ml)	MOISTURE CONTENT(%)	MOISTURE ABSORPTION(%)	MASS OF BENTONITE
BN-49073	90	25	9.4	663	0.867 (lb/ft ²)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT# R8081803 ROLL# 501 DATE 09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 139.99FT x 15.5 ft
42.66m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

MASS(lb/ft ²)	TENSILE (LB)		ELONGATION (%)		PERMEABILITY, K(cm/s)	MOISTURE CONTENT(%)
	LENGTH	CROSS	LENGTH	CROSS		
0.969	105	271	76	43	<5E-9	8.8

2. TOP LAYER TYPE: NON WOVEN

LAYER #	MASS(lb/ft ²)
98071305B	0.051

3. BOTTOM LAYER TYPE : WOVEN

LAYER#	MASS(lb/ft ²)
7365135	0.023

4. BENTONITE TYPE : 30 MESH

SHIPMENT#	%MONTMORILLONITE	SWELL INDEX(ml)	MOISTURE CONTENT(%)	MOISTURE ABSORPTION(%)	MASS OF BENTONITE
49341	90	30	8.8	736	0.895 (lb/ft ²)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT# ROLL# DATE
R8082503 735 09/11/98

BOL: 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00 ft x 15.5 ft
45.72m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

MASS(lb/ft ²)	TENSILE (LB) LENGTH	CROSS	ELONGATION (%) LENGTH	CROSS	PERMEABILITY, K(cm/s)	MOISTURE CONTENT(%)
0.924	105	66	255	38	<5E-9	9.3

2. TOP LAYER TYPE: NON WOVEN
LAYER # MASS(lb/ft²)
980817205B 0.051

3. BOTTOM LAYER TYPE: WOVEN
LAYER# MASS(lb/ft²)
7343309 0.023

4. BENTONITE TYPE: 30 MESH

SHIPMENT#	%MONTMORILLONITE	SWELL INDEX(ml)	MOISTURE CONTENT(%)	MOISTURE ABSORPTION(%)	MASS OF BENTONITE
49317	90	28	9.3	669	0.850 (lb/ft ²)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT# R8082603 ROLL# 804 DATE 09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00 ft x 15.5 ft
45.72m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

MASS(lb/ft ²)	TENSILE (LB) LENGTH	CROSS CROSS	ELONGATION (%) LENGTH	CROSS	PERMEABILITY, K(cm/s)	MOISTURE CONTENT(%)
0.992	108	247	111	58	<5E-9	8.8

2. TOP LAYER TYPE: NON WOVEN
LAYER # 980629205B MASS(lb/ft²) 0.051

3. BOTTOM LAYER TYPE: WOVEN
LAYER# 7358086 MASS(lb/ft²) 0.023

4. BENTONITE TYPE: 30 MESH

SHIPMENT#	%MONTMORILLONITE	SWELL INDEX(ml)	MOISTURE CONTENT(%)	MOISTURE ABSORPTION(%)	MASS OF BENTONITE
BN-454776	90	25	8.8	663	0.918 (lb/ft ²)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT# R8082903 ROLL# 895 DATE 09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00 ft x 15.5 ft
45.72 m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL		TENSILE (LB)		ELONGATION (%)		MOISTURE	
MASS(lb/ft ²)		LENGTH	CROSS	LENGTH	CROSS	PERMEABILITY, K(cm/s)	CONTENT(%)
1.042		115	279	68	157	<5E-9	9.7
2. TOP LAYER		TYPE: NON WOVEN					
LAYER #	MASS(lb/ft ²)						
980721205B	0.050						
3. BOTTOM LAYER		TYPE: WOVEN					
LAYER#	MASS(lb/ft ²)						
7426745	0.023						
4. BENTONITE		TYPE: 30 MESH					
SHIPMENT#	% MONTMORILLONITE	SWELL INDEX (ml)	MOISTURE CONTENT (%)	MOISTURE ABSORPTION (%)	MASS OF BENTONIT		
WHW-361	90	27	9.7	789	0.969 (lb/ft ²)		

BENTOFIX TECHNOLOGIES, INC.
QUALITY CONTROL CERTIFICATE

LOT# R8090203 ROLL# 1033 DATE 09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00m x 15.5 ft
45.72m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

MASS(lb/ft ²)	TENSILE (LB) LENGTH	CROSS	ELONGATION (%) LENGTH	CROSS	PERMEABILITY, K(cm/s)	MOISTURE CONTENT(%)
1.015	103	249	74	43	<5E-9	8.4

2. TOP LAYER TYPE: NON WOVEN
LAYER # MASS(lb/ft²)
980825205B 0.047

3. BOTTOM LAYER TYPE: WOVEN
LAYER# MASS(lb/ft²)
85102 0.023

4. BENTONITE TYPE: 30 MESH

SHIPMENT#	%MONTMORILLONITE	SWELL INDEX(ml)	MOISTURE CONTENT(%)	MOISTURE ABSORPTION(%)	MASS OF BENTONITE
311906	90	27	8.4	580	0.945 (lb/ft ²)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT# R8090803 ROLL# 1272 DATE 09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00 ft x 15.5 ft
45.72m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

	TENSILE (LB)	ELONGATION (%)	MOISTURE			
MASS(lb/ft ²)	LENGTH	CROSS	LENGTH	CROSS	PERMEABILITY, K(cm/s)	CONTENT(%)
1.015	134	277	70	32	<5E-9	10.2

2. TOP LAYER TYPE: NON WOVEN

LAYER #	MASS(lb/ft ²)
980821205B	0.053

3. BOTTOM LAYER TYPE: WOVEN

LAYER#	MASS(lb/ft ²)
7439706	0.023

4. BENTONITE TYPE: 30 MESH

SHIPMENT#	% MONTMORILLONITE	SWELL INDEX (ml)	MOISTURE CONTENT (%)	MOISTURE ABSORPTION (%)	MASS OF BENTONITE
455986	90	28	10.2	593	0.939 (lb/ft ²)

APPENDIX C

APPENDIX C

Technical Revision No. 1, Summary of Discussion, November 16, 1998

**CASH MINE / GOLD HILL MILL
GOLD HILL, COLORADO**

TAILINGS IMPOUNDMENT EXPANSION

TECHNICAL REVISION

A. EMBANKMENT STABILITY AND LINER FOUNDATION

Background

The original design for the expansion of the tailings impoundment at the Gold Hill Mill includes a 12-foot raise of the embankment, based on a modified upstream construction technique. The footprint of the embankment raise extends approximately 40 feet out from the upstream face of the original embankment onto the surface of the existing tailings. Approximately 20 to 25 feet of the existing tailings remain exposed beyond the upstream toe of the embankment raise. A biaxial geogrid was installed on the surface of the existing tailings, within the footprint of the embankment raise, prior to construction of the new embankment, to facilitate placement of the initial fill layers. The geogrid was not specifically designed as a reinforcing member in the embankment raise, although some reinforcement benefit is realized.

The stability of the raised embankment was analyzed as part of the design for the new facility. The rotational failure potential of the upstream and downstream slopes of the facility was evaluated at various stages of filling of the impoundment. The soil parameters used in the computer model analyses were based, in part, on results of laboratory analyses of representative soil and tailings samples collected from the site and, in part, on conservative estimates from published literature and previous experience with similar materials. All of the stability analyses indicated factors of safety greater than the minimum acceptable values. The indicated governing condition was determined to be the post-construction condition, with saturated tailings as the foundation for the embankment raise and no buttressing by newly placed tailings. Minimum calculated factors of safety were 1.2 for static conditions and 1.14 for pseudo static (seismic) conditions. Throughout the analyses, it was assumed that the existing tailings would be left in place.

It was subsequently proposed that a portion of the exposed saturated tailings upstream of the embankment raise be removed to improve foundation conditions below the new liner system for the expanded impoundment. Observation of the embankment raise following completion of construction has revealed no evidence of distress that would indicate potential instability of the foundation. However, initiation of mechanical removal of the exposed tailings and established vegetation in two areas of the existing impoundment gave rise to concerns that such removal may compromise the stability of the embankment through removal of the existing materials that are providing passive resistance against movement of the foundation tailings under the embankment raise. Analysis of possible block failure mechanisms in the embankment and foundation tailings was conducted using the soil property and soil/liner interface friction values employed in the original stability analyses. This analysis of possible block failure mechanisms indicated potential instability, even with the existing tailings left in place. The factors of safety calculated through the analysis were in the range between 0.85 and 0.91.

Proposed Design Revision

A proposal was made to leave the existing tailings in place, and to enhance the foundation conditions for the new liner system over these tailings by extending the geogrid across the full surface area of the tailings and placing a nominal layer of granular soil over the geogrid prior to installing the liner system. This proposal was rejected by the Colorado Division of Minerals and Geology. The Division acknowledged the validity of the concern regarding the stability of the embankment, but cited concerns regarding the long-term integrity of the liner system on a foundation of unconsolidated tailings in support of their rejection of the proposal. Accordingly, a compromise proposal was developed as follows:

- Surficial organic materials are to be removed.
- The majority of the existing tailings are to be left in place.
- The geogrid reinforcement layer is to be extended across the balance of the surface of the existing tailings, secured to the previously placed geogrid mat near the upstream toe of the embankment raise, but left unsecured at the other edge of the mat extension near the toe of the interim berm.
- Settlement gauges are to be installed at representative locations on top of the geogrid mat extension.
- Surcharge fill (waste rock or other available material) is to be placed on the geogrid mat to preload the tailings (At ITEC's discretion, excess fill material may be placed in order to expedite consolidation).
- Consolidation of the underlying tailings is to be monitored via the settlement gauges.
- When the rate of settlement is observed to decrease significantly, indicating achievement of primary consolidation of the tailings, the majority of the surcharge fill material may be removed, at ITEC's discretion, and a cushion layer of finer grained material placed over the fill, as necessary.
- The second phase of the bentonite geocomposite liner (GCL) and HDPE primary liner is to be installed to complete the liner system.

Supplementary Stability Analysis

Based on the observation that there has been no distress of the embankment and underlying tailings foundation following completion of the embankment construction, the values for material properties and interface friction used in the previous stability analyses were reviewed. The block failure analyses were rerun to back calculate appropriate realized values for the various parameters, given that the apparent factor of safety is at least unity under current conditions. Figures 1a and 1b present graphical representations of the existing post-construction scenario (static and pseudo static, respectively), which are considered to be conservative. Table 1 presents the apparent minimum realized values for the various parameters.

Table 1
Strength and Physical Property Values for Soil, Tailings and Geomembrane Interface
used in the Slope Stability Analysis

Soil Unit	Material	Bulk Density (pcf)	Saturated Density (pcf)	Cohesion (psf)	Friction Angle (degrees)
1	Tailings	94	100	40	20
2	Embankment (proposed)	130	130	0	35
3	Embankment (existing)	123	130	0	30
4	Overburden	125	130	0	32
5	Bedrock	138	138	0	37
6	Tailing/Geomembrane Interface	100	100	30	17
7	Soil Buttress above Tailings	110	115	0	33

The minimum apparent parameter values, determined through the reanalysis of the existing condition at the site were then utilized in further stability analyses to assess the factor of safety against block failure if the existing exposed tailings were to be removed. This procedure was also used to determine the thickness of surcharge material that should be left in place over the existing tailings upstream of the embankment raise to provide a minimum safety factor of 1.2 against failure under static loading conditions. Figures 2a, 2b, 3a and 3b (static and pseudo static, respectively) present these scenarios graphically and Table 2 summarizes the predicted factors of safety for the respective conditions. The results show that removal of the tailings would result in instability of the embankment (F.S. = 0.81 for the static condition and 0.77 for the pseudo static condition). The required surcharge thickness was determined to be approximately 1.5 ft. The stability of the embankment will be further enhanced as tailings are placed in the new impoundment. The tailings will be spigotted from the new embankment so that the initial beach will be established immediately against the upstream face of the embankment raise and the loading from the tailings will act to increase the ballast on the existing underlying tailings upstream of the embankment raise. The impoundment will be maintained such that the decant pond is toward the back of the impoundment. A revised design cross-section through the impoundment is shown on Drawing 5461-C5.

Table 2
Summary of Slope Stability Analyses Results

Figure	XSTABL file	Parameters	Safety Factor	
			Static	Pseudostatic ($k_h=0.02g$)
1	PCRB20	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, saturated tailings (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	1.02	0.98
2	UPXRB1	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, wedge of the tailings removed, saturated tailings (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	0.81	0.77
3	PCRB21L	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, 1.5 ft of soil buttress on top of tailings, saturated tails (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	1.20	1.15

B. LINER EXTENSION AND CONTINUITY

Background

The original design of the liner system for the tailings impoundment expansion contemplated that the trimmed upstream edge of the existing HDPE FML would be secured in an anchor trench excavated in an interim berm left between the original pond and the excavation area of the expanded pond. The first phase of the new liner system (GCL and FML) would then be secured in the same anchor trench, followed by the second phase GCL component of the new liner system. Finally, the upstream edge of the second phase of the new FML would be deployed such that it would overlap the anchor trench and this edge of the FML would be welded to the previously installed first phase FML to produce a continuous new liner system throughout the impoundment. During excavation of the expanded impoundment, bedrock was encountered in the vicinity of the interim berm that precluded the effective construction of an appropriate anchor trench.

Proposed Liner System Design Modification

The following alternate approach is proposed to secure and maintain the effective continuity of the various components of the liner systems:

- Trim the upstream edge of the existing HDPE FML such that it terminates along the crest of the interim berm.
- Deploy the GCL component of the first phase of the new liner system such that it significantly overlaps the trimmed free edge of the existing FML.
- Deploy the FML component of the first phase of the new liner system such that it extends beyond the end of the deployed GCL and weld the new FML to the underlying existing FML.
- Deploy the GCL component of the second phase of the new liner system such that it significantly overlaps the weld securing the first phase FML to the previously existing FML and the first phase GCL.
- Place a bead of granular bentonite along the free ends of the second phase GCL panels to provide an enhanced seal against moisture migrating under the GCL.
- Deploy the FML component of the second phase of the new liner system such that it overlaps the free end of the second phase GCL component and weld the second phase FML to the first phase FML.

All FML seams are to be tested both non-destructively and destructively, in accordance with approved protocols, to ensure the integrity and strength of the welds. A typical cross-section of the proposed liner system design modification at the interim berm is shown on Detail 4, Drawing 5461-C5.

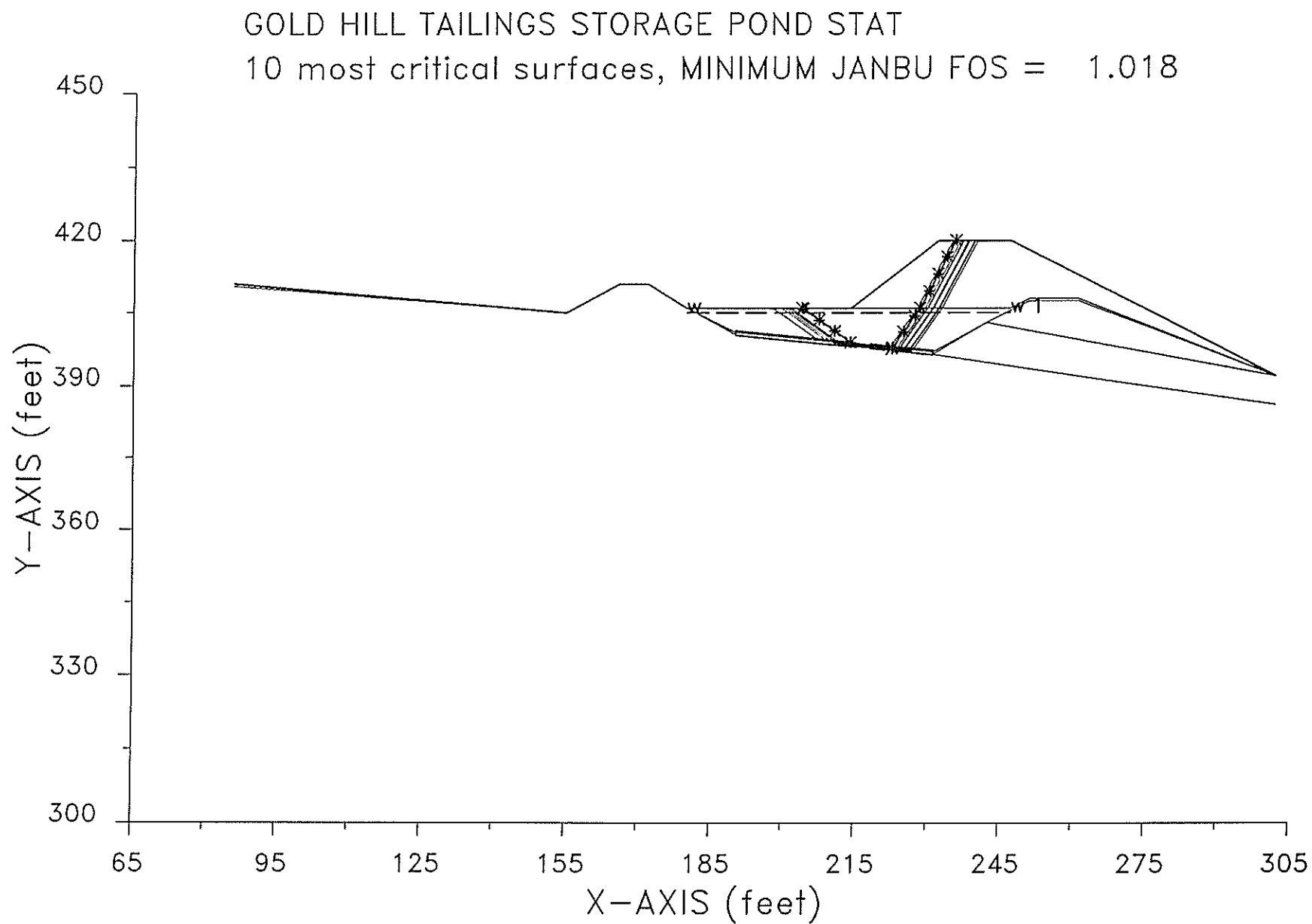


FIGURE 1a

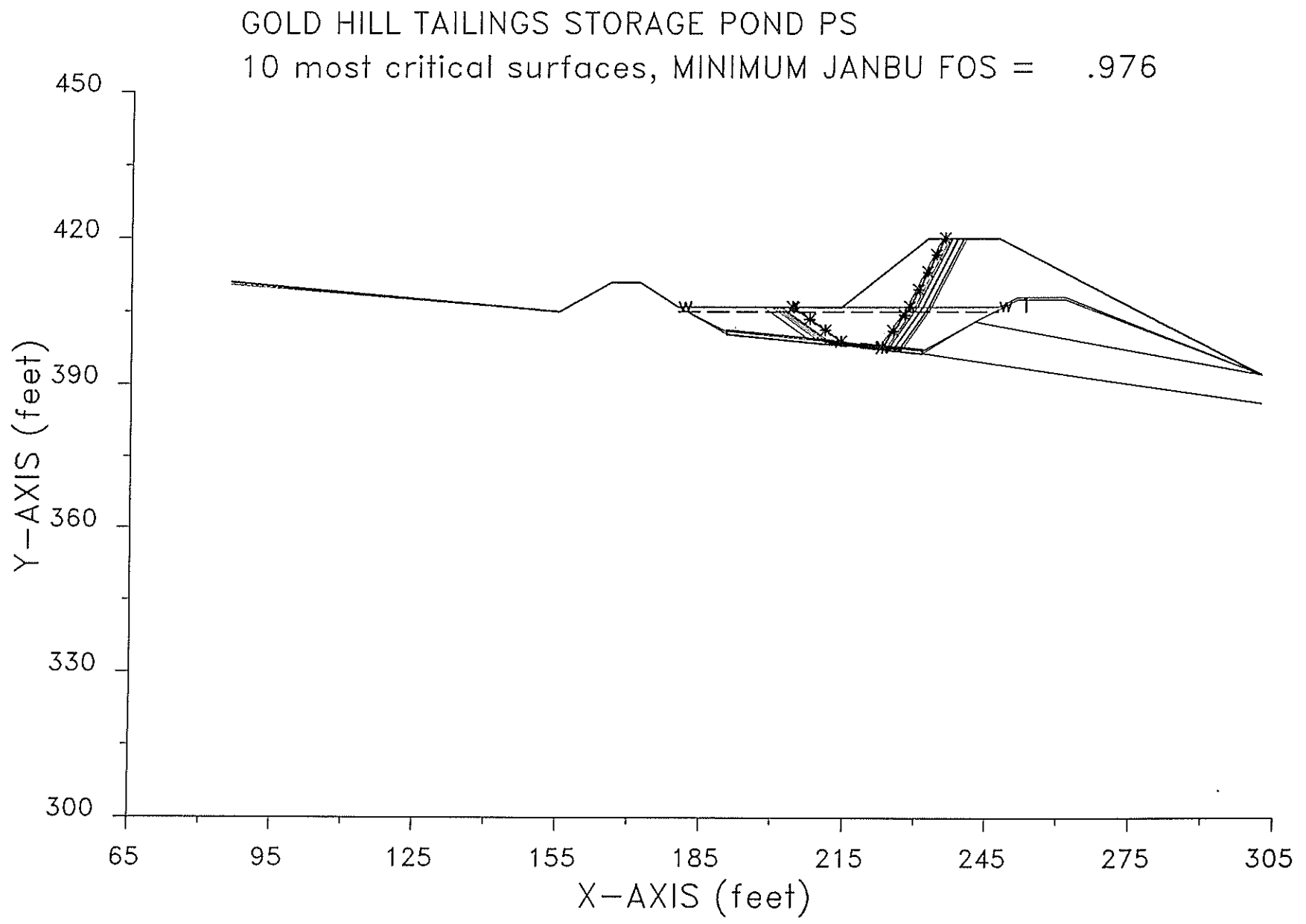


FIGURE 1b

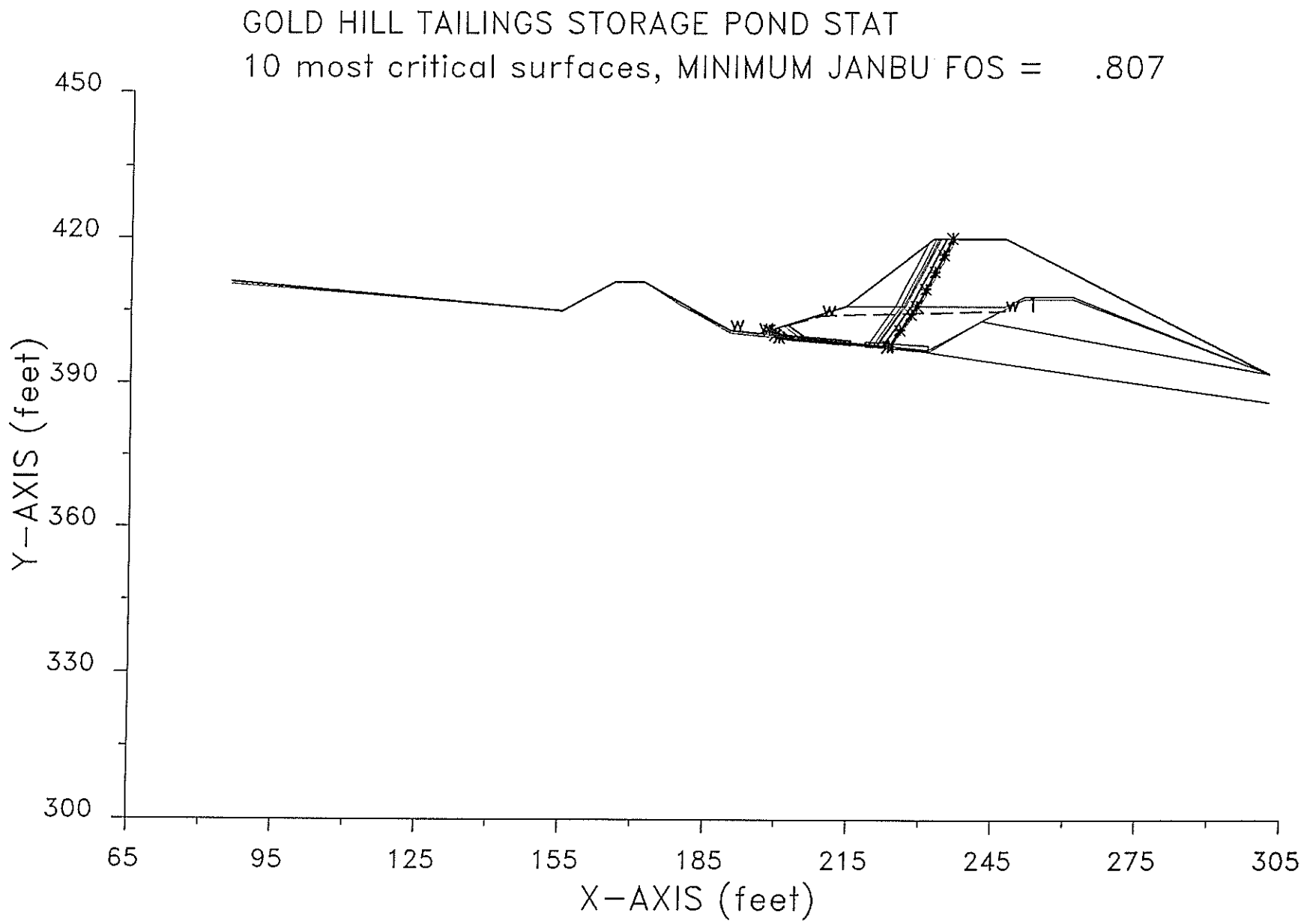


FIGURE 2a

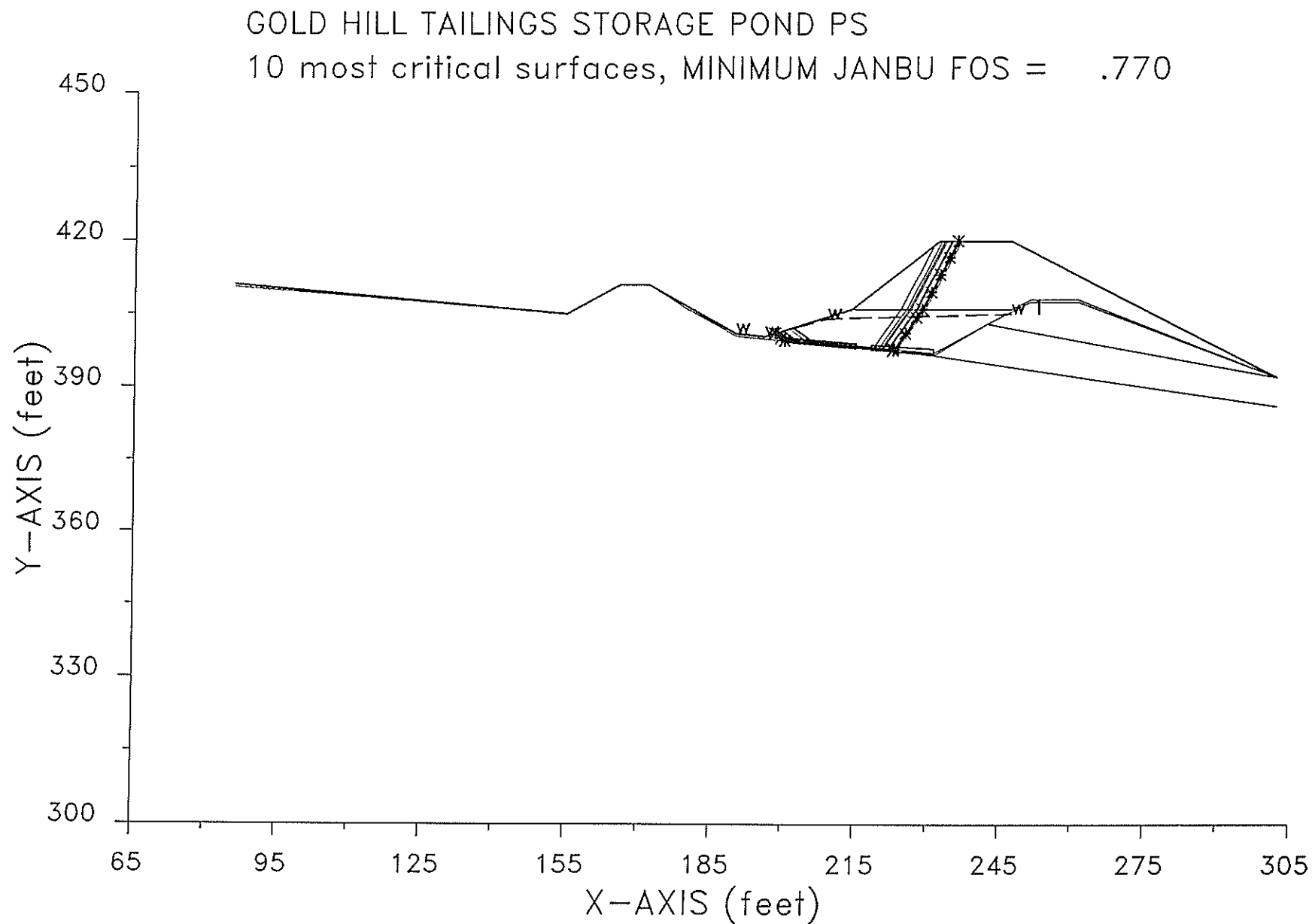


FIGURE 2b

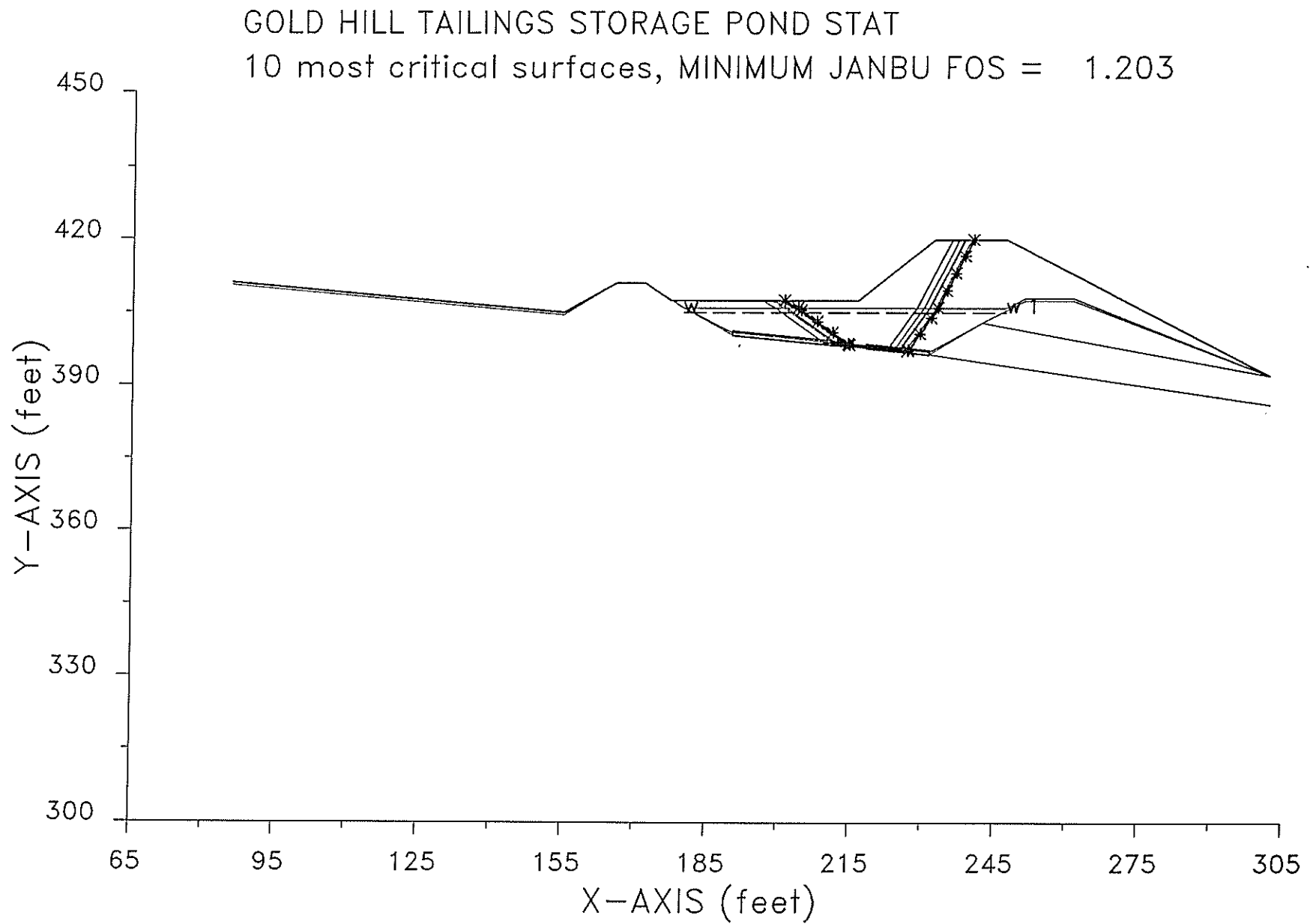


FIGURE 3a

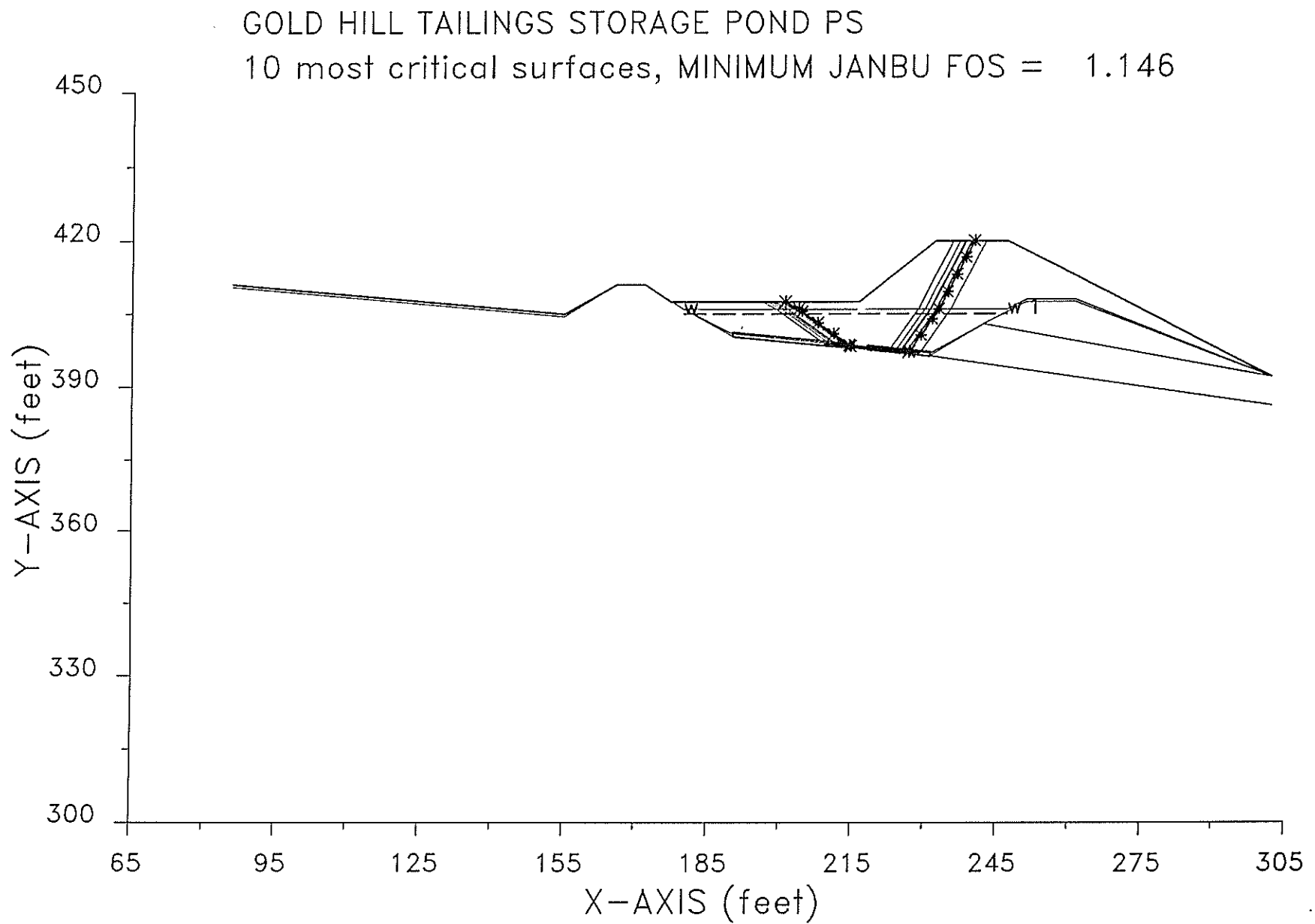
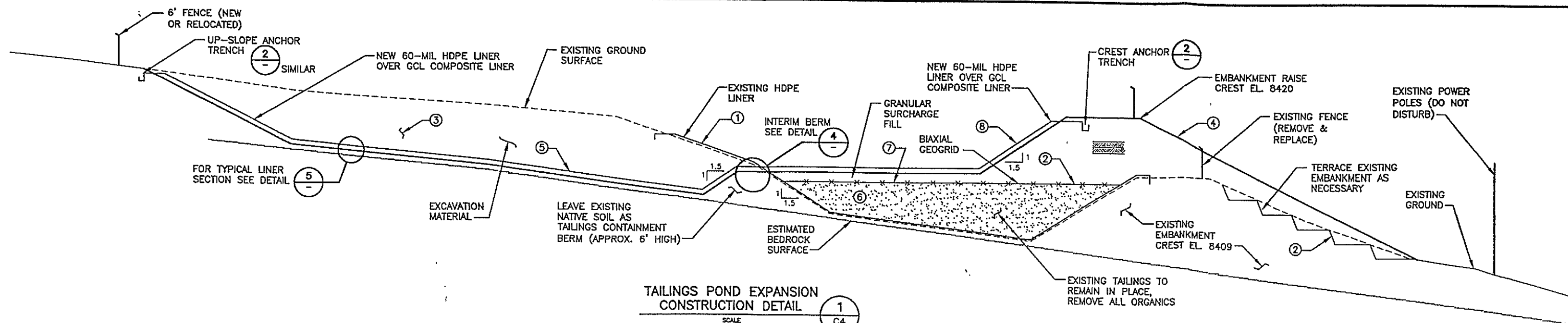
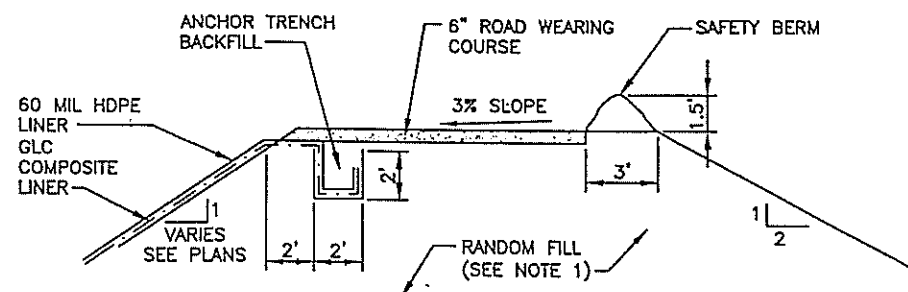


FIGURE 3b



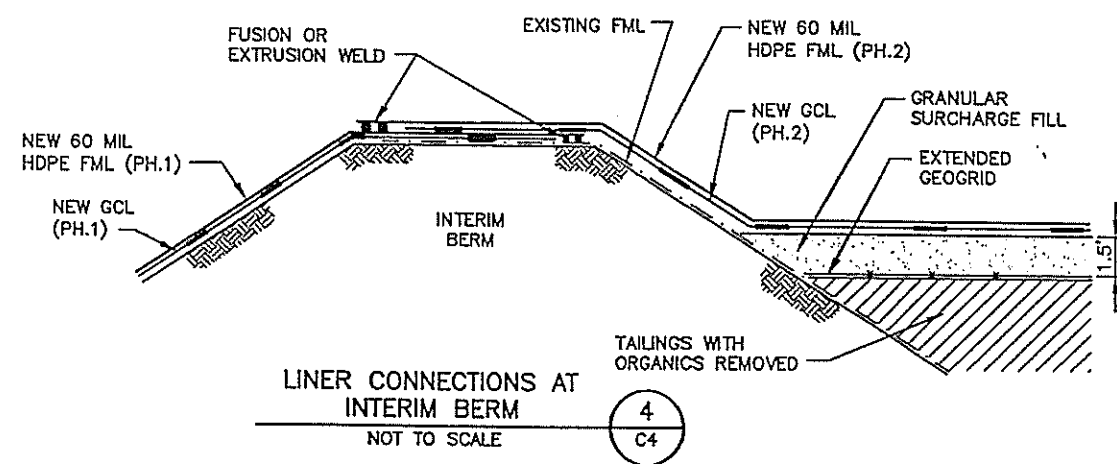
TAILINGS POND EXPANSION
CONSTRUCTION DETAIL 1
SCALE
10 0 10 FEET (HORIZ. & VERT.)



NOTES:

1. RANDOM FILL CONSISTS OF BORROW MATERIAL GENERATED FROM POND EXCAVATION. LARGE ROCK FRAGMENTS AND BOULDERS THAT ARE GREATER THAN 6" IN DIAMETER SHALL BE GRADED TO THE DOWNSTREAM FACE. FINER GRAIN MATERIAL SHALL BE PLACED IN THE UPSTREAM ZONE OF THE EMBANKMENT.
2. ALL FILL PLACED SHALL BE COMPACTED TO 90% OF MAX. DRY DENSITY, AS DETERMINED BY ASTM D-1557.

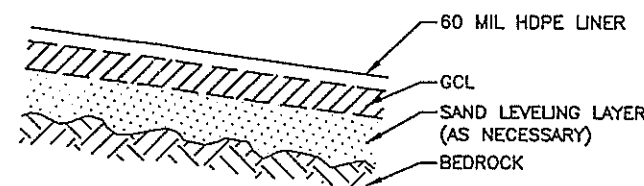
TAILINGS POND CREST
GEOMEMBRANE/GCL
ANCHOR TRENCH 2
SCALE
4 0 4 FEET



NOTES:

1. CAST EXCAVATED SPOIL TO DOWNSLOPE SIDE OF DITCH, SHAPE COMPACT AND TRIM TO CONFIGURATION SHOWN.
2. SLOPE OF DITCH TO BE MAINTAINED AT NO GREATER THAN 2%.
3. HAY BALES SHALL BE PLACED PERIODICALLY ALONG DITCH LENGTH AND AT THE DITCH OUTLET FOR SEDIMENT CONTROL.

V-NOTCH DRAINAGE DITCH 3
SCALE
2 0 2 FEET



TYPICAL LINER SECTION 5
NOT TO SCALE
C4

CONSTRUCTION SEQUENCE

1. REMOVE THE EXPOSED LINER LOCATED ON THE NORTH BANK OF THE EXISTING POND AND THE FENCE SURROUNDING THE POND.
2. PLACE A BIAXIAL GEOGRID OVER THE EXISTING TAILINGS WHICH ARE TO BE COVERED BY THE EMBANKMENT EXTENSION/RAISE. TERRACE THE DOWNSTREAM SLOPE OF THE EXISTING EMBANKMENT AS NECESSARY TO PROVIDE SUITABLE SURFACE FOR PLACEMENT AND COMPACTION OF MATERIAL.
3. EXCAVATE THE MATERIAL NORTH OF THE EXISTING POND TO THE CONTOUR SHOWN ON DRAWING 5461-C2. LEAVE AN INTERIM CONTAINMENT BERM BETWEEN THE NEW EXCAVATION AND THE EXISTING TAILINGS POND. SECURE EDGE OF EXISTING LINER IN INTERIM ANCHOR TRENCH.
4. PLACE AND COMPACT THE EXCAVATED MATERIAL TO FORM THE EMBANKMENT EXTENSION. TERRACE THE DOWNSTREAM SLOPE OF THE EXISTING EMBANKMENT AS NECESSARY TO PROPERLY PLACE AND COMPACT THE NEW EMBANKMENT MATERIAL.
5. INSTALL THE NEW 60-MIL HDPE LINER AND GCL IN THE NEWLY EXCAVATED PORTION OF THE POND FROM THE UP-SLOPE ANCHOR TRENCH TO THE CONTAINMENT BERM. TEMPORARILY ANCHOR THE LINER AND GCL AT THE CONTAINMENT BERM USING SAND BAGS.
6. REMOVE SURFICIAL VEGETATION/ORGANIC MATERIAL FROM EXPOSED TAILING.
7. PLACE BIAXIAL GEOGRID OVER REMAINING TAILING SURFACE. PLACE SETTLEMENT MONUMENTS ON TOP OF GEOGRID SURFACE. PLACE GRANULAR SURCHARGE FILL OVER THE BIAXIAL GEOGRID.
8. MONITOR SETTLEMENT, THEN INSTALL THE NEW LINER AND GCL FROM THE CONTAINMENT BERM, ACROSS THE EXISTING POND, AND UP THE NEW EMBANKMENT EXTENSION TO THE CREST ANCHOR TRENCH.
9. PLACE FENCE AROUND POND PERIMETER AND EMBANKMENT CREST.



REFERENCE	NO.	REVISIONS	BY	DATE	NO.	REVISIONS	BY	DATE	McCulley, Frick & Gilman, Inc. providing environmental consulting and engineering services	ITEC ENVIRONMENTAL COLORADO INC CASH MINE SITE DEVELOPMENT
					1	REISSUED FOR TECHNICAL REVISION	LCO	10/9/98		POND DETAILS
					0	ISSUE FOR REVIEW - NOT FOR CONSTRUCTION	LCO	6/98		

DESIGNED BY:	DJH
DRAWN BY:	PRM
CHECKED BY:	LCO
APPROVED BY:	-
FILE NAME:	5461-11.DWG
DATE:	JUNE, 1998
DRAWING NO.	5461-C5
REVISION:	1

**CASH MINE / GOLD HILL MILL
GOLD HILL, COLORADO**

TAILINGS IMPOUNDMENT EXPANSION

**AMENDMENT TO TECHNICAL REVISION
DATED 10/09/98**

The Technical Revision (TR) submitted to the Colorado Division of Minerals and Geology (DMG) on October 9, 1998 presented, in part, a proposal to install a layer of ballast material on the remaining exposed tailings in the original tailings impoundment at the Gold Hill Mill site. The effects of this ballast material will be to preconsolidate those tailings, prior to placement of the liner system for the expanded impoundment facility, and to enhance the stability of the embankment raise constructed partly on the adjacent portion of the originally impounded tailings. The proposal presented in that TR was based on the outcome of field discussions and follow-up telephone conversations between representatives of the DMG and the operator's consultant, as well as the DMG inspection report of October 7, 1998.

Subsequent to preparation and submittal of that TR, additional data has been obtained regarding the depths of tailings at various locations along the approximate centerline of the remaining exposed portion of the original tailings impoundment. The tailings depths range from less than one foot to a maximum of approximately 4.5 feet. A plot of the approximate locations of the soundings and the corresponding depths of tailings is attached. There is a significant area in the central portion of the exposed tailings impoundment where the depth of tailings is approximately one foot or less. This area of shallow depths is consistent with the alignment of an underlying bedrock ridge that was encountered during excavation of the western portion of the expanded impoundment and the intermediate berm. Another area at the north end of the impoundment reflects a shallowing of the tailings towards the lateral boundary of the original basin. The data regarding depths of the exposed tailings is consistent with the depth trend identified during earlier limited soundings along the upstream toe of the new embankment raise. The data from these soundings are also shown on the attached plot.

In light of the newly obtained data, it is suggested that it would be neither necessary nor appropriate to universally apply the consolidation and stability enhancing measures proposed in the TR over the full area of the exposed tailings. The block failure analysis conducted in support of the TR, and described therein, conservatively evaluated conditions for the maximum cross-section through the impoundment. Similarly, the estimate of possible consolidation and surface settlement in the remaining area of exposed tailings was based on the maximum cross-section with tailings depths under the embankment raise taken to be as much as ten feet. The new data indicates that these analyses were overly conservative.

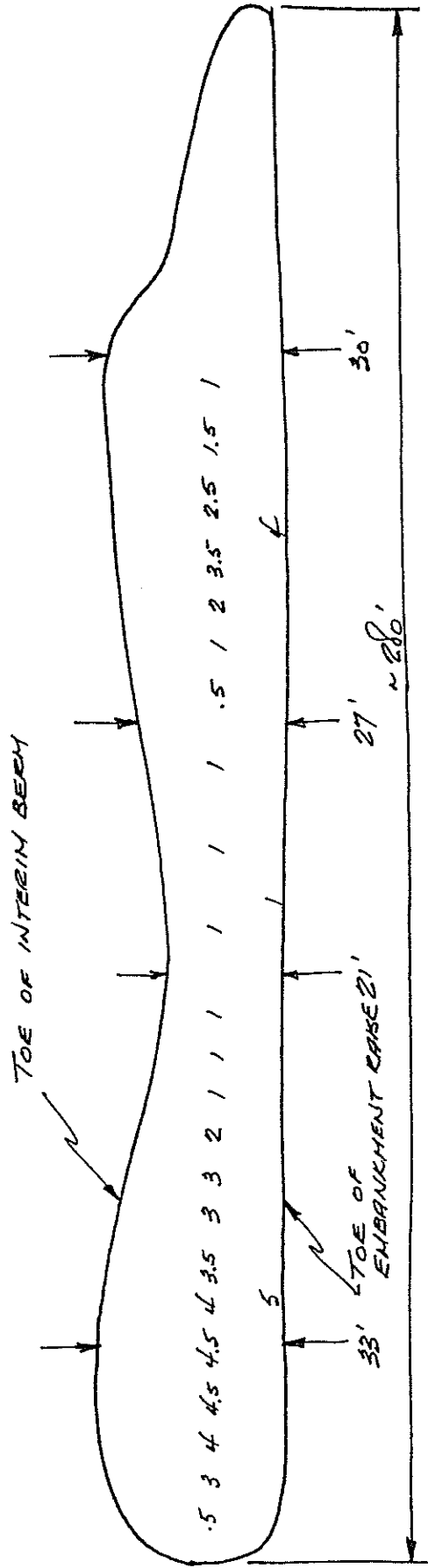
Accordingly, it is proposed that the tailings consolidation and stability enhancing actions described in the TR be refined as follows:

- Remove surficial organic materials from the tailings (now completed).

- Extend the geogrid reinforcement layer over the full surface area of the exposed tailings, as proposed.
- Install settlement gauges at representative locations on top of the geogrid layer.
- Place a ballast layer of waste rock (selected oversized material screened from the stock being prepared for mill feed) over the full width of the exposed tailings in the two areas where the indicated tailings depths exceed one foot. As previously proposed, the final thickness of the ballast layer will be at least 18 inches, but the operator may initially place the material to a thickness greater than 18 inches in order to expedite consolidation.
- Place no ballast material in areas where the indicated tailings depth is less than one foot.
- Monitor the consolidation of the surcharged tailings, through regular surveys of the settlement gauges.
- When the rate of settlement is observed to decrease significantly, remove or redistribute any excess waste rock ballast, and place a cushion layer of finer grained material (minimum 4-inch thickness), as a base for the liner system.
- Install the second phase of the liner system for the expanded impoundment.

The actions proposed herein will effectively consolidate, in a timely manner, those portions of the remaining exposed tailings where surface settlement subsequent to installation of the liner system might compromise the integrity of the liner. The waste rock material will also provide appropriate ballast to adequately increase the factor of safety against block failure of the foundation materials supporting the embankment raise during the immediate "post-construction" period, prior to buttressing of the embankment by newly placed tailings.

CASH MINE / GOLD HILL MILL RESIDUAL TAILINGS DEPTH.



1" = 30'

Albuquerque Office
8100 Mountain Road, NE
Suite 210
Albuquerque, NM
87110
505/266-8880
FAX: 505/266-8881

Austin Office
8900 Business Park Drive
Austin, TX
78759-7439
512/338-1667
Fax: 512/338-1331

Boston Office
500 West Cummings Park
Suite 1050
Woburn, MA
01801
781/937-0500
Fax: 781/937-0578

Boulder Office
4900 Pearl East Circle
Suite 300W
Boulder, CO
80301
303/447-1823
Fax: 303/447-1836

Iselin Office
33 Wood Avenue South
Suite 600
Iselin, NJ
08830
732/603-5228
FAX: 732/603-5240

Missoula Office
P.O. Box 7158
Missoula, MT
59807-7158
406/728-4600
Fax: 406/728-4698

Pittsburgh Office
800 Vinial Street
Suite 408B
Pittsburgh, PA
15212
412/321-2278
FAX: 412/321-2283

Port Lavaca Office
320 East Main
Port Lavaca, TX
77979
512/552-8839
Fax: 512/553-6115

San Francisco Office
71 Stevenson Street
Suite 1450
San Francisco, CA
94105
415/495-7110
Fax: 415/495-7107

Santa Ana Office
640 North Tustin Avenue
Suite 101
Santa Ana, CA
92705
714/973-3090
FAX: 714/973-3097

Seattle Office
19203 36th Avenue W.
Suite 101
Lynnwood, WA
98036-5707
425/921-4000
Fax: 425/921-4040

Wallace Office
P.O. Box 30
Wallace, ID
83873
208/556-6811
Fax: 208/556-7271

TAILINGS STORAGE FACILITY EMBANKMENT STABILITY ANALYSIS

The tailings facility at the Gold Hill Mill was expanded in 1998 under the supervision of the Colorado Division of Reclamation, Mining, and Safety. As part of the Designated Mining Operation conversion, CDRMS has asked for a re-evaluation of the stability of the embankment of the tailings storage facility. The analysis detailed here addresses this request.

1. Site Specific Data

The tailings storage facility was expanded in 1998 by ITEC. The construction of the expansion consisted of installation of a new liner atop of a taller embankment to increase the total storage capacity. An overall diagram of the expansion is shown in Figure 2. Material properties for all components of the construction were documented in the as-built from McCulley, Frick, and Gilman, Inc. (Figure 1). The material properties were determined by assuming the pre-1998 embankment was stable at unity ($FOS = 1.0$) and determining the material properties that would generate that FOS for the pre-1998 embankment. This method of determining the material properties is very conservative; the pre-1998 embankment likely had a stability $FOS > 1.0$. The material properties determined by McCulley have been used in this contemporary analysis, carrying forward both the conservative and site specific nature of the material properties.

The geometry of the embankment in the Lewicki analysis is the same geometry as the McCulley analysis. McCulley figures from their report have been rebuilt in GALENA software to model the embankment stability conditions. See McCulley Figures 1a – 3b in their report for reference.

The Tailings/Geomembrane Interface material is used in a thin layer over the model where the liner was installed, include in the anchor trench in the embankment. As it is a very thin material layer it is not easily visible on the GALENA software output figures.

**Strength and Physical Property Values for Soil, Tailings and Geomembrane Interface
used in the Slope Stability Analysis**

Soil Unit	Material	Bulk Density (pcf)	Saturated Density (pcf)	Cohesion (psf)	Friction Angle (degrees)
1	Tailings	94	100	40	20
2	Embankment (proposed)	130	130	0	35
3	Embankment (existing)	123	130	0	30
4	Overburden	125	130	0	32
5	Bedrock	138	138	0	37
6	Tailing/Geomembrane Interface	100	100	30	17
7	Soil Butress above Tailings	110	115	0	33

Figure 1. Material Properties

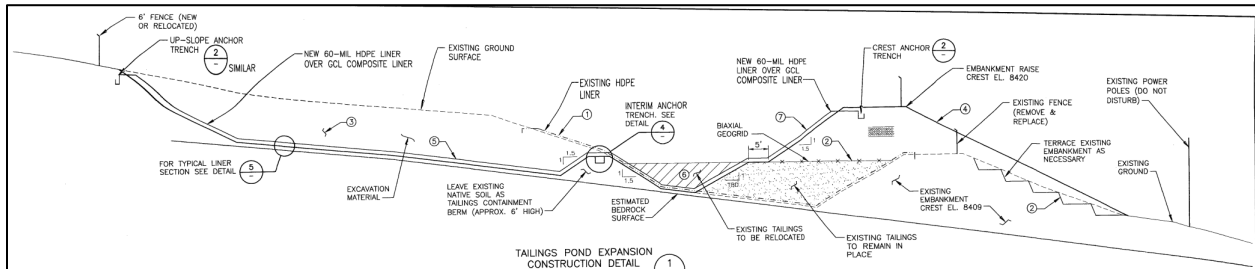


Figure 2. Tailings Expansion Diagram.

2. Analyses Conducted

There are two slope conditions that could potentially affect the stability of the embankment: the inslope and the out slope. Inslope failure must be analyzed for to determine if a failure condition would lead to the embankment being reduced in width in a manner that threatens the liner installation (: i.e., does the minimum Factor of Safety failure condition reach the anchor trench of the liner?) or overall embankment width (i.e., does the minimum FOS failure condition reach the mid-point of the embankment?). Outslope failure must be analyzed to determine if a failure condition would lead to the embankment being reduced in width to a manner that threatens the liner installation or the overall bank presence.

During the last expansion of the Tailings Storage Facility, the design engineers (McCulley) evaluated the slope stability of the embankment in-slope in various scenarios. The results of this analysis determined that the tailings within the TSF were providing a buttressing benefit to the existing and raised embankment and that a proposed removal of these tailings could lead to an unacceptably low embankment inslope stability condition ($FOS = 0.81$). Therefore, the design engineers and CDRMS agreed to placement of surcharge material against the inslope toe in order to enhance the buttress effect of the existing tailings. This revised plan was analyzed and suitable factors of safety were determined ($FOS = 1.20$). Table 2 in the 1998 slope stability analysis summarized the factors of safety in the various scenarios:

Table 2
Summary of Slope Stability Analyses Results

Figure	XSTABL file	Parameters	Safety Factor	
			Static	Pseudostatic ($k_h=0.02g$)
1	PCRB20	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, saturated tailings (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	1.02	0.98
2	UPXRB1	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, wedge of the tailings removed, saturated tailings (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	0.81	0.77
3	PCRB21L	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, 1.5 ft of soil buttress on top of tailings, saturated tails (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	1.20	1.15

The net result of the analysis conducted shows the embankment stability increases (0.81 to 1.20) with additional material placed against the inslope of the embankment (Figures 1-3).

Tailings material has continued to be placed within the TSF since the embankment raising in 1998.

2.1. Inslope

Lewicki & Associates does not have access to the original software model used in the 1998 analysis. Therefore, a GALENA-software model has been built to re-create the original analysis geometry. Using the material properties determined in 1998, a Bishop's method of slices slope stability analysis was run on the re-created 1998 stable condition: material placed against the toe of the embankment inslope, which had a factor of safety of 1.20. The GALENA model reported a FOS = 1.3, similar to the McCulley model of 1.2. The recreated McCulley model can then be used as the basis of evaluating slope stability in more modern conditions.

Using recreated McCulley model as a starting point, additional analyses were conducted with the tailings becoming deeper and deeper. These follow-up analyses showed close to a factor of safety of 1.2 for the embankment inslope, similar to the McCulley model.

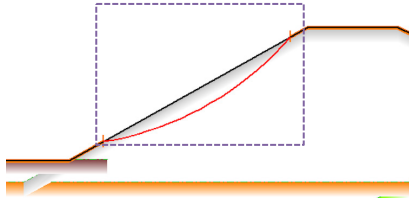
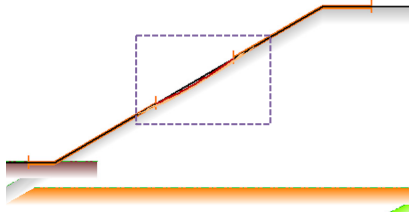
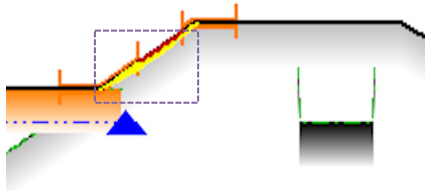
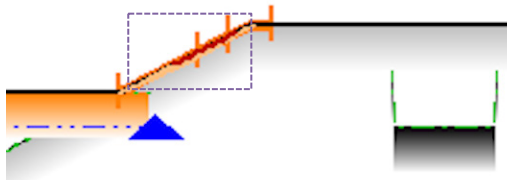
In total three model scenarios of the inslope were analyzed under non-seismic and seismic conditions.

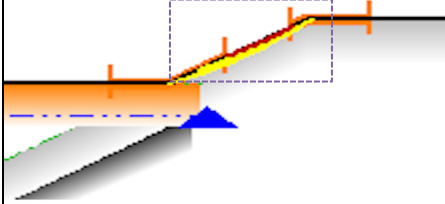
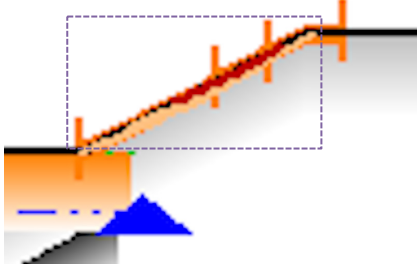
1. Tailings storage facility in the same condition as the 1998 stable model (~10-ft from top of embankment to top of tailings/fill)
2. Tailings storage facility filled to a lower level of five feet below the maximum level.
3. Tailings storage facility filled to the maximum level (two feet of freeboard).

The first scenario is the re-creation of the 1998 stable model with minimum tailings fill along the inslope toe. The second scenario represents operating, or active state, with additional room remaining for more tailings but not as much as in 1998. The third scenario represents the tailings storage facility in its end state filled with tailings to the minimum required freeboard depth. In McCulley's original embankment stability analysis, the presence of tailings as a buttress at the inside toe of the embankment was determined to be a key part of the stability of the embankment inslope. The embankment continuing to be stable in the same manner as additional tailings are added is to be expected. The lowest two inslope FOSs both show "sliver" failures: very thin failures that only occur because the depth of material resisting movement is very shallow (<0.1-ft). The inslope of the embankment is covered with liner material which restrains material in the embankment; sliver failures will not move beneath the liner.

To evaluate more potentially impactful inslope failure scenarios, the GALENA model iterations were reviewed to find the FOS > 1.30 (seismic FOS > 1.15) failure circle. FOS = 1.30 is the CDRMS standard for slope stability of critical structures with site specific materials properties. It should be noted that the 1998 embankment raise was determined to be acceptable by CDRMS under the slope stability standards at the time (FOS > 1.20). The FOS > 1.30 failure circle were identified for each tailings depth scenario. Table 1 shows these failure circles (yellow or red arcs) within the embankment inslope for each tailings depth scenario. Based on the results of the Bishop's Method of Slices analyses conducted for the inslope scenarios show no failure scenario that threatens the embankment integrity or the liner installation. All scenarios can be considered satisfactorily stable.

Table 1. Location of Failure Circles within Embankment Inslope (in box)

10-ft below top of embankment (McCulley rebuilt)		FOS = 1.3
		Seismic FOS > 1.15 (orange arcs)
5-ft below top of embankment		FOS > 1.3 (yellow arcs) Anchor trench can be seen with green lines and black gradient bottom.
		Seismic FOS > 1.15 (orange arcs)

2-ft below top of embankment		FOS < 1.30 (Yellow arcs) Anchor trench outside of figure to the right. This figure is zoomed in more due to the small size of failure arcs.
		Seismic FOS > 1.15 (orange arcs)

2.2. Outslope

Given that the embankment inslope has shown to be consistently stable, the only other risk of slope stability is the outslope. An outslope model was assembled in GALENA as well, and showed a FOS = 1.39 (seismic = 1.20). Only the scenario of greatest tailings depth was evaluated for outslope stability; tailings depth does not provide any buttress benefit to the outslope. The outslope failure circles show no risk to the embankment width or the liner anchor trench. Therefore the outslope can be considered stable.

A list of the Factors of Safety for different scenarios modelled in GALENA are listed in Table 1. GALENA output figures and data log are located in Attachment 1.

Table 2. Factors of Safety for Slope Stability

GALENA Analysis	Lowest Factor of Safety	Depth from top of embankment to top of tailings (ft)	Condition
1	1.26	2	Static model, inslope of embankment
2	1.12	2	Seismic model, iterated from static minimum FoS
3	1.19	5	Static model, inslope of embankment
4	1.04	5	Seismic model, iterated from static minimum FoS
5	1.30	10	Static model, inslope of embankment
6	1.09	10	Seismic model, iterated from static minimum FoS
7	1.39	2	Static model, outslope of embankment
8	1.20	2	Seismic model, iterated from static minimum FoS

3. Conclusion

Colorado Division of Reclamation, Mining, and Safety requirements for typical slope stability analysis are outline in a 2018 memo¹. Non-critical structures are expected to have a minimum factor of safety of 1.25 (seismic > 1.1) with strength data from onsite testing. Critical structures are expected to have a minimum factor of safety of 1.3 (seismic > 1.15). The structure in question at the Gold Hill Mill is the tailings embankment as its failure could lead to a discharge or tailings downhill towards Gold Run Road. Gold Run Road is roughly 2500-ft downhill of the TSF embankment. Potential failure of the embankment exists in two scenarios: inslope failure that leads to compromising of the embankment from within the TSF or outslope failure that causes embankment failure.

3.1. Inslope Failure

Inslope failure was evaluated by McCulley in 1998, with follow up analysis in this report. The inslope of the TSF embankment was shown to have a factor of safety of 1.20 to 1.30 depending on the scenario within the GALENA model. The highest factor of safety was in the GALENA model of the McCulley stable scenario. The lowest factor of safety was in the same base model, but with more tailings in place. No inslope model scenario shows a minimum FOS arc that reaches the midpoint of the embankment or the liner trench.

The danger of inslope failure within the TSF is very limited with the current presence of tailings within the TSF. This can be seen with the very limited failure arc for each analysis. Furthermore, all of the embankment material that could fail on the inslope is located below the plastic liner which is sandwiched against the existing tailings. This greatly limits the potential damage to the embankment of any inslope failure and the risk to downstream structures and human life in the event of any inslope failure shown in the models.

3.2. Outslope Failure

Outslope failure was not evaluated by McCulley in 1998. The GALENA model in this report does. The outslope was modelled based on the design criteria in the McCulley analysis. The lowest factor of safety for the outslope was 1.39 (seismic = 1.20). Failure of the outslope would lead to potential failure of the embankment, making it the appropriate slope stability to analyze and compare to CDRMS standards.

The outslope minimum factor of safety is above the CDRMS standards (FOS = 1.3, seismic = 1.15) for Critical Structures with site specific data. The outslope analysis passes both of these standards.

¹ Based on *Factors of Safety for Slope Stability/Geotechnical Analyses Associated with Mining Operations* from CDRMS, dated May 16, 2018.

4. Spencer-Wright Analysis

At the request of CDRMS, a Spencer-Wright non-circular failure model was run on the embankment inslope of the tailings embankment at Gold Hill Mill. The Spencer-Wright model is considered a rigorous Method of Slices slope stability analysis since it satisfies both force and moment equilibrium. Janbu and Spencer-Wright are both accepted slope stability analyses for non-circular failures in the geotechnical industry.

A non-circular failure block was created in each of the three inslope scenarios with the tailings storage facility embankment. Material properties and configuration was the same as the Bishop's method for circular failures. The lowest FOS results are summarized in Table 3 and the GALENA models can be seen in Attachment 2. The slope stability results for Spencer-Wright all produce greater critical FOS on the inslope than either the Bishop's analyses or the Janbu analysis from McCulley in 1998. According to analysis conducted by Wright² in 1979, the difference in FOS between methods should be within 5% for identical conditions.

To ensure modelling consistency, the failure circle for Bishop's method lowest FOS (1.30) in the 10-ft condition (Table 2, Analysis 6) was remodeled as a non-circular failure using Spencer-Wright. The resulting FOS was 1.29, essentially the same as the Bishop's method. This shows that the difference in FOS is not due to the method but due to the different analysis goals, i.e. failure block in Spencer-Wright and circular failure in Bishop.

Table 3. Spencer-Wright Analysis Results

GALENA Analysis	Lowest Factor of Safety (FOS)	Depth from top of embankment to top of tailings (ft)	Condition
2	3.28	2	Static model, inslope of embankment
3	2.52	2	Seismic model, iterated from static minimum FoS
5	2.23	5	Static model, inslope of embankment
6	1.90	5	Seismic model, iterated from static minimum FoS
11	1.75	10	Static model, inslope of embankment
12	1.47	10	Seismic model, iterated from static minimum FoS
Comparison of Analysis Type			
Janbu	1.20	10	Static model, inslope of embankment
Bishop's	1.30	10	Static model, inslope of embankment
Spencer-Wright	1.75	10	Static model, inslope of embankment

² J.M. Duncan, S.G. Wright, *The accuracy of equilibrium methods of slope stability analysis*, Engineering Geology, Volume 16, Issues 1–2, 1980, Pages 5-17, ISSN 0013-7952, [https://doi.org/10.1016/0013-7952\(80\)90003-4](https://doi.org/10.1016/0013-7952(80)90003-4).

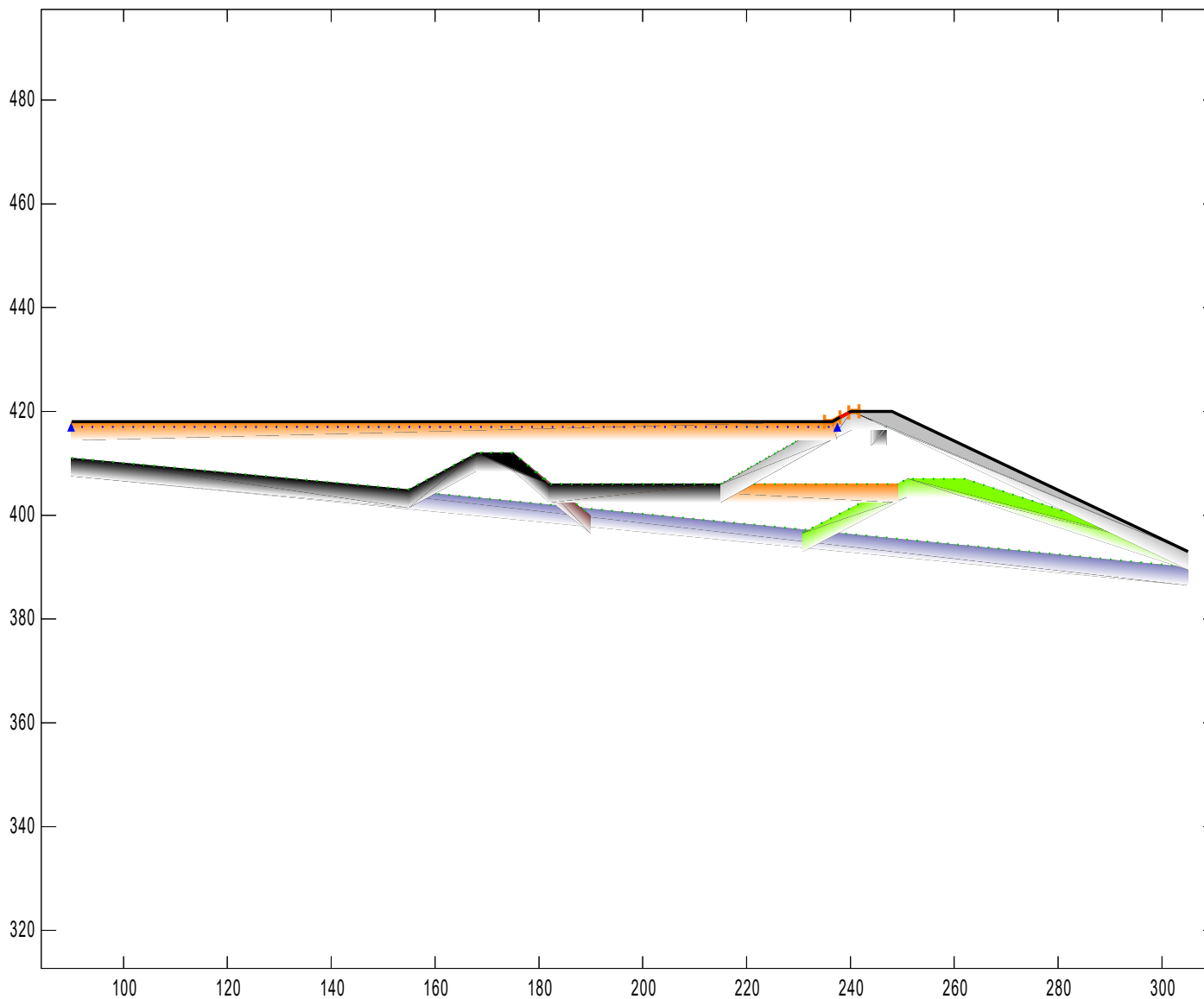
The slope stability analysis in this permit has been prepared according to appropriate engineering standards and practices.



Ben Langenfeld, P.E.

P.E.# 0047151

ATTACHMENT-1 GALENA INFORMATION



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

- 1: Tailings
- 2: Embankment (Proposed)
- 3: Embankment (Existing)
- 4: Soil Butress
- 5: Bedrock
- 6: Tailings/Geomembrane Interface

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

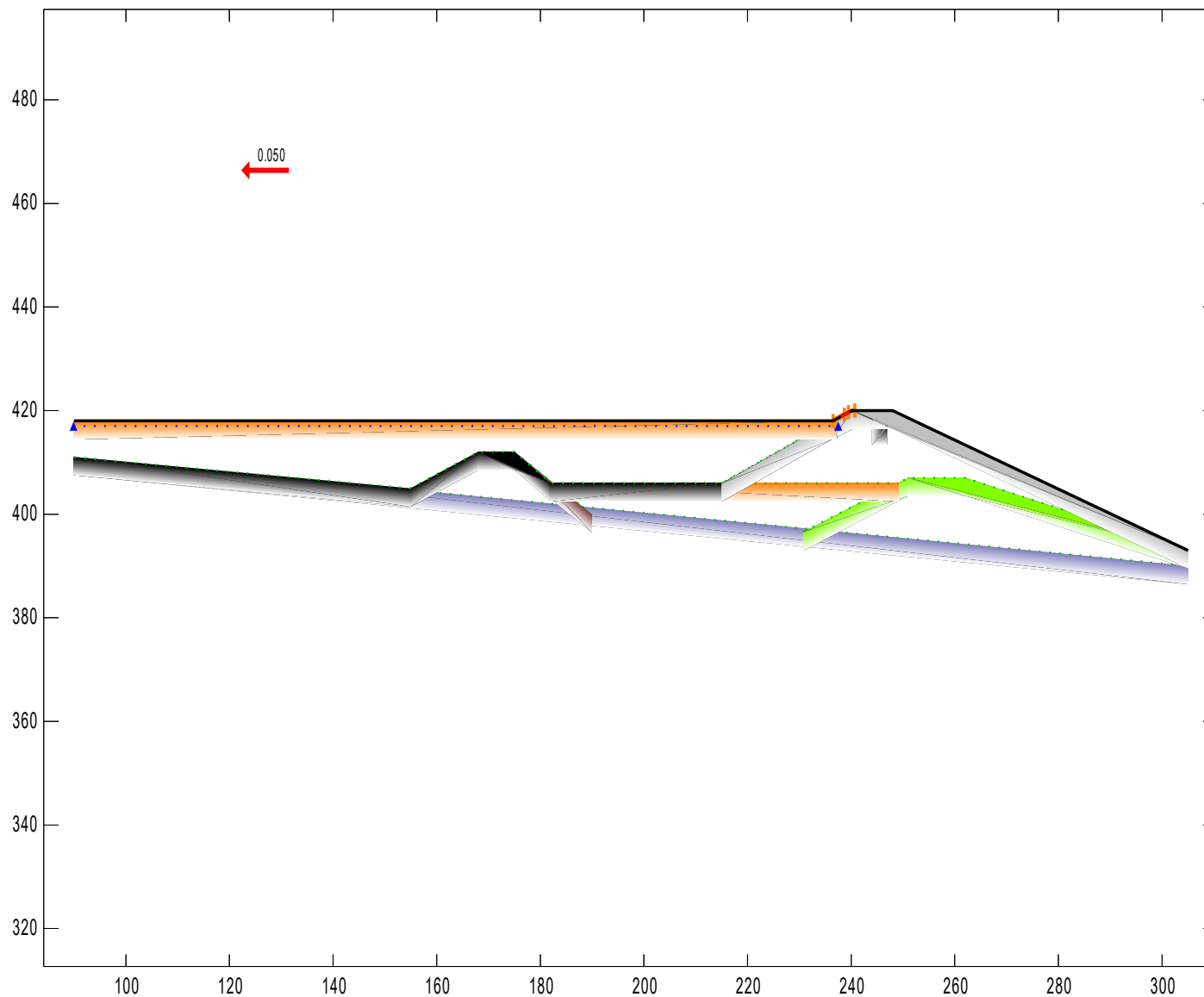
Critical Factor of Safety: 1.26

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 2FT Below Top of Embankment

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Edited: 1 Aug 2023
Processed: 1 Aug 2023





Material Keys

- 1: Tailings
- 2: Embankment (Proposed)
- 3: Embankment (Existing)
- 4: Soil Butress
- 5: Bedrock
- 6: Tailings/Geomembrane Interface

Analysis 2

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular (Critical Seed)

Results

Critical Factor of Safety: 1.12

GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 2FT Below Top of Embankment - Seismic

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Edited: 1 Aug 2023
Processed: 1 Aug 2023



Material Keys

1: Tailings

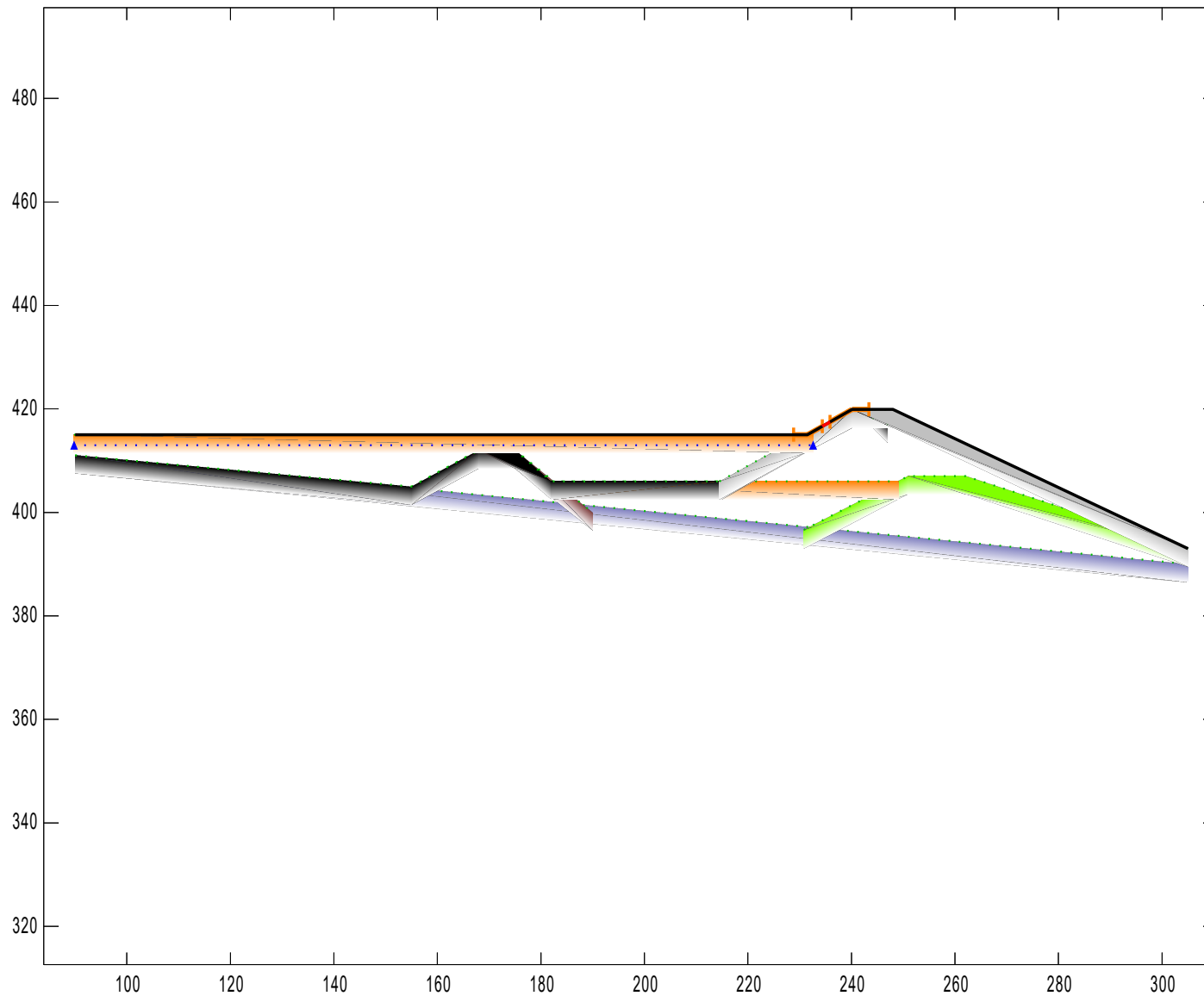
2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Butress

5: Bedrock

6: Tailings/Geomembrane Interface



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Analysis 3

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.23

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 5FT Below Embankment Top

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Edited: 1 Aug 2023
Processed: 1 Aug 2023



Material Keys

1: Tailings

2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttrass

5: Bedrock

6: Tailings/Geomembrane Interface

Analysis 4

Multiple Stability Analysis

Method: Bishop Simplified

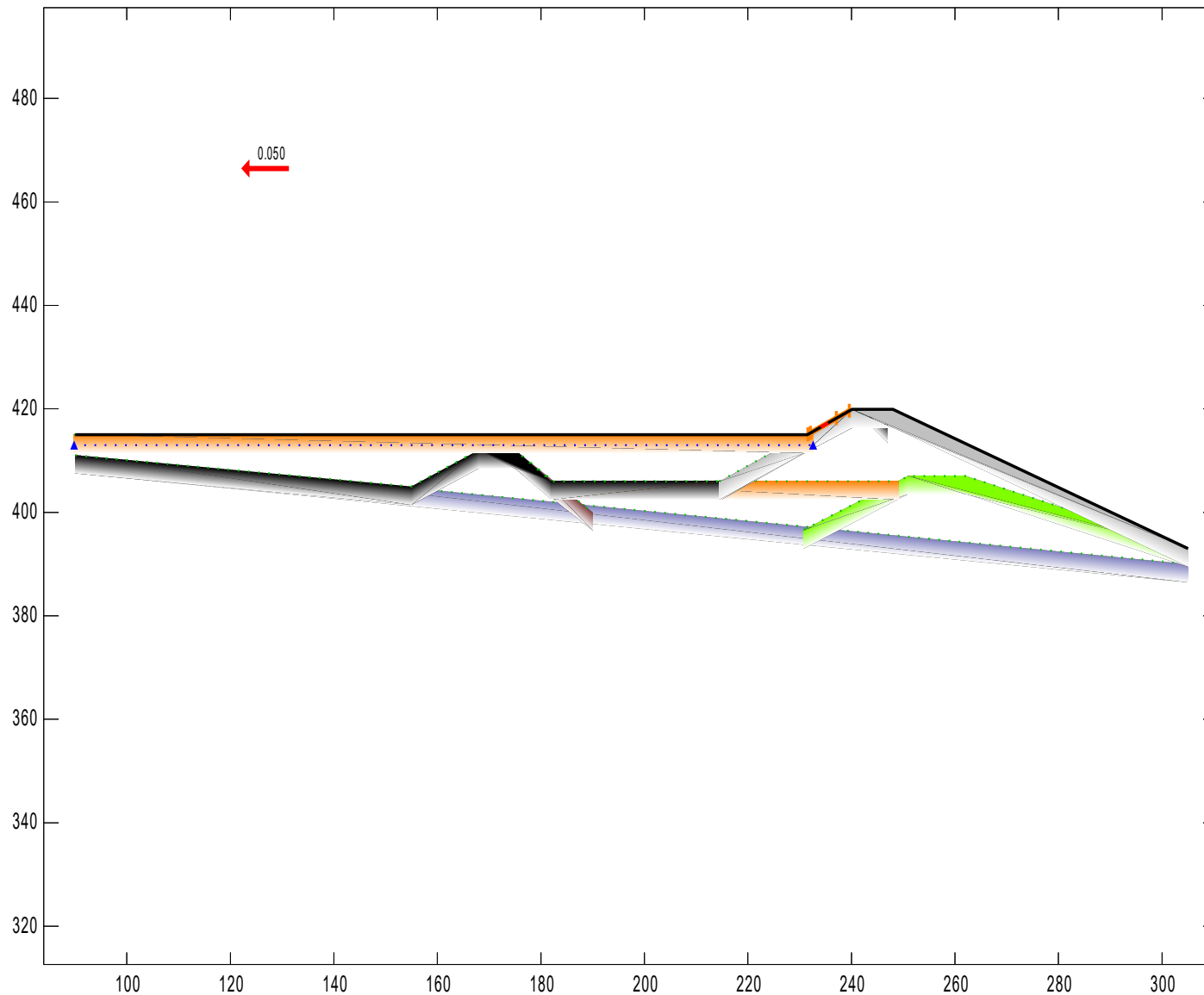
Surface: Circular (Critical Seed)

Results

Critical Factor of Safety: 1.10

Edited: 1 Aug 2023

Processed: 1 Aug 2023



GALENA Version 7.1

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Project GHM - Tailings Storage Facility
2023 Embankment Stability - 5FT Below Top of Embankment - Seismic

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Material Keys

1: Tailings

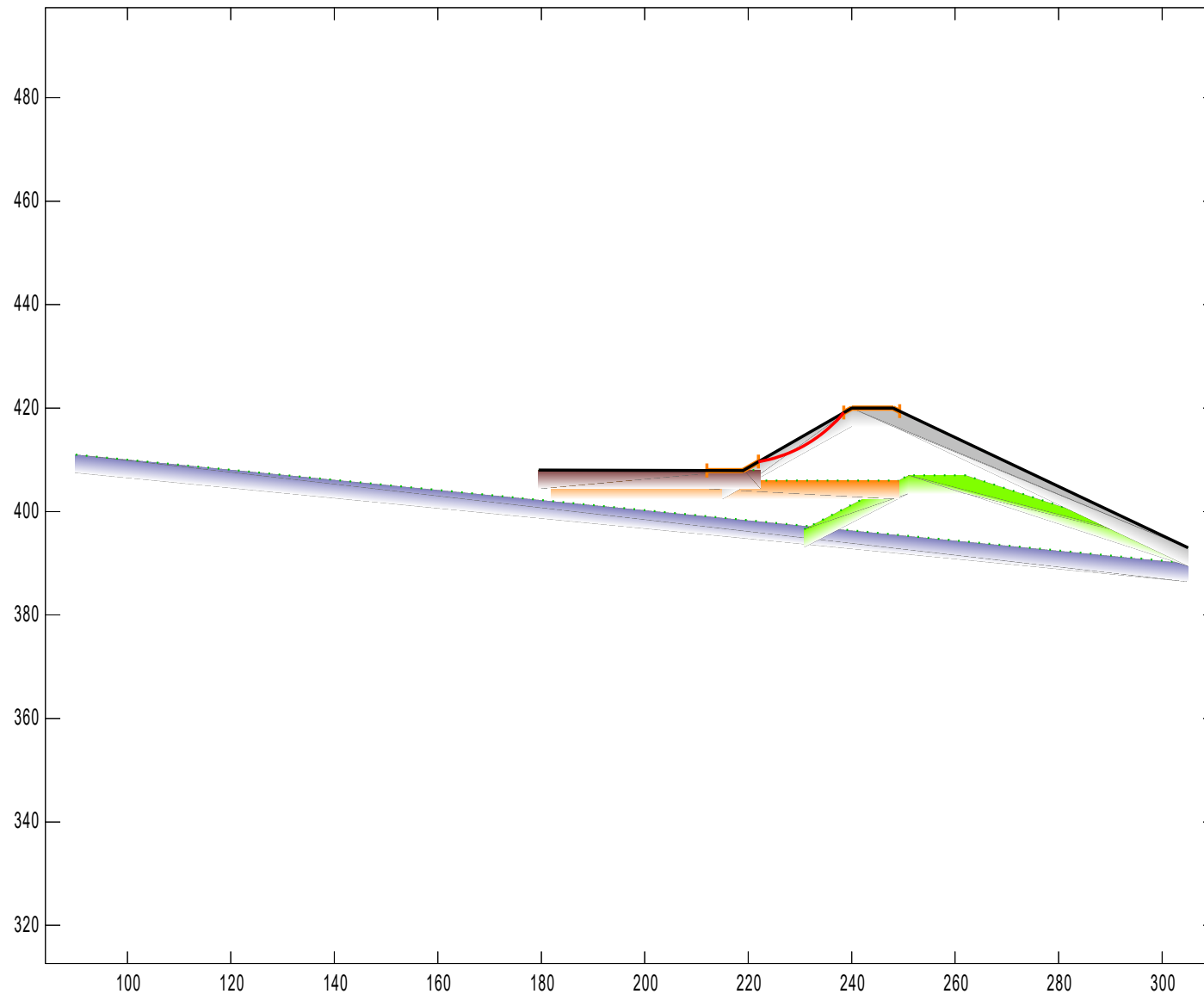
2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttress

5: Bedrock

6: Tailings/Geomembrane Interface



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Analysis 5

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.30

Edited: 31 Jul 2023

Processed: 31 Jul 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 10FT Below Embankment Top

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf



Material Keys

1: Tailings

2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttrass

5: Bedrock

6: Tailings/Geomembrane Interface

Analysis 6

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular (Critical Seed)

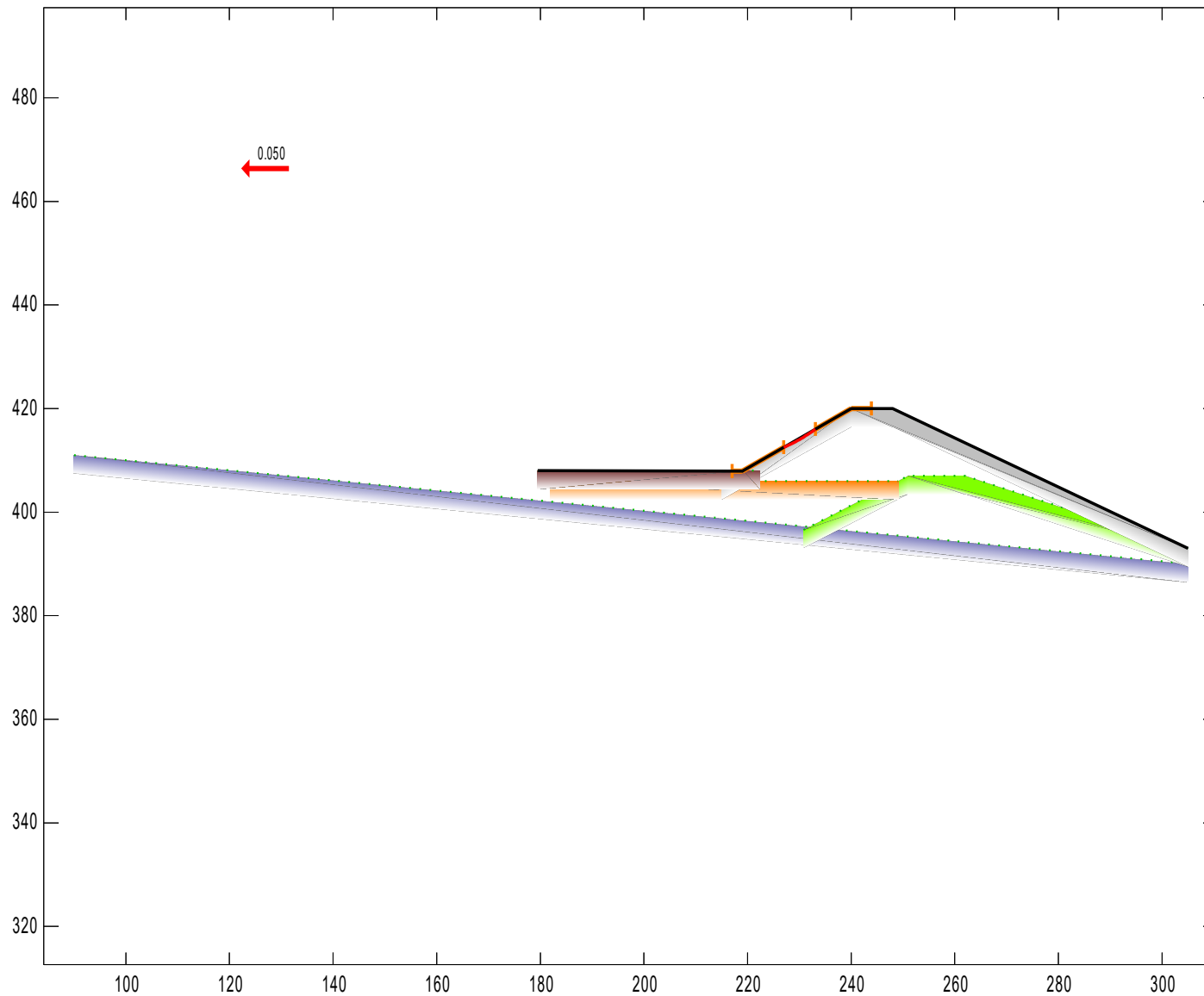
Results

Critical Factor of Safety: 1.09

Edited: 31 Jul 2023

Processed: 31 Jul 2023

L Lewicki & Associates

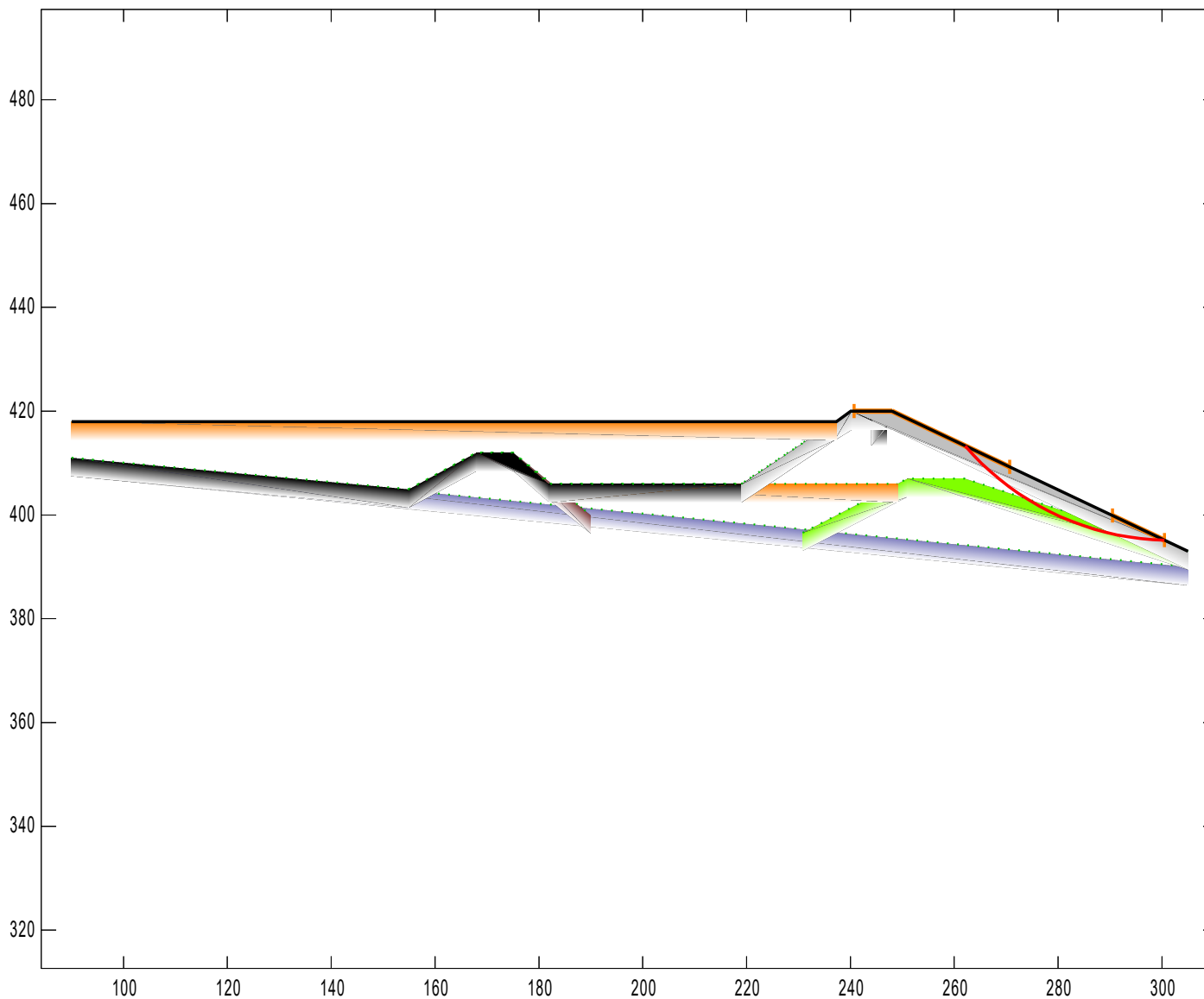


GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 10FT Below Embankment Top - Seismic

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Tailings

2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttress

5: Bedrock

6: Tailings/Geomembrane Interface

Analysis 7

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.39

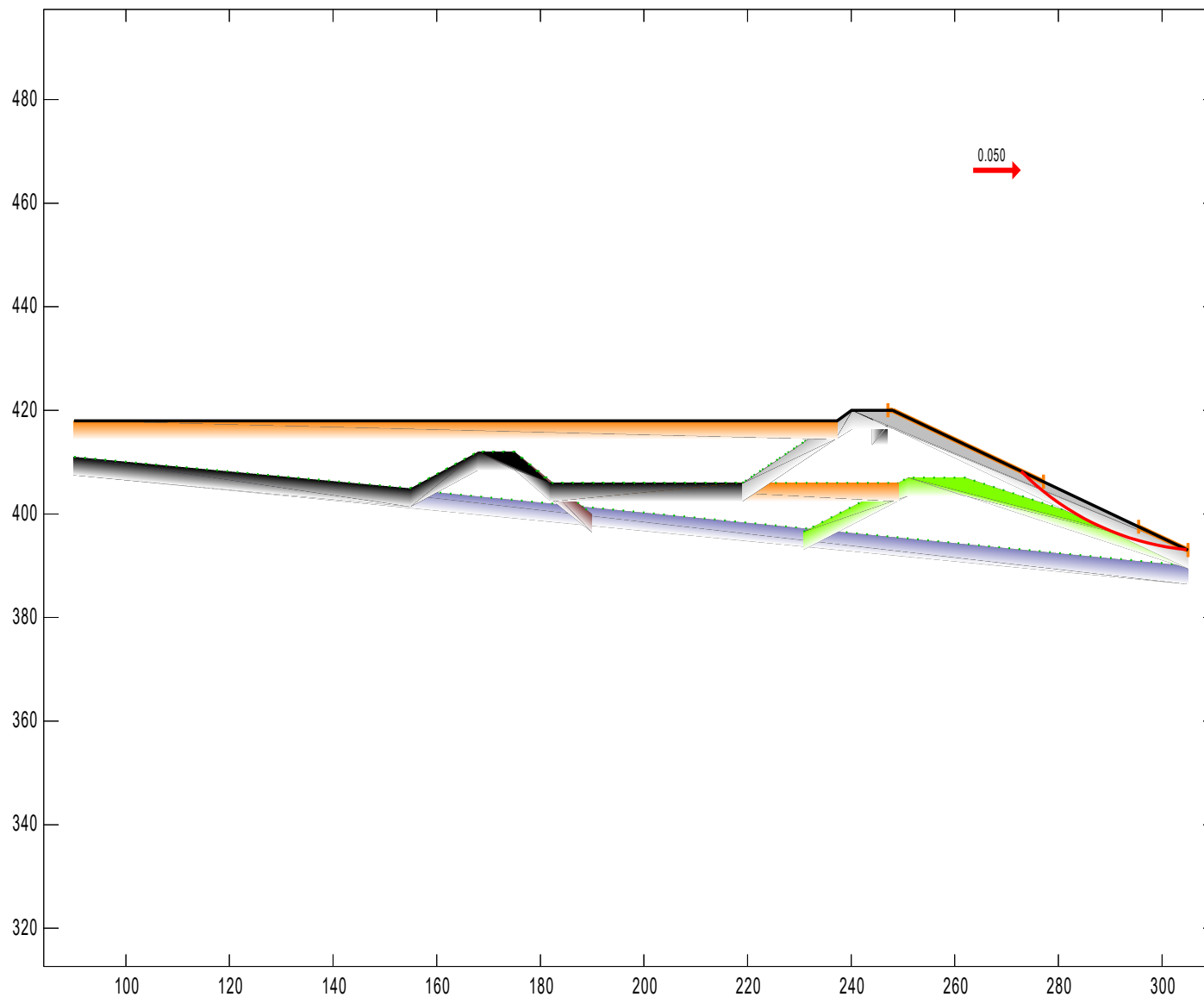
Edited: 31 Jul 2023

Processed: 31 Jul 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - Outslope

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf





Material Keys

- 1: Tailings
- 2: Embankment (Proposed)
- 3: Embankment (Existing)
- 4: Soil Buttress
- 5: Bedrock
- 6: Tailings/Geomembrane Interface

Analysis 8

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular (Critical Seed)

Results

Critical Factor of Safety: 1.20

Edited: 31 Jul 2023
Processed: 31 Jul 2023



Project GHM - Tailings Storage Facility
2023 Embankment Stability - Outslope

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Project: GHM - Tailings Storage Facility

File: E:\Work\GLA Dropbox\Ben Langenfeld\Colorado Milling Company\Tailings
Pond-...\GHM-Tailings Storage Facility COMBINED.gmf

Processed: 01 Aug 2023 17:48:59

DATA: Analysis 1 - 2023 Embankment Stability - 2FT Below Top of Embankment

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400
0.000

Unit weight of water/medium above ground:

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 5 - Bedrock

90.00	411.00	305.00	390.00
-------	--------	--------	--------

Profile: 2 (4 points) Material beneath: 3 - Embankment (Existing)

230.80	396.60	251.00	407.00	262.00	407.00
--------	--------	--------	--------	--------	--------

305.00	393.00				
Profile: 3 (4 points)		Material beneath: 4 - Soil Buttress			
155.00	405.00	168.00	412.00	175.00	412.00
190.00	400.00				
Profile: 4 (2 points)		Material beneath: 1 - Tailings			
182.00	406.00	249.10	406.00		
Profile: 5 (11 points)		Material beneath: 6 - Tailings/Geomembrane Interface			
90.00	411.00	155.00	405.00	168.00	412.00
175.00	412.00	182.00	406.00		
215.00	406.00	240.00	420.10	244.00	420.10
244.10	417.00	246.90	417.00		
247.00	420.00				
Profile: 6 (4 points)		Material beneath: 2 - Embankment (Proposed)			
215.00	406.00	240.00	420.00	248.00	420.00
305.00	393.00				
Profile: 7 (2 points)		Material beneath: 1 - Tailings			
90.00	418.00	237.30	418.00		

Slope Surface (5 points)

90.00	418.00	236.50	418.00	240.10	420.00
248.00	420.00	305.00	393.00		

Piezometric Surfaces (1 surface)

Surface within profile: 7 (2 points) - Tailings

89.90	417.00	237.50	417.00
-------	--------	--------	--------

Failure Surface

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

Intersects:	XL:	236.50	YL:	418.00	XR:	240.70	YR:
							420.00
	Centre:	XC:	231.58	YC:	433.75	Radius:	R:
							16.50

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	3.00	2.00	10.00
Trial positions within range:	5	5	10

RESULTS: Analysis 1 - 2023 Embankment Stability - 2FT Below Top of Embankment

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.421

There were: 151 successful analyses from a total of 251 trial surfaces
100 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.26

Results Summary - Lowest 99 Factor of Safety circles

Circle Radius	X-Left FoS	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre
1	238.00	418.83	239.70	419.78	228.42	438.08
21.50	1.261	<-- Critical Surface				
2	238.00	418.83	239.70	419.78	228.96	437.11
20.39	1.262					
3	238.00	418.83	239.70	419.78	229.50	436.14
19.28	1.262					
4	238.00	418.83	239.70	419.78	230.04	435.16
18.17	1.262					
5	238.00	418.83	239.70	419.78	230.58	434.19
17.06	1.262					
6	238.00	418.83	239.70	419.78	231.12	433.22
15.94	1.263					
7	237.25	418.42	239.70	419.78	228.06	437.85
21.50	1.263					
8	238.00	418.83	239.70	419.78	231.66	432.24
14.83	1.263					
9	237.25	418.42	239.70	419.78	228.60	436.88
20.39	1.263					
10	238.00	418.83	239.70	419.78	232.20	431.27
13.72	1.263					
11	237.25	418.42	239.70	419.78	229.14	435.90
19.28	1.264					
12	237.25	418.42	239.70	419.78	229.68	434.93
18.17	1.264					
13	238.00	418.83	239.70	419.78	232.74	430.30
12.61	1.264					
14	237.25	418.42	239.70	419.78	230.22	433.96
17.06	1.265					
15	238.00	418.83	239.70	419.78	233.29	429.32
11.50	1.265					
16	236.50	418.00	239.70	419.78	227.70	437.62
21.50	1.265					
17	237.25	418.42	239.70	419.78	230.76	432.98
15.94	1.265					
18	236.50	418.00	239.70	419.78	228.24	436.64
20.39	1.265					
19	237.25	418.42	239.70	419.78	231.30	432.01

14.83	1.266					
20	236.50	418.00	239.70	419.78	228.78	435.66
19.28	1.266					
21	236.50	418.00	239.70	419.78	229.32	434.69
18.17	1.267					
22	237.25	418.42	239.70	419.78	231.85	431.03
13.72	1.267					
23	236.50	418.00	239.70	419.78	229.86	433.71
17.06	1.268					
24	237.25	418.42	239.70	419.78	232.39	430.05
12.61	1.268					
25	236.50	418.00	239.70	419.78	230.41	432.73
15.94	1.269					
26	237.25	418.42	239.70	419.78	232.93	429.08
11.50	1.270					
27	236.50	418.00	239.70	419.78	230.95	431.76
14.83	1.270					
28	236.50	418.00	239.70	419.78	231.50	430.78
13.72	1.272					
29	236.50	418.00	239.70	419.78	232.04	429.80
12.61	1.274					
30	236.50	418.00	239.70	419.78	232.59	428.81
11.50	1.277					
31	236.50	418.00	240.20	420.00	228.18	437.82
21.50	1.278					
32	236.50	418.00	240.20	420.00	228.71	436.84
20.39	1.279					
33	236.50	418.00	240.20	420.00	229.24	435.86
19.28	1.279					
34	236.50	418.00	240.20	420.00	229.77	434.87
18.17	1.280					
35	236.50	418.00	240.20	420.00	230.30	433.89
17.06	1.281					
36	236.50	418.00	240.20	420.00	230.83	432.90
15.94	1.282					
37	237.25	418.42	240.20	420.00	228.59	438.09
21.50	1.283					
38	237.25	418.42	240.20	420.00	229.12	437.11
20.39	1.283					
39	237.25	418.42	240.20	420.00	229.64	436.13
19.28	1.283					
40	237.25	418.42	240.20	420.00	230.17	435.15
18.17	1.283					
41	237.25	418.42	240.20	420.00	230.70	434.16
17.06	1.284					
42	236.50	418.00	240.20	420.00	231.37	431.92
14.83	1.284					
43	237.25	418.42	240.20	420.00	231.23	433.18
15.94	1.284					
44	237.25	418.42	240.20	420.00	231.75	432.19

14.83	1.285					
45	237.25	418.42	240.20	420.00	232.28	431.21
13.72	1.286					
46	236.50	418.00	240.20	420.00	231.90	430.93
13.72	1.286					
47	237.25	418.42	240.20	420.00	232.81	430.22
12.61	1.287					
48	236.50	418.00	240.20	420.00	232.44	429.94
12.61	1.289					
49	237.25	418.42	240.20	420.00	233.34	429.23
11.50	1.289					
50	236.50	418.00	240.20	420.00	232.97	428.95
11.50	1.292					
51	238.00	418.83	240.20	420.00	232.70	431.49
13.72	1.294					
52	238.00	418.83	240.20	420.00	232.18	432.48
14.83	1.294					
53	238.00	418.83	240.20	420.00	233.22	430.50
12.61	1.294					
54	238.00	418.83	240.20	420.00	231.65	433.46
15.94	1.294					
55	238.00	418.83	240.20	420.00	231.13	434.44
17.06	1.294					
56	238.00	418.83	240.20	420.00	233.74	429.52
11.50	1.294					
57	238.00	418.83	240.20	420.00	230.61	435.43
18.17	1.295					
58	238.00	418.83	240.20	420.00	230.09	436.41
19.28	1.295					
59	238.00	418.83	240.20	420.00	229.57	437.40
20.39	1.295					
60	238.00	418.83	240.20	420.00	229.04	438.38
21.50	1.296					
61	236.50	418.00	240.70	420.00	231.58	433.75
16.50	1.421					
62	236.50	418.00	240.70	420.00	231.82	433.24
15.94	1.421					
63	236.50	418.00	240.70	420.00	231.34	434.25
17.06	1.421					
64	236.50	418.00	240.70	420.00	232.30	432.23
14.83	1.422					
65	236.50	418.00	240.70	420.00	230.85	435.27
18.17	1.422					
66	236.50	418.00	240.70	420.00	230.37	436.28
19.28	1.422					
67	236.50	418.00	240.70	420.00	232.79	431.21
13.72	1.422					
68	236.50	418.00	240.70	420.00	229.89	437.29
20.39	1.423					
69	236.50	418.00	240.70	420.00	229.41	438.30

21.50	1.423					
70	236.50	418.00	240.70	420.00	233.27	430.19
12.61	1.424					
71	236.50	418.00	240.70	420.00	233.76	429.17
11.50	1.427					
72	237.25	418.42	240.70	420.00	233.77	430.54
12.61	1.474					
73	237.25	418.42	240.70	420.00	233.31	431.56
13.72	1.474					
74	237.25	418.42	240.70	420.00	234.24	429.52
11.50	1.474					
75	237.25	418.42	240.70	420.00	232.84	432.58
14.83	1.475					
76	237.25	418.42	240.70	420.00	232.37	433.60
15.94	1.476					
77	237.25	418.42	240.70	420.00	231.91	434.61
17.06	1.477					
78	237.25	418.42	240.70	420.00	231.44	435.63
18.17	1.478					
79	237.25	418.42	240.70	420.00	230.97	436.64
19.28	1.479					
80	237.25	418.42	240.70	420.00	230.51	437.66
20.39	1.480					
81	237.25	418.42	240.70	420.00	230.04	438.67
21.50	1.481					
82	238.00	418.83	240.70	420.00	234.83	429.89
11.50	1.569					
83	238.00	418.83	240.70	420.00	234.38	430.91
12.61	1.571					
84	238.00	418.83	240.70	420.00	233.94	431.94
13.72	1.572					
85	238.00	418.83	240.70	420.00	233.50	432.97
14.83	1.574					
86	238.00	418.83	240.70	420.00	233.05	433.99
15.94	1.575					
87	238.00	418.83	240.70	420.00	232.61	435.01
17.06	1.577					
88	238.00	418.83	240.70	420.00	232.17	436.04
18.17	1.578					
89	238.00	418.83	240.70	420.00	231.73	437.06
19.28	1.580					
90	238.00	418.83	240.70	420.00	231.28	438.08
20.39	1.581					
91	238.00	418.83	240.70	420.00	230.84	439.11
21.50	1.582					
92	236.50	418.00	241.20	420.00	232.69	433.48
15.94	1.594					
93	236.50	418.00	241.20	420.00	232.25	434.52
17.06	1.594					
94	236.50	418.00	241.20	420.00	231.81	435.55

18.17	1.594					
95	236.50	418.00	241.20	420.00	233.13	432.45
14.83	1.594					
96	236.50	418.00	241.20	420.00	231.37	436.58
19.28	1.595					
97	236.50	418.00	241.20	420.00	233.57	431.41
13.72	1.595					
98	236.50	418.00	241.20	420.00	230.93	437.61
20.39	1.595					
99	236.50	418.00	241.20	420.00	230.49	438.64
21.50	1.596					

Critical Failure Surface (circle 1)

 Intersects: XL: 238.00 YL: 418.83 XR: 239.70 YR: 419.78

Centre: XC: 228.42 YC: 438.08 Radius: R: 21.50

Generated failure surface: (20 points)

238.00	418.83	238.09	418.88	238.18	418.93
238.27	418.97	238.36	419.02		
238.46	419.07	238.55	419.11	238.64	419.16
238.73	419.21	238.82	419.26		
238.91	419.31	238.99	419.36	239.08	419.41
239.17	419.46	239.26	419.51		
239.35	419.57	239.44	419.62	239.53	419.67
239.61	419.72	239.70	419.78		

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

 Slice X-S ----- Base -----
 PoreWater Normal Test
 X-Left Area Angle Width Length Matl Cohesion Phi
 Weight Force Stress Factor

1	238.00	0.00	26.6	0.05	0.05	2	0.00	35.0
0.01	0.00	0.13	0.88					
2	238.05	0.00	26.6	0.05	0.05	2	0.00	35.0
0.02	0.00	0.38	0.88					
3	238.09	0.00	26.9	0.05	0.05	2	0.00	35.0
0.04	0.00	0.62	0.87					
4	238.14	0.00	26.9	0.05	0.05	2	0.00	35.0
0.05	0.00	0.85	0.87					
5	238.18	0.00	27.2	0.05	0.05	2	0.00	35.0
0.06	0.00	1.06	0.87					
6	238.23	0.00	27.1	0.05	0.05	2	0.00	35.0
0.07	0.00	1.25	0.87					
7	238.27	0.00	27.4	0.05	0.05	2	0.00	35.0
0.08	0.00	1.43	0.87					
8	238.32	0.00	27.4	0.05	0.05	2	0.00	35.0
0.09	0.00	1.60	0.87					

9	238.36	0.00	27.7	0.05	0.05	2	0.00	35.0
0.10	0.00	1.75	0.87					
10	238.41	0.00	27.7	0.05	0.05	2	0.00	35.0
0.11	0.00	1.89	0.87					
11	238.46	0.00	27.9	0.05	0.05	2	0.00	35.0
0.12	0.00	2.01	0.87					
12	238.50	0.00	28.0	0.05	0.05	2	0.00	35.0
0.12	0.00	2.12	0.87					
13	238.55	0.00	28.2	0.05	0.05	2	0.00	35.0
0.13	0.00	2.22	0.87					
14	238.59	0.00	28.2	0.05	0.05	2	0.00	35.0
0.13	0.00	2.30	0.87					
15	238.64	0.00	28.5	0.04	0.05	2	0.00	35.0
0.14	0.00	2.37	0.87					
16	238.68	0.00	28.5	0.04	0.05	2	0.00	35.0
0.14	0.00	2.42	0.87					
17	238.73	0.00	28.8	0.04	0.05	2	0.00	35.0
0.14	0.00	2.46	0.87					
18	238.77	0.00	28.8	0.04	0.05	2	0.00	35.0
0.15	0.00	2.48	0.87					
19	238.82	0.00	29.0	0.04	0.05	2	0.00	35.0
0.15	0.00	2.49	0.87					
20	238.86	0.00	29.1	0.04	0.05	2	0.00	35.0
0.15	0.00	2.49	0.87					
21	238.91	0.00	29.3	0.04	0.05	2	0.00	35.0
0.14	0.00	2.47	0.87					
22	238.95	0.00	29.3	0.04	0.05	2	0.00	35.0
0.14	0.00	2.45	0.87					
23	238.99	0.00	29.6	0.04	0.05	2	0.00	35.0
0.14	0.00	2.39	0.87					
24	239.04	0.00	29.6	0.04	0.05	2	0.00	35.0
0.14	0.00	2.34	0.87					
25	239.08	0.00	29.9	0.04	0.05	2	0.00	35.0
0.13	0.00	2.26	0.87					
26	239.13	0.00	29.9	0.04	0.05	2	0.00	35.0
0.13	0.00	2.18	0.87					
27	239.17	0.00	30.2	0.04	0.05	2	0.00	35.0
0.12	0.00	2.08	0.87					
28	239.22	0.00	30.1	0.04	0.05	2	0.00	35.0
0.12	0.00	1.97	0.87					
29	239.26	0.00	30.4	0.04	0.05	2	0.00	35.0
0.11	0.00	1.84	0.87					
30	239.31	0.00	30.4	0.04	0.05	2	0.00	35.0
0.10	0.00	1.71	0.87					
31	239.35	0.00	30.7	0.04	0.05	2	0.00	35.0
0.09	0.00	1.55	0.87					
32	239.39	0.00	30.7	0.04	0.05	2	0.00	35.0
0.08	0.00	1.39	0.87					
33	239.44	0.00	31.0	0.04	0.05	2	0.00	35.0
0.07	0.00	1.21	0.87					

34	239.48	0.00	31.0	0.04	0.05	2	0.00	35.0
0.06	0.00		1.02	0.87				
35	239.53	0.00	31.2	0.04	0.05	2	0.00	35.0
0.05	0.00		0.81	0.87				
36	239.57	0.00	31.2	0.04	0.05	2	0.00	35.0
0.03	0.00		0.60	0.87				
37	239.61	0.00	31.5	0.04	0.05	2	0.00	35.0
0.02	0.00		0.36	0.88				
38	239.66	0.00	31.5	0.04	0.05	2	0.00	35.0
0.01	0.00		0.12	0.88				

X-S Area: 0.03 Path Length: 1.95 X-S Weight: 3.70

DATA: Analysis 2 - 2023 Embankment Stability - 2FT Below Top of Embankment - Seismic

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (7 profiles)

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-----
Profile: 1 (2 points)   Material beneath: 5 - Bedrock
    90.00    411.00      305.00    390.00
Profile: 2 (4 points)   Material beneath: 3 - Embankment (Existing)
    230.80    396.60      251.00    407.00    262.00    407.00
    305.00    393.00
Profile: 3 (4 points)   Material beneath: 4 - Soil Buttress
    155.00    405.00      168.00    412.00    175.00    412.00
    190.00    400.00
Profile: 4 (2 points)   Material beneath: 1 - Tailings
    182.00    406.00      249.10    406.00
Profile: 5 (11 points)  Material beneath: 6 - Tailings/Geomembrane Interface
    90.00    411.00      155.00    405.00    168.00    412.00
    175.00    412.00      182.00    406.00
    215.00    406.00      240.00    420.10    244.00    420.10
    244.10    417.00      246.90    417.00
    247.00    420.00
Profile: 6 (4 points)   Material beneath: 2 - Embankment (Proposed)
    215.00    406.00      240.00    420.00    248.00    420.00
    305.00    393.00
Profile: 7 (2 points)   Material beneath: 1 - Tailings
    90.00    418.00      237.30    418.00

```

Slope Surface (5 points)

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-----
    90.00    418.00      236.50    418.00    240.10    420.00
    248.00    420.00      305.00    393.00

```

Piezometric Surfaces (1 surface)

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-----
Surface within profile: 7 (2 points) - Tailings
    89.90    417.00      237.50    417.00

```

Failure Surface (Critical, from previous analysis)

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-----
Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL:    238.00    YL:    418.83    XR:    239.70    YR:
419.78
          Centre: XC:    228.42    YC:    438.08          Radius: R:
21.50

```

Earthquake Force

```

-----
Pseudo-static earthquake (seismic) coefficient: 0.050

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Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:           3.00         2.00        10.00

```

Trial positions within range: 5 5 10

- - - - -
- - - - -

RESULTS: Analysis 2 - 2023 Embankment Stability - 2FT Below Top of Embankment - Seismic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.125

There were: 156 successful analyses from a total of 251 trial surfaces
95 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.12

Results Summary - Lowest 99 Factor of Safety circles

Circle X-Left Y-Left X-Right Y-Right X-Centre Y-Centre
Radius FoS
1 238.00 418.83 239.70 419.78 225.99 442.46
26.50 1.124 <-- Critical Surface
2 238.00 418.83 239.70 419.78 226.53 441.48
25.39 1.124
3 238.00 418.83 239.70 419.78 227.07 440.51
24.28 1.125
4 238.00 418.83 239.70 419.78 227.61 439.54
23.17 1.125
5 237.25 418.42 239.20 419.50 225.37 442.10
26.50 1.125
6 237.25 418.42 239.20 419.50 225.91 441.13
25.39 1.125
7 238.00 418.83 239.70 419.78 228.15 438.57
22.06 1.125
8 237.25 418.42 238.70 419.22 228.89 435.17
18.72 1.125
9 238.00 418.83 239.70 419.78 228.42 438.08
21.50 1.125
10 237.25 418.42 239.20 419.50 226.45 440.16
24.28 1.125
11 238.00 418.83 239.70 419.78 228.69 437.59
20.94 1.125
12 237.25 418.42 238.70 419.22 229.43 434.20
17.61 1.125
13 236.50 418.00 238.70 419.22 224.74 441.75
26.50 1.125

14	237.25	418.42	239.20	419.50	226.99	439.19
23.17	1.125					
15	238.00	418.83	239.70	419.78	229.23	436.62
19.83	1.125					
16	236.50	418.00	238.70	419.22	225.29	440.78
25.39	1.125					
17	237.25	418.42	238.70	419.22	229.97	433.22
16.50	1.125					
18	237.25	418.42	239.20	419.50	227.53	438.21
22.06	1.125					
19	236.50	418.00	238.70	419.22	225.83	439.81
24.28	1.125					
20	238.00	418.83	239.70	419.78	229.77	435.65
18.72	1.125					
21	237.25	418.42	239.70	419.78	225.62	442.23
26.50	1.125					
22	237.25	418.42	239.20	419.50	228.07	437.24
20.94	1.125					
23	236.50	418.00	238.70	419.22	226.37	438.83
23.17	1.125					
24	238.00	418.83	239.70	419.78	230.31	434.68
17.61	1.125					
25	237.25	418.42	239.70	419.78	226.16	441.26
25.39	1.125					
26	237.25	418.42	239.20	419.50	228.61	436.27
19.83	1.126					
27	236.50	418.00	238.70	419.22	226.91	437.86
22.06	1.126					
28	237.25	418.42	239.70	419.78	226.70	440.28
24.28	1.126					
29	236.50	418.00	239.20	419.50	225.00	441.88
26.50	1.126					
30	238.00	418.83	239.70	419.78	230.85	433.70
16.50	1.126					
31	237.25	418.42	239.20	419.50	229.15	435.30
18.72	1.126					
32	236.50	418.00	238.70	419.22	227.45	436.89
20.94	1.126					
33	237.25	418.42	239.70	419.78	227.24	439.31
23.17	1.126					
34	236.50	418.00	239.20	419.50	225.54	440.90
25.39	1.126					
35	237.25	418.42	239.20	419.50	229.69	434.32
17.61	1.126					
36	236.50	418.00	238.70	419.22	227.99	435.91
19.83	1.126					
37	237.25	418.42	239.70	419.78	227.79	438.34
22.06	1.126					
38	236.50	418.00	239.20	419.50	226.08	439.93
24.28	1.126					

39	236.50	418.00	239.20	419.50	226.62	438.96
23.17	1.126					
40	237.25	418.42	239.70	419.78	228.33	437.36
20.94	1.126					
41	236.50	418.00	238.70	419.22	228.53	434.94
18.72	1.126					
42	237.25	418.42	239.20	419.50	230.23	433.35
16.50	1.126					
43	236.50	418.00	239.70	419.78	225.26	442.00
26.50	1.127					
44	236.50	418.00	239.20	419.50	227.17	437.98
22.06	1.127					
45	237.25	418.42	239.70	419.78	228.87	436.39
19.83	1.127					
46	236.50	418.00	238.70	419.22	229.07	433.97
17.61	1.127					
47	236.50	418.00	239.70	419.78	225.80	441.03
25.39	1.127					
48	236.50	418.00	239.20	419.50	227.71	437.01
20.94	1.127					
49	237.25	418.42	239.70	419.78	229.41	435.42
18.72	1.127					
50	236.50	418.00	239.70	419.78	226.34	440.05
24.28	1.127					
51	236.50	418.00	238.70	419.22	229.61	432.99
16.50	1.127					
52	236.50	418.00	239.20	419.50	228.25	436.03
19.83	1.127					
53	236.50	418.00	239.70	419.78	226.88	439.08
23.17	1.127					
54	237.25	418.42	239.70	419.78	229.95	434.44
17.61	1.127					
55	236.50	418.00	239.20	419.50	228.79	435.06
18.72	1.128					
56	236.50	418.00	239.70	419.78	227.43	438.10
22.06	1.128					
57	237.25	418.42	239.70	419.78	230.49	433.47
16.50	1.128					
58	236.50	418.00	239.70	419.78	227.97	437.13
20.94	1.128					
59	236.50	418.00	239.20	419.50	229.33	434.09
17.61	1.128					
60	236.50	418.00	239.70	419.78	228.51	436.15
19.83	1.129					
61	236.50	418.00	239.20	419.50	229.87	433.11
16.50	1.129					
62	236.50	418.00	239.70	419.78	229.05	435.18
18.72	1.129					
63	236.50	418.00	239.70	419.78	229.59	434.20
17.61	1.130					

64	236.50	418.00	239.70	419.78	230.14	433.22
16.50	1.131					
65	236.50	418.00	240.20	420.00	225.79	442.24
26.50	1.138					
66	236.50	418.00	240.20	420.00	226.32	441.26
25.39	1.138					
67	236.50	418.00	240.20	420.00	226.85	440.28
24.28	1.139					
68	236.50	418.00	240.20	420.00	227.38	439.30
23.17	1.139					
69	236.50	418.00	240.20	420.00	227.91	438.31
22.06	1.139					
70	236.50	418.00	240.20	420.00	228.44	437.33
20.94	1.140					
71	236.50	418.00	240.20	420.00	228.97	436.35
19.83	1.140					
72	236.50	418.00	240.20	420.00	229.50	435.37
18.72	1.141					
73	236.50	418.00	240.20	420.00	230.04	434.38
17.61	1.142					
74	236.50	418.00	240.20	420.00	230.57	433.40
16.50	1.143					
75	237.25	418.42	240.20	420.00	227.80	439.57
23.17	1.143					
76	237.25	418.42	240.20	420.00	228.32	438.59
22.06	1.143					
77	237.25	418.42	240.20	420.00	228.85	437.60
20.94	1.143					
78	237.25	418.42	240.20	420.00	227.27	440.55
24.28	1.143					
79	237.25	418.42	240.20	420.00	226.74	441.53
25.39	1.143					
80	237.25	418.42	240.20	420.00	229.38	436.62
19.83	1.143					
81	237.25	418.42	240.20	420.00	226.22	442.51
26.50	1.143					
82	237.25	418.42	240.20	420.00	229.91	435.64
18.72	1.143					
83	237.25	418.42	240.20	420.00	230.43	434.66
17.61	1.144					
84	237.25	418.42	240.20	420.00	230.96	433.67
16.50	1.144					
85	238.00	418.83	240.20	420.00	231.39	433.95
16.50	1.153					
86	238.00	418.83	240.20	420.00	230.87	434.94
17.61	1.153					
87	238.00	418.83	240.20	420.00	230.35	435.92
18.72	1.153					
88	238.00	418.83	240.20	420.00	229.83	436.90
19.83	1.153					

89	238.00	418.83	240.20	420.00	229.30	437.89
20.94	1.154					
90	238.00	418.83	240.20	420.00	228.78	438.87
22.06	1.154					
91	238.00	418.83	240.20	420.00	228.26	439.85
23.17	1.154					
92	238.00	418.83	240.20	420.00	227.74	440.84
24.28	1.155					
93	238.00	418.83	240.20	420.00	227.22	441.82
25.39	1.155					
94	238.00	418.83	240.20	420.00	226.70	442.80
26.50	1.155					
95	238.75	419.25	240.20	420.00	231.90	434.26
16.50	1.179					
96	238.75	419.25	240.20	420.00	231.39	435.25
17.61	1.180					
97	238.75	419.25	240.20	420.00	230.88	436.24
18.72	1.181					
98	238.75	419.25	240.20	420.00	230.37	437.23
19.83	1.182					
99	238.75	419.25	240.20	420.00	229.86	438.21
20.94	1.182					

Critical Failure Surface (circle 1)

Intersects: XL: 238.00 YL: 418.83 XR: 239.70 YR:
419.78
Centre: XC: 225.99 YC: 442.46 Radius: R:
26.50

Generated failure surface: (20 points)

238.00	418.83	238.09	418.88	238.18	418.93
238.27	418.97	238.36	419.02		
238.45	419.07	238.54	419.12	238.63	419.17
238.72	419.22	238.81	419.27		
238.90	419.31	238.99	419.36	239.08	419.42
239.17	419.47	239.26	419.52		
239.35	419.57	239.44	419.62	239.52	419.67
239.61	419.72	239.70	419.78		

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice X-S ----- Base -----
PoreWater Normal Test
X-Left Area Angle Width Length Matl Cohesion Phi
Weight Force Stress Factor
1 238.00 0.00 27.1 0.05 0.05 2 0.00 35.0
0.01 0.00 0.10 0.85
2 238.05 0.00 27.1 0.05 0.05 2 0.00 35.0
0.02 0.00 0.30 0.85
3 238.09 0.00 27.3 0.05 0.05 2 0.00 35.0

0.03	0.00	0.49	0.85					
4	238.14	0.00	27.3	0.05	0.05	2	0.00	35.0
0.04	0.00	0.67	0.85					
5	238.18	0.00	27.5	0.05	0.05	2	0.00	35.0
0.05	0.00	0.83	0.85					
6	238.23	0.00	27.5	0.05	0.05	2	0.00	35.0
0.06	0.00	0.99	0.85					
7	238.27	0.00	27.7	0.05	0.05	2	0.00	35.0
0.07	0.00	1.13	0.85					
8	238.32	0.00	27.7	0.05	0.05	2	0.00	35.0
0.08	0.00	1.26	0.85					
9	238.36	0.00	27.9	0.05	0.05	2	0.00	35.0
0.08	0.00	1.38	0.85					
10	238.41	0.00	27.9	0.05	0.05	2	0.00	35.0
0.09	0.00	1.49	0.85					
11	238.45	0.00	28.2	0.05	0.05	2	0.00	35.0
0.10	0.00	1.59	0.85					
12	238.50	0.00	28.2	0.05	0.05	2	0.00	35.0
0.10	0.00	1.67	0.85					
13	238.54	0.00	28.4	0.05	0.05	2	0.00	35.0
0.11	0.00	1.75	0.85					
14	238.59	0.00	28.4	0.05	0.05	2	0.00	35.0
0.11	0.00	1.82	0.85					
15	238.63	0.00	28.6	0.04	0.05	2	0.00	35.0
0.11	0.00	1.87	0.85					
16	238.68	0.00	28.6	0.04	0.05	2	0.00	35.0
0.12	0.00	1.91	0.85					
17	238.72	0.00	28.8	0.04	0.05	2	0.00	35.0
0.12	0.00	1.94	0.85					
18	238.77	0.00	28.8	0.04	0.05	2	0.00	35.0
0.12	0.00	1.96	0.85					
19	238.81	0.00	29.1	0.04	0.05	2	0.00	35.0
0.12	0.00	1.97	0.85					
20	238.86	0.00	29.0	0.04	0.05	2	0.00	35.0
0.12	0.00	1.97	0.85					
21	238.90	0.00	29.3	0.04	0.05	2	0.00	35.0
0.12	0.00	1.95	0.85					
22	238.95	0.00	29.3	0.04	0.05	2	0.00	35.0
0.12	0.00	1.93	0.85					
23	238.99	0.00	29.5	0.04	0.05	2	0.00	35.0
0.11	0.00	1.89	0.85					
24	239.04	0.00	29.5	0.04	0.05	2	0.00	35.0
0.11	0.00	1.85	0.85					
25	239.08	0.00	29.7	0.04	0.05	2	0.00	35.0
0.11	0.00	1.79	0.85					
26	239.13	0.00	29.7	0.04	0.05	2	0.00	35.0
0.10	0.00	1.72	0.85					
27	239.17	0.00	29.9	0.04	0.05	2	0.00	35.0
0.10	0.00	1.65	0.85					
28	239.22	0.00	29.9	0.04	0.05	2	0.00	35.0

0.09	0.00	1.56	0.85					
29	239.26	0.00	30.2	0.04	0.05	2	0.00	35.0
0.09	0.00	1.46	0.85					
30	239.30	0.00	30.1	0.04	0.05	2	0.00	35.0
0.08	0.00	1.35	0.85					
31	239.35	0.00	30.4	0.04	0.05	2	0.00	35.0
0.07	0.00	1.23	0.85					
32	239.39	0.00	30.4	0.04	0.05	2	0.00	35.0
0.07	0.00	1.10	0.85					
33	239.44	0.00	30.6	0.04	0.05	2	0.00	35.0
0.06	0.00	0.96	0.85					
34	239.48	0.00	30.6	0.04	0.05	2	0.00	35.0
0.05	0.00	0.81	0.85					
35	239.52	0.00	30.8	0.04	0.05	2	0.00	35.0
0.04	0.00	0.64	0.85					
36	239.57	0.00	30.8	0.04	0.05	2	0.00	35.0
0.03	0.00	0.47	0.85					
37	239.61	0.00	31.0	0.04	0.05	2	0.00	35.0
0.02	0.00	0.29	0.85					
38	239.66	0.00	31.1	0.04	0.05	2	0.00	35.0
0.01	0.00	0.10	0.85					

X-S Area:	0.02	Path Length:	1.95	X-S Weight:
3.00				

DATA: Analysis 3 - 2023 Embankment Stability - 5FT Below Embankment Top

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
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30.00	17.0	100.00	Auto
Material: 7 (Mohr-Coulomb Isotropic) - Soil Butress above Tailings			
Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400	Unit weight of water/medium above ground:
0.000	

Material Profiles (7 profiles)

Profile: 1 (2 points)	Material beneath: 5 - Bedrock
90.00 411.00	305.00 390.00
Profile: 2 (4 points)	Material beneath: 3 - Embankment (Existing)
230.80 396.60	251.00 407.00 262.00 407.00
305.00 393.00	
Profile: 3 (4 points)	Material beneath: 4 - Soil Butress
155.00 405.00	168.00 412.00 175.00 412.00
190.00 400.00	
Profile: 4 (2 points)	Material beneath: 1 - Tailings
182.00 406.00	249.10 406.00
Profile: 5 (11 points)	Material beneath: 6 - Tailings/Geomembrane Interface
90.00 411.00	155.00 405.00 168.00 412.00
175.00 412.00	182.00 406.00
215.00 406.00	240.00 420.10 244.00 420.10
244.10 417.00	246.90 417.00
247.00 420.00	
Profile: 6 (4 points)	Material beneath: 2 - Embankment (Proposed)
214.50 406.00	240.00 420.00 248.00 420.00
305.00 393.00	
Profile: 7 (2 points)	Material beneath: 1 - Tailings
89.80 415.00	232.60 415.00

Slope Surface (5 points)

90.00 415.00	231.50 415.00	240.10 419.90
248.00 419.90	305.00 393.00	

Piezometric Surfaces (1 surface)

Surface within profile: 7 (2 points) - Tailings
89.80 413.00 232.60 413.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R			
Intersects: XL:	231.60	YL:	415.06
		XR:	239.60
419.62		YR:	
Centre: XC:	228.53	YC:	429.74
		Radius: R:	

15.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	5.50	7.50	2.70
Trial positions within range:	10	10	10

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RESULTS: Analysis 3 - 2023 Embankment Stability - 5FT Below Embankment Top

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.434

There were: 606 successful analyses from a total of 1001 trial surfaces
395 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.23

Results Summary - Lowest 99 Factor of Safety circles

Circle Radius	X-Left FoS	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre
1	234.35	416.62	235.85	417.48	227.02	431.24
16.35	1.231	<-- Critical Surface				
2	234.35	416.62	235.85	417.48	227.17	430.98
16.05	1.231					
3	234.35	416.62	235.85	417.48	227.31	430.72
15.75	1.231					
4	234.35	416.62	235.85	417.48	227.46	430.45
15.45	1.231					
5	234.35	416.62	235.85	417.48	227.61	430.19
15.15	1.231					
6	234.35	416.62	235.85	417.48	227.76	429.93
14.85	1.231					
7	234.35	416.62	235.85	417.48	227.91	429.67
14.55	1.231					
8	234.35	416.62	235.85	417.48	228.06	429.41
14.25	1.231					
9	234.35	416.62	235.85	417.48	228.21	429.15
13.95	1.231					
10	234.35	416.62	235.85	417.48	228.36	428.89
13.65	1.231					
11	233.74	416.28	235.85	417.48	226.72	431.04

16.35	1.232					
12	233.74	416.28	235.85	417.48	226.87	430.78
16.05	1.232					
13	233.74	416.28	235.85	417.48	227.02	430.52
15.75	1.233					
14	233.74	416.28	235.85	417.48	227.17	430.26
15.45	1.233					
15	233.74	416.28	235.85	417.48	227.32	430.00
15.15	1.233					
16	233.74	416.28	235.85	417.48	227.47	429.74
14.85	1.233					
17	234.35	416.62	236.68	417.95	227.45	431.45
16.35	1.233					
18	233.74	416.28	235.85	417.48	227.62	429.47
14.55	1.233					
19	234.35	416.62	236.68	417.95	227.60	431.18
16.05	1.233					
20	234.35	416.62	236.68	417.95	227.75	430.92
15.75	1.233					
21	233.74	416.28	235.85	417.48	227.77	429.21
14.25	1.233					
22	234.35	416.62	236.68	417.95	227.90	430.66
15.45	1.234					
23	233.74	416.28	235.85	417.48	227.91	428.95
13.95	1.234					
24	234.35	416.62	236.68	417.95	228.05	430.40
15.15	1.234					
25	233.74	416.28	235.85	417.48	228.06	428.69
13.65	1.234					
26	234.35	416.62	236.68	417.95	228.20	430.14
14.85	1.234					
27	234.35	416.62	236.68	417.95	228.34	429.88
14.55	1.234					
28	234.35	416.62	236.68	417.95	228.49	429.61
14.25	1.235					
29	234.35	416.62	236.68	417.95	228.64	429.35
13.95	1.235					
30	234.35	416.62	236.68	417.95	228.79	429.09
13.65	1.235					
31	233.74	416.28	236.68	417.95	227.16	431.24
16.35	1.236					
32	233.74	416.28	236.68	417.95	227.31	430.98
16.05	1.236					
33	233.74	416.28	236.68	417.95	227.46	430.72
15.75	1.236					
34	233.74	416.28	236.68	417.95	227.61	430.46
15.45	1.237					
35	234.35	416.62	237.52	418.43	227.89	431.64
16.35	1.237					
36	233.74	416.28	236.68	417.95	227.76	430.20

15.15	1.237					
37	234.35	416.62	237.52	418.43	228.04	431.38
16.05	1.237					
38	233.74	416.28	236.68	417.95	227.91	429.93
14.85	1.237					
39	234.35	416.62	237.52	418.43	228.19	431.12
15.75	1.237					
40	233.74	416.28	236.68	417.95	228.06	429.67
14.55	1.238					
41	234.35	416.62	237.52	418.43	228.34	430.86
15.45	1.238					
42	233.74	416.28	236.68	417.95	228.21	429.41
14.25	1.238					
43	234.35	416.62	237.52	418.43	228.49	430.59
15.15	1.238					
44	233.74	416.28	236.68	417.95	228.36	429.15
13.95	1.238					
45	234.35	416.62	237.52	418.43	228.64	430.33
14.85	1.239					
46	233.74	416.28	236.68	417.95	228.51	428.88
13.65	1.239					
47	234.35	416.62	237.52	418.43	228.79	430.07
14.55	1.239					
48	234.35	416.62	237.52	418.43	228.94	429.81
14.25	1.239					
49	234.35	416.62	237.52	418.43	229.09	429.54
13.95	1.240					
50	233.74	416.28	237.52	418.43	227.61	431.43
16.35	1.240					
51	234.35	416.62	237.52	418.43	229.24	429.28
13.65	1.240					
52	233.74	416.28	237.52	418.43	227.76	431.17
16.05	1.241					
53	233.74	416.28	237.52	418.43	227.91	430.91
15.75	1.241					
54	233.74	416.28	237.52	418.43	228.06	430.64
15.45	1.242					
55	234.35	416.62	238.35	418.90	228.34	431.83
16.35	1.242					
56	234.35	416.62	238.35	418.90	228.49	431.56
16.05	1.242					
57	233.74	416.28	237.52	418.43	228.21	430.38
15.15	1.242					
58	234.35	416.62	238.35	418.90	228.64	431.30
15.75	1.243					
59	233.74	416.28	237.52	418.43	228.36	430.12
14.85	1.243					
60	234.35	416.62	238.35	418.90	228.79	431.04
15.45	1.243					
61	233.74	416.28	237.52	418.43	228.51	429.85

14.55	1.243					
62	234.35	416.62	238.35	418.90	228.94	430.77
15.15	1.244					
63	233.74	416.28	237.52	418.43	228.66	429.59
14.25	1.244					
64	234.35	416.62	238.35	418.90	229.09	430.51
14.85	1.245					
65	233.74	416.28	237.52	418.43	228.81	429.32
13.95	1.245					
66	234.35	416.62	238.35	418.90	229.24	430.25
14.55	1.245					
67	233.74	416.28	237.52	418.43	228.96	429.06
13.65	1.245					
68	234.35	416.62	238.35	418.90	229.39	429.98
14.25	1.246					
69	233.74	416.28	238.35	418.90	228.06	431.61
16.35	1.246					
70	234.35	416.62	238.35	418.90	229.54	429.72
13.95	1.247					
71	233.74	416.28	238.35	418.90	228.21	431.34
16.05	1.247					
72	233.74	416.28	238.35	418.90	228.36	431.08
15.75	1.247					
73	234.35	416.62	238.35	418.90	229.69	429.45
13.65	1.248					
74	234.35	416.62	239.18	419.38	228.79	432.00
16.35	1.248					
75	233.74	416.28	238.35	418.90	228.51	430.81
15.45	1.248					
76	234.35	416.62	239.18	419.38	228.94	431.74
16.05	1.249					
77	233.74	416.28	238.35	418.90	228.66	430.55
15.15	1.249					
78	234.35	416.62	239.18	419.38	229.09	431.47
15.75	1.249					
79	233.13	415.93	237.52	418.43	228.38	429.36
14.25	1.250					
80	233.74	416.28	238.35	418.90	228.81	430.28
14.85	1.250					
81	234.35	416.62	239.18	419.38	229.24	431.21
15.45	1.250					
82	233.74	416.28	238.35	418.90	228.96	430.02
14.55	1.251					
83	234.35	416.62	239.18	419.38	229.39	430.94
15.15	1.251					
84	233.74	416.28	238.35	418.90	229.11	429.75
14.25	1.252					
85	234.35	416.62	239.18	419.38	229.55	430.68
14.85	1.252					
86	233.74	416.28	238.35	418.90	229.26	429.49

13.95	1.253					
87	234.35	416.62	239.18	419.38	229.70	430.41
14.55	1.253					
88	233.74	416.28	239.18	419.38	228.52	431.77
16.35	1.253					
89	233.74	416.28	238.35	418.90	229.42	429.22
13.65	1.254					
90	233.13	415.93	238.35	418.90	228.24	430.58
15.45	1.254					
91	234.35	416.62	239.18	419.38	229.85	430.14
14.25	1.254					
92	233.74	416.28	239.18	419.38	228.67	431.50
16.05	1.254					
93	233.13	415.93	238.35	418.90	228.39	430.32
15.15	1.255					
94	233.74	416.28	239.18	419.38	228.82	431.24
15.75	1.255					
95	234.35	416.62	239.18	419.38	230.00	429.88
13.95	1.255					
96	234.35	416.62	240.02	419.85	229.25	432.16
16.35	1.255					
97	233.13	415.93	238.35	418.90	228.54	430.05
14.85	1.256					
98	233.74	416.28	239.18	419.38	228.97	430.97
15.45	1.256					
99	234.35	416.62	240.02	419.85	229.40	431.89
16.05	1.256					

Critical Failure Surface (circle 1)

Intersects: XL: 234.35 YL: 416.62 XR: 235.85 YR:
417.48
Centre: XC: 227.02 YC: 431.24 Radius: R:
16.35

Generated failure surface: (20 points)

234.35	416.62	234.43	416.66	234.51	416.71
234.59	416.75	234.67	416.79		
234.75	416.83	234.83	416.88	234.91	416.92
234.99	416.96	235.07	417.01		
235.15	417.05	235.23	417.10	235.31	417.15
235.39	417.19	235.46	417.24		
235.54	417.29	235.62	417.33	235.70	417.38
235.77	417.43	235.85	417.48		

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice X-S Base -----
 Normal Test
 Area Angle Width Length Matl Cohesion Phi
Weight PoreWater Force Stress Factor

1	234.35	0.00	26.8	0.04	0.05	2	0.00	35.0
0.01	0.00		0.13	0.87				
2	234.39	0.00	26.8	0.04	0.05	2	0.00	35.0
0.02	0.00		0.39	0.87				
3	234.43	0.00	27.1	0.04	0.05	2	0.00	35.0
0.03	0.00		0.64	0.87				
4	234.47	0.00	27.1	0.04	0.05	2	0.00	35.0
0.05	0.00		0.88	0.87				
5	234.51	0.00	27.4	0.04	0.05	2	0.00	35.0
0.06	0.00		1.09	0.87				
6	234.55	0.00	27.4	0.04	0.05	2	0.00	35.0
0.07	0.00		1.30	0.87				
7	234.59	0.00	27.8	0.04	0.05	2	0.00	35.0
0.08	0.00		1.48	0.87				
8	234.63	0.00	27.8	0.04	0.05	2	0.00	35.0
0.09	0.00		1.66	0.87				
9	234.67	0.00	28.1	0.04	0.05	2	0.00	35.0
0.09	0.00		1.81	0.87				
10	234.71	0.00	28.1	0.04	0.05	2	0.00	35.0
0.10	0.00		1.96	0.87				
11	234.75	0.00	28.4	0.04	0.05	2	0.00	35.0
0.11	0.00		2.08	0.87				
12	234.79	0.00	28.4	0.04	0.05	2	0.00	35.0
0.11	0.00		2.20	0.87				
13	234.83	0.00	28.7	0.04	0.05	2	0.00	35.0
0.12	0.00		2.29	0.87				
14	234.87	0.00	28.7	0.04	0.05	2	0.00	35.0
0.12	0.00		2.38	0.87				
15	234.91	0.00	29.0	0.04	0.05	2	0.00	35.0
0.13	0.00		2.44	0.87				
16	234.95	0.00	29.0	0.04	0.05	2	0.00	35.0
0.13	0.00		2.50	0.87				
17	234.99	0.00	29.4	0.04	0.05	2	0.00	35.0
0.13	0.00		2.53	0.87				
18	235.03	0.00	29.4	0.04	0.05	2	0.00	35.0
0.13	0.00		2.56	0.87				
19	235.07	0.00	29.7	0.04	0.05	2	0.00	35.0
0.13	0.00		2.57	0.87				
20	235.11	0.00	29.7	0.04	0.05	2	0.00	35.0
0.13	0.00		2.57	0.87				
21	235.15	0.00	30.0	0.04	0.05	2	0.00	35.0
0.13	0.00		2.55	0.87				
22	235.19	0.00	30.0	0.04	0.05	2	0.00	35.0
0.13	0.00		2.52	0.87				
23	235.23	0.00	30.3	0.04	0.05	2	0.00	35.0
0.13	0.00		2.46	0.87				
24	235.27	0.00	30.3	0.04	0.05	2	0.00	35.0
0.13	0.00		2.41	0.87				
25	235.31	0.00	30.6	0.04	0.05	2	0.00	35.0
0.12	0.00		2.33	0.87				

26	235.35	0.00	30.6	0.04	0.05	2	0.00	35.0
0.12	0.00		2.25	0.87				
27	235.39	0.00	30.9	0.04	0.05	2	0.00	35.0
0.11	0.00		2.14	0.87				
28	235.43	0.00	30.9	0.04	0.05	2	0.00	35.0
0.11	0.00		2.03	0.87				
29	235.46	0.00	31.3	0.04	0.05	2	0.00	35.0
0.10	0.00		1.90	0.87				
30	235.50	0.00	31.3	0.04	0.05	2	0.00	35.0
0.09	0.00		1.75	0.87				
31	235.54	0.00	31.6	0.04	0.05	2	0.00	35.0
0.08	0.00		1.60	0.87				
32	235.58	0.00	31.6	0.04	0.05	2	0.00	35.0
0.07	0.00		1.43	0.87				
33	235.62	0.00	31.9	0.04	0.05	2	0.00	35.0
0.06	0.00		1.24	0.87				
34	235.66	0.00	31.9	0.04	0.05	2	0.00	35.0
0.05	0.00		1.04	0.87				
35	235.70	0.00	32.2	0.04	0.05	2	0.00	35.0
0.04	0.00		0.84	0.87				
36	235.73	0.00	32.2	0.04	0.05	2	0.00	35.0
0.03	0.00		0.61	0.87				
37	235.77	0.00	32.5	0.04	0.05	2	0.00	35.0
0.02	0.00		0.37	0.87				
38	235.81	0.00	32.5	0.04	0.05	2	0.00	35.0
0.01	0.00		0.13	0.87				

X-S Area:	0.03	Path Length:	1.73	X-S Weight:
3.40				

DATA: Analysis 4 - 2023 Embankment Stability - 5FT Below Top of Embankment - Seismic

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
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0.00	33.0	110.00	Auto
Material: 5 (Mohr-Coulomb Isotropic) - Bedrock			
Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto
Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface			
Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto
Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings			
Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400	Unit weight of water/medium above ground:
0.000	

Material Profiles (7 profiles)

Profile: 1 (2 points)	Material beneath: 5 - Bedrock
90.00 411.00	305.00 390.00
Profile: 2 (4 points)	Material beneath: 3 - Embankment (Existing)
230.80 396.60	251.00 407.00 262.00 407.00
305.00 393.00	
Profile: 3 (4 points)	Material beneath: 4 - Soil Buttress
155.00 405.00	168.00 412.00 175.00 412.00
190.00 400.00	
Profile: 4 (2 points)	Material beneath: 1 - Tailings
182.00 406.00	249.10 406.00
Profile: 5 (11 points)	Material beneath: 6 - Tailings/Geomembrane Interface
90.00 411.00	155.00 405.00 168.00 412.00
175.00 412.00	182.00 406.00
215.00 406.00	240.00 420.10 244.00 420.10
244.10 417.00	246.90 417.00
247.00 420.00	
Profile: 6 (4 points)	Material beneath: 2 - Embankment (Proposed)
214.50 406.00	240.00 420.00 248.00 420.00
305.00 393.00	
Profile: 7 (2 points)	Material beneath: 1 - Tailings
89.80 415.00	232.60 415.00

Slope Surface (5 points)

90.00 415.00	231.50 415.00	240.10 419.90
248.00 419.90	305.00 393.00	

Piezometric Surfaces (1 surface)

Surface within profile: 7 (2 points) - Tailings
89.80 413.00 232.60 413.00

Failure Surface (Critical, from previous analysis)

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

Intersects: XL: 234.35 YL: 416.62 XR: 235.85 YR: 417.48
Centre: XC: 227.02 YC: 431.24 Radius: R: 16.35

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.050

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	5.50	7.50	2.70
Trial positions within range:	10	10	10

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- - - - -

RESULTS: Analysis 4 - 2023 Embankment Stability - 5FT Below Top of Embankment - Seismic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.099

There were: 528 successful analyses from a total of 1001 trial surfaces
473 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.10

Results Summary - Lowest 99 Factor of Safety circles

Circle Radius	X-Left FoS	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre
1	234.04	416.45	235.43	417.24	225.99	432.21
17.70	1.098	<-- Critical Surface				
2	234.04	416.45	235.43	417.24	226.13	431.95
17.40	1.098					
3	234.04	416.45	235.43	417.24	226.28	431.69
17.10	1.098					
4	236.49	417.84	237.93	418.67	228.46	433.62
17.70	1.098					
5	234.04	416.45	235.43	417.24	226.43	431.43
16.80	1.098					

6	236.49	417.84	237.93	418.67	228.61	433.36
17.40	1.098					
7	234.04	416.45	235.43	417.24	226.58	431.16
16.50	1.098					
8	236.49	417.84	237.93	418.67	228.76	433.09
17.10	1.099					
9	234.04	416.45	235.43	417.24	226.73	430.90
16.20	1.099					
10	236.49	417.84	237.93	418.67	228.90	432.83
16.80	1.099					
11	234.04	416.45	235.43	417.24	226.88	430.64
15.90	1.099					
12	236.49	417.84	237.93	418.67	229.05	432.57
16.50	1.099					
13	236.49	417.84	237.93	418.67	229.20	432.31
16.20	1.099					
14	234.04	416.45	235.43	417.24	227.03	430.38
15.60	1.099					
15	234.04	416.45	235.43	417.24	227.17	430.12
15.30	1.099					
16	236.49	417.84	237.93	418.67	229.35	432.05
15.90	1.099					
17	234.66	416.80	236.27	417.72	226.71	432.61
17.70	1.099					
18	234.35	416.62	235.85	417.48	227.02	431.24
16.35	1.099					
19	234.66	416.80	236.27	417.72	226.86	432.35
17.40	1.099					
20	234.04	416.45	235.43	417.24	227.32	429.86
15.00	1.099					
21	236.49	417.84	237.93	418.67	229.50	431.79
15.60	1.099					
22	234.66	416.80	236.27	417.72	227.01	432.09
17.10	1.099					
23	237.10	418.19	238.77	419.14	229.18	434.02
17.70	1.099					
24	236.49	417.84	237.93	418.67	229.65	431.53
15.30	1.099					
25	237.10	418.19	238.77	419.14	229.33	433.76
17.40	1.099					
26	234.66	416.80	236.27	417.72	227.16	431.83
16.80	1.099					
27	236.49	417.84	237.93	418.67	229.80	431.27
15.00	1.099					
28	237.10	418.19	238.77	419.14	229.48	433.50
17.10	1.099					
29	234.66	416.80	236.27	417.72	227.31	431.57
16.50	1.099					
30	237.10	418.19	238.77	419.14	229.63	433.24
16.80	1.099					

31	234.66	416.80	236.27	417.72	227.45	431.31
16.20	1.099					
32	237.10	418.19	238.77	419.14	229.78	432.98
16.50	1.099					
33	234.66	416.80	236.27	417.72	227.60	431.05
15.90	1.099					
34	237.10	418.19	238.77	419.14	229.93	432.72
16.20	1.099					
35	234.66	416.80	236.27	417.72	227.75	430.79
15.60	1.099					
36	235.27	417.15	237.10	418.19	227.44	433.02
17.70	1.099					
37	237.10	418.19	238.77	419.14	230.08	432.46
15.90	1.099					
38	234.66	416.80	236.27	417.72	227.90	430.53
15.30	1.099					
39	235.27	417.15	237.10	418.19	227.59	432.76
17.40	1.099					
40	237.10	418.19	238.77	419.14	230.23	432.19
15.60	1.099					
41	235.27	417.15	237.10	418.19	227.73	432.50
17.10	1.099					
42	234.66	416.80	236.27	417.72	228.05	430.27
15.00	1.099					
43	237.10	418.19	238.77	419.14	230.37	431.93
15.30	1.099					
44	235.27	417.15	237.10	418.19	227.88	432.24
16.80	1.099					
45	235.27	417.15	237.10	418.19	228.03	431.98
16.50	1.100					
46	237.10	418.19	238.77	419.14	230.52	431.67
15.00	1.100					
47	233.43	416.10	235.43	417.24	225.69	432.02
17.70	1.100					
48	235.27	417.15	237.10	418.19	228.18	431.71
16.20	1.100					
49	233.43	416.10	235.43	417.24	225.84	431.76
17.40	1.100					
50	235.27	417.15	237.10	418.19	228.33	431.45
15.90	1.100					
51	235.88	417.49	237.93	418.67	228.16	433.42
17.70	1.100					
52	233.43	416.10	235.43	417.24	225.99	431.50
17.10	1.100					
53	235.27	417.15	237.10	418.19	228.48	431.19
15.60	1.100					
54	235.88	417.49	237.93	418.67	228.31	433.16
17.40	1.100					
55	233.43	416.10	235.43	417.24	226.14	431.23
16.80	1.100					

56	235.27	417.15	237.10	418.19	228.63	430.93
15.30	1.100					
57	235.88	417.49	237.93	418.67	228.46	432.90
17.10	1.100					
58	233.43	416.10	235.43	417.24	226.29	430.97
16.50	1.100					
59	235.88	417.49	237.93	418.67	228.61	432.64
16.80	1.100					
60	235.27	417.15	237.10	418.19	228.78	430.67
15.00	1.100					
61	233.43	416.10	235.43	417.24	226.43	430.71
16.20	1.100					
62	235.88	417.49	237.93	418.67	228.76	432.38
16.50	1.100					
63	234.04	416.45	236.27	417.72	226.42	432.42
17.70	1.100					
64	233.43	416.10	235.43	417.24	226.58	430.45
15.90	1.100					
65	235.88	417.49	237.93	418.67	228.91	432.12
16.20	1.100					
66	234.04	416.45	236.27	417.72	226.57	432.16
17.40	1.100					
67	233.43	416.10	235.43	417.24	226.73	430.19
15.60	1.100					
68	236.49	417.84	238.77	419.14	228.89	433.83
17.70	1.100					
69	235.88	417.49	237.93	418.67	229.06	431.86
15.90	1.100					
70	234.04	416.45	236.27	417.72	226.71	431.90
17.10	1.100					
71	233.43	416.10	235.43	417.24	226.88	429.93
15.30	1.101					
72	236.49	417.84	238.77	419.14	229.04	433.57
17.40	1.101					
73	235.88	417.49	237.93	418.67	229.21	431.60
15.60	1.101					
74	234.04	416.45	236.27	417.72	226.86	431.64
16.80	1.101					
75	233.43	416.10	235.43	417.24	227.03	429.67
15.00	1.101					
76	236.49	417.84	238.77	419.14	229.19	433.31
17.10	1.101					
77	235.88	417.49	237.93	418.67	229.35	431.33
15.30	1.101					
78	234.04	416.45	236.27	417.72	227.01	431.38
16.50	1.101					
79	236.49	417.84	238.77	419.14	229.34	433.04
16.80	1.101					
80	235.88	417.49	237.93	418.67	229.50	431.07
15.00	1.101					

81	234.04	416.45	236.27	417.72	227.16	431.11
16.20	1.101					
82	234.66	416.80	237.10	418.19	227.14	432.82
17.70	1.101					
83	236.49	417.84	238.77	419.14	229.49	432.78
16.50	1.101					
84	234.04	416.45	236.27	417.72	227.31	430.85
15.90	1.101					
85	234.66	416.80	237.10	418.19	227.29	432.56
17.40	1.101					
86	236.49	417.84	238.77	419.14	229.63	432.52
16.20	1.101					
87	237.10	418.19	239.60	419.62	229.62	434.23
17.70	1.101					
88	234.04	416.45	236.27	417.72	227.46	430.59
15.60	1.101					
89	234.66	416.80	237.10	418.19	227.44	432.30
17.10	1.101					
90	236.49	417.84	238.77	419.14	229.78	432.26
15.90	1.101					
91	237.10	418.19	239.60	419.62	229.77	433.97
17.40	1.101					
92	234.04	416.45	236.27	417.72	227.61	430.33
15.30	1.101					
93	234.66	416.80	237.10	418.19	227.59	432.04
16.80	1.101					
94	236.49	417.84	238.77	419.14	229.93	432.00
15.60	1.101					
95	237.10	418.19	239.60	419.62	229.91	433.71
17.10	1.101					
96	234.04	416.45	236.27	417.72	227.76	430.07
15.00	1.101					
97	234.66	416.80	237.10	418.19	227.74	431.78
16.50	1.101					
98	236.49	417.84	238.77	419.14	230.08	431.74
15.30	1.102					
99	237.10	418.19	239.60	419.62	230.06	433.45
16.80	1.102					

Critical Failure Surface (circle 1)

Intersects: XL: 234.04 YL: 416.45 XR: 235.43 YR: 417.24

Centre: XC: 225.99 YC: 432.21 Radius: R: 17.70

Generated failure surface: (20 points)

234.04	416.45	234.12	416.49	234.19	416.53
234.27	416.57	234.34	416.61		
234.42	416.65	234.49	416.69	234.56	416.73
234.64	416.77	234.71	416.81		

234.78	416.85	234.86	416.89	234.93	416.93
235.00	416.98	235.07	417.02		
235.15	417.06	235.22	417.11	235.29	417.15
235.36	417.20	235.43	417.24		

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice	X-S	-----	Base	-----				
	PoreWater	Normal	Test					
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Stress	Factor					
1	234.04	0.00	27.2	0.04	0.04	2	0.00	35.0
0.01	0.00	0.10	0.85					
2	234.08	0.00	27.2	0.04	0.04	2	0.00	35.0
0.01	0.00	0.30	0.85					
3	234.12	0.00	27.5	0.04	0.04	2	0.00	35.0
0.02	0.00	0.49	0.85					
4	234.16	0.00	27.5	0.04	0.04	2	0.00	35.0
0.03	0.00	0.67	0.85					
5	234.19	0.00	27.8	0.04	0.04	2	0.00	35.0
0.04	0.00	0.84	0.85					
6	234.23	0.00	27.8	0.04	0.04	2	0.00	35.0
0.05	0.00	1.00	0.85					
7	234.27	0.00	28.1	0.04	0.04	2	0.00	35.0
0.06	0.00	1.14	0.85					
8	234.31	0.00	28.0	0.04	0.04	2	0.00	35.0
0.06	0.00	1.27	0.85					
9	234.34	0.00	28.3	0.04	0.04	2	0.00	35.0
0.07	0.00	1.39	0.85					
10	234.38	0.00	28.3	0.04	0.04	2	0.00	35.0
0.07	0.00	1.50	0.85					
11	234.42	0.00	28.6	0.04	0.04	2	0.00	35.0
0.08	0.00	1.60	0.85					
12	234.45	0.00	28.6	0.04	0.04	2	0.00	35.0
0.08	0.00	1.69	0.85					
13	234.49	0.00	28.8	0.04	0.04	2	0.00	35.0
0.09	0.00	1.76	0.84					
14	234.53	0.00	28.9	0.04	0.04	2	0.00	35.0
0.09	0.00	1.83	0.84					
15	234.56	0.00	29.1	0.04	0.04	2	0.00	35.0
0.09	0.00	1.88	0.84					
16	234.60	0.00	29.2	0.04	0.04	2	0.00	35.0
0.10	0.00	1.92	0.84					
17	234.64	0.00	29.4	0.04	0.04	2	0.00	35.0
0.10	0.00	1.95	0.84					
18	234.67	0.00	29.4	0.04	0.04	2	0.00	35.0
0.10	0.00	1.97	0.84					
19	234.71	0.00	29.7	0.04	0.04	2	0.00	35.0
0.10	0.00	1.98	0.84					
20	234.75	0.00	29.7	0.04	0.04	2	0.00	35.0

0.10	0.00	1.97	0.84					
21	234.78	0.00	29.9	0.04	0.04	2	0.00	35.0
0.10	0.00	1.96	0.84					
22	234.82	0.00	29.9	0.04	0.04	2	0.00	35.0
0.10	0.00	1.94	0.84					
23	234.86	0.00	30.2	0.04	0.04	2	0.00	35.0
0.09	0.00	1.90	0.84					
24	234.89	0.00	30.2	0.04	0.04	2	0.00	35.0
0.09	0.00	1.86	0.84					
25	234.93	0.00	30.5	0.04	0.04	2	0.00	35.0
0.09	0.00	1.80	0.84					
26	234.97	0.00	30.5	0.04	0.04	2	0.00	35.0
0.09	0.00	1.73	0.84					
27	235.00	0.00	30.7	0.04	0.04	2	0.00	35.0
0.08	0.00	1.65	0.84					
28	235.04	0.00	30.8	0.04	0.04	2	0.00	35.0
0.08	0.00	1.56	0.84					
29	235.07	0.00	31.0	0.04	0.04	2	0.00	35.0
0.07	0.00	1.46	0.84					
30	235.11	0.00	31.0	0.04	0.04	2	0.00	35.0
0.07	0.00	1.35	0.84					
31	235.15	0.00	31.3	0.04	0.04	2	0.00	35.0
0.06	0.00	1.23	0.84					
32	235.18	0.00	31.3	0.04	0.04	2	0.00	35.0
0.05	0.00	1.10	0.84					
33	235.22	0.00	31.6	0.04	0.04	2	0.00	35.0
0.05	0.00	0.96	0.84					
34	235.25	0.00	31.6	0.04	0.04	2	0.00	35.0
0.04	0.00	0.81	0.84					
35	235.29	0.00	31.9	0.04	0.04	2	0.00	35.0
0.03	0.00	0.64	0.84					
36	235.33	0.00	31.9	0.04	0.04	2	0.00	35.0
0.02	0.00	0.47	0.84					
37	235.36	0.00	32.1	0.04	0.04	2	0.00	35.0
0.01	0.00	0.29	0.84					
38	235.40	0.00	32.1	0.04	0.04	2	0.00	35.0
0.00	0.00	0.10	0.84					

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X-S Area:	0.02	Path Length: 1.60
2.50		X-S Weight:

DATA: Analysis 5 - 2023 Embankment Stability - 10FT Below Embankment Top

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto
Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)			
Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto
Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)			
Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto
Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress			
Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto
Material: 5 (Mohr-Coulomb Isotropic) - Bedrock			
Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto
Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface			
Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto
Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings			
Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400	Unit weight of water/medium above ground:
0.000	

Material Profiles (7 profiles)

Profile: 1 (2 points)	Material beneath: 5 - Bedrock
90.00 411.00	305.00 390.00
Profile: 2 (4 points)	Material beneath: 3 - Embankment (Existing)
230.80 396.60	251.00 407.00 262.00 407.00
305.00 393.00	
Profile: 3 (4 points)	Material beneath: 4 - Soil Buttress
155.00 405.00	168.00 412.00 175.00 412.00
190.00 400.00	
Profile: 4 (2 points)	Material beneath: 1 - Tailings
182.00 406.00	249.10 406.00
Profile: 5 (4 points)	Material beneath: 2 - Embankment (Proposed)
215.00 406.00	240.00 420.00 248.00 420.00
305.00 393.00	
Profile: 6 (2 points)	Material beneath: 4 - Soil Buttress
179.50 408.00	222.40 408.00
Profile: 7 (11 points)	Material beneath: 6 - Tailings/Geomembrane Interface
90.10 410.90	155.00 404.40 168.00 411.80
175.20 411.70	181.80 405.60
215.00 406.00	240.00 420.10 244.00 420.10
244.10 417.00	246.90 417.00
247.00 420.00	

Slope Surface (5 points)

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      179.50      408.00      219.00      407.90      240.00      420.00
248.00      420.00      305.00      393.00

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Piezometric Surfaces (1 surface)

Failure Surface

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

```

Intersects:  XL:      217.00      YL:      407.91      XR:      243.90      YR:
420.00
Centre:  XC:      222.17      YC:      432.36      Radius:  R:
25.00

```

Variable Restraints

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Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.80    5.00
Trial positions within range:  15      15      25

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RESULTS: Analysis 5 - 2023 Embankment Stability - 10FT Below Embankment Top

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.612

There were: 5373 successful analyses from a total of 5625 trial surfaces
252 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.30

Results Summary - Lowest 99 Factor of Safety circles

Circle Radius	X-Left FoS	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre
1	222.00	409.63	238.50	419.14	217.37	436.74
27.50	1.298	<-- Critical Surface				
2	222.00	409.63	238.50	419.14	217.48	436.54
27.29	1.299					
3	222.00	409.63	238.50	419.14	217.59	436.35
27.08	1.301					
4	222.00	409.63	238.50	419.14	217.70	436.16

26.88	1.302					
5	222.00	409.63	238.50	419.14	217.81	435.96
26.67	1.304					
6	222.00	409.63	238.50	419.14	217.93	435.77
26.46	1.305					
7	221.29	409.22	238.50	419.14	217.09	436.40
27.50	1.306					
8	222.00	409.63	239.27	419.58	217.84	436.81
27.50	1.306					
9	222.00	409.63	238.50	419.14	218.04	435.58
26.25	1.307					
10	221.29	409.22	238.50	419.14	217.20	436.20
27.29	1.307					
11	222.00	409.63	239.27	419.58	217.95	436.62
27.29	1.308					
12	222.00	409.63	238.50	419.14	218.15	435.38
26.04	1.308					
13	221.29	409.22	238.50	419.14	217.31	436.01
27.08	1.309					
14	222.00	409.63	239.27	419.58	218.06	436.42
27.08	1.310					
15	222.00	409.63	238.50	419.14	218.26	435.19
25.83	1.310					
16	221.29	409.22	238.50	419.14	217.43	435.81
26.88	1.310					
17	222.00	409.63	239.27	419.58	218.18	436.23
26.88	1.311					
18	222.00	409.63	238.50	419.14	218.37	435.00
25.62	1.312					
19	221.29	409.22	238.50	419.14	217.54	435.62
26.67	1.312					
20	222.00	409.63	239.27	419.58	218.29	436.04
26.67	1.313					
21	222.00	409.63	238.50	419.14	218.48	434.80
25.42	1.313					
22	221.29	409.22	238.50	419.14	217.65	435.42
26.46	1.314					
23	220.57	408.81	238.50	419.14	216.82	436.05
27.50	1.314					
24	222.00	409.63	239.27	419.58	218.40	435.84
26.46	1.314					
25	221.29	409.22	239.27	419.58	217.56	436.46
27.50	1.315					
26	222.00	409.63	238.50	419.14	218.60	434.61
25.21	1.315					
27	221.29	409.22	238.50	419.14	217.76	435.23
26.25	1.315					
28	220.57	408.81	238.50	419.14	216.93	435.85
27.29	1.316					
29	222.00	409.63	240.04	420.00	218.34	436.88

27.50	1.316					
30	222.00	409.63	239.27	419.58	218.51	435.65
26.25	1.316					
31	221.29	409.22	239.27	419.58	217.68	436.27
27.29	1.316					
32	222.00	409.63	238.50	419.14	218.71	434.41
25.00	1.317					
33	221.29	409.22	238.50	419.14	217.87	435.03
26.04	1.317					
34	220.57	408.81	238.50	419.14	217.04	435.66
27.08	1.317					
35	222.00	409.63	240.04	420.00	218.45	436.69
27.29	1.318					
36	222.00	409.63	239.27	419.58	218.62	435.45
26.04	1.318					
37	221.29	409.22	239.27	419.58	217.79	436.07
27.08	1.318					
38	222.00	409.63	238.50	419.14	218.82	434.22
24.79	1.319					
39	221.29	409.22	238.50	419.14	217.99	434.84
25.83	1.319					
40	220.57	408.81	238.50	419.14	217.15	435.46
26.88	1.319					
41	222.00	409.63	240.04	420.00	218.56	436.49
27.08	1.319					
42	222.00	409.63	239.27	419.58	218.74	435.26
25.83	1.320					
43	221.29	409.22	239.27	419.58	217.90	435.88
26.88	1.320					
44	222.00	409.63	238.50	419.14	218.93	434.02
24.58	1.321					
45	221.29	409.22	238.50	419.14	218.10	434.64
25.62	1.321					
46	220.57	408.81	238.50	419.14	217.27	435.27
26.67	1.321					
47	222.00	409.63	240.04	420.00	218.67	436.30
26.88	1.321					
48	222.00	409.63	239.27	419.58	218.85	435.06
25.62	1.322					
49	221.29	409.22	239.27	419.58	218.02	435.68
26.67	1.322					
50	222.00	409.63	238.50	419.14	219.05	433.82
24.38	1.323					
51	221.29	409.22	238.50	419.14	218.21	434.45
25.42	1.323					
52	220.57	408.81	238.50	419.14	217.38	435.07
26.46	1.323					
53	222.00	409.63	240.04	420.00	218.79	436.10
26.67	1.323					
54	219.86	408.39	238.50	419.14	216.54	435.69

27.50	1.323					
55	222.00	409.63	239.27	419.58	218.96	434.86
25.42	1.323					
56	221.29	409.22	239.27	419.58	218.13	435.49
26.46	1.324					
57	220.57	408.81	239.27	419.58	217.29	436.11
27.50	1.324					
58	222.00	409.63	238.50	419.14	219.16	433.63
24.17	1.325					
59	221.29	409.22	238.50	419.14	218.33	434.25
25.21	1.325					
60	220.57	408.81	238.50	419.14	217.49	434.87
26.25	1.325					
61	219.86	408.39	238.50	419.14	216.66	435.50
27.29	1.325					
62	222.00	409.63	240.04	420.00	218.90	435.90
26.46	1.325					
63	221.29	409.22	240.04	420.00	218.06	436.53
27.50	1.325					
64	222.00	409.63	239.27	419.58	219.08	434.67
25.21	1.325					
65	221.29	409.22	239.27	419.58	218.24	435.29
26.25	1.325					
66	220.57	408.81	239.27	419.58	217.41	435.91
27.29	1.325					
67	219.86	408.39	238.50	419.14	216.77	435.30
27.08	1.327					
68	220.57	408.81	238.50	419.14	217.60	434.68
26.04	1.327					
69	221.29	409.22	240.04	420.00	218.18	436.33
27.29	1.327					
70	221.29	409.22	238.50	419.14	218.44	434.05
25.00	1.327					
71	222.00	409.63	240.04	420.00	219.01	435.71
26.25	1.327					
72	222.00	409.63	238.50	419.14	219.27	433.43
23.96	1.327					
73	220.57	408.81	239.27	419.58	217.52	435.72
27.08	1.327					
74	221.29	409.22	239.27	419.58	218.35	435.09
26.04	1.327					
75	222.00	409.63	239.27	419.58	219.19	434.47
25.00	1.327					
76	219.86	408.39	238.50	419.14	216.88	435.10
26.88	1.328					
77	221.29	409.22	240.04	420.00	218.29	436.13
27.08	1.328					
78	220.57	408.81	238.50	419.14	217.72	434.48
25.83	1.329					
79	222.00	409.63	240.04	420.00	219.12	435.51

26.04	1.329					
80	221.29	409.22	238.50	419.14	218.55	433.86
24.79	1.329					
81	222.00	409.63	238.50	419.14	219.39	433.23
23.75	1.329					
82	220.57	408.81	239.27	419.58	217.63	435.52
26.88	1.329					
83	221.29	409.22	239.27	419.58	218.47	434.90
25.83	1.329					
84	222.00	409.63	239.27	419.58	219.30	434.27
24.79	1.330					
85	219.86	408.39	238.50	419.14	217.00	434.91
26.67	1.330					
86	221.29	409.22	240.04	420.00	218.40	435.94
26.88	1.330					
87	220.57	408.81	238.50	419.14	217.83	434.28
25.62	1.331					
88	222.00	409.63	240.04	420.00	219.24	435.31
25.83	1.331					
89	221.29	409.22	238.50	419.14	218.67	433.66
24.58	1.331					
90	222.00	409.63	238.50	419.14	219.50	433.04
23.54	1.331					
91	220.57	408.81	239.27	419.58	217.75	435.32
26.67	1.331					
92	221.29	409.22	239.27	419.58	218.58	434.70
25.62	1.331					
93	222.00	409.63	239.27	419.58	219.42	434.08
24.58	1.332					
94	219.14	407.98	238.50	419.14	216.28	435.33
27.50	1.332					
95	221.29	409.22	240.04	420.00	218.52	435.74
26.67	1.332					
96	219.86	408.39	238.50	419.14	217.11	434.71
26.46	1.332					
97	222.00	409.63	240.04	420.00	219.35	435.12
25.62	1.333					
98	220.57	408.81	238.50	419.14	217.95	434.09
25.42	1.333					
99	219.86	408.39	239.27	419.58	217.03	435.75
27.50	1.333					

Critical Failure Surface (circle 1)

Intersects: XL: 222.00 YL: 409.63 XR: 238.50 YR: 419.14

Centre: XC: 217.37 YC: 436.74 Radius: R: 27.50

Generated failure surface: (20 points)

222.00 409.63 223.01 409.82 224.00 410.05

224.99	410.31	225.97	410.62		
226.94	410.95	227.89	411.33	228.83	411.74
229.75	412.18	230.65	412.66		
231.54	413.17	232.41	413.71	233.25	414.29
234.08	414.89	234.88	415.53		
235.66	416.20	236.41	416.89	237.13	417.61
237.83	418.36	238.50	419.14		

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice	PoreWater	X-S	Normal	Test		Base		
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Stress		Factor				
1	222.00	0.05	10.8	0.50	0.51	2	0.00	35.0
6.34	0.00	11.45	0.92					
2	222.50	0.15	10.8	0.50	0.51	2	0.00	35.0
19.03	0.00	34.34	0.92					
3	223.01	0.24	12.9	0.50	0.51	2	0.00	35.0
30.79	0.00	54.95	0.91					
4	223.50	0.32	12.9	0.50	0.51	2	0.00	35.0
42.03	0.00	75.00	0.91					
5	224.00	0.40	15.0	0.49	0.51	2	0.00	35.0
52.09	0.00	92.07	0.90					
6	224.50	0.48	15.0	0.49	0.51	2	0.00	35.0
61.86	0.00	109.34	0.90					
7	224.99	0.54	17.2	0.49	0.51	2	0.00	35.0
70.19	0.00	123.07	0.90					
8	225.48	0.60	17.2	0.49	0.51	2	0.00	35.0
78.51	0.00	137.65	0.90					
9	225.97	0.65	19.3	0.48	0.51	2	0.00	35.0
85.09	0.00	148.19	0.89					
10	226.45	0.71	19.3	0.48	0.51	2	0.00	35.0
91.95	0.00	160.14	0.89					
11	226.94	0.74	21.4	0.48	0.51	2	0.00	35.0
96.78	0.00	167.68	0.89					
12	227.41	0.79	21.4	0.48	0.51	2	0.00	35.0
102.20	0.00	177.08	0.89					
13	227.89	0.81	23.6	0.47	0.51	2	0.00	35.0
105.32	0.00	181.78	0.88					
14	228.36	0.84	23.6	0.47	0.51	2	0.00	35.0
109.33	0.00	188.71	0.88					
15	228.83	0.85	25.7	0.46	0.51	2	0.00	35.0
110.77	0.00	190.73	0.88					
16	229.29	0.87	25.7	0.46	0.51	2	0.00	35.0
113.40	0.00	195.26	0.88					
17	229.75	0.87	27.8	0.45	0.51	2	0.00	35.0
113.23	0.00	194.76	0.88					
18	230.20	0.88	27.8	0.45	0.51	2	0.00	35.0
114.52	0.00	196.98	0.88					

19	230.65	0.87	29.9	0.44	0.51	2	0.00	35.0
112.83	0.00	194.14	0.88					
20	231.10	0.87	30.0	0.44	0.51	2	0.00	35.0
112.83	0.00	194.14	0.88					
21	231.54	0.84	32.1	0.43	0.51	2	0.00	35.0
109.72	0.00	189.11	0.88					
22	231.97	0.83	32.1	0.43	0.51	2	0.00	35.0
108.48	0.00	186.98	0.88					
23	232.41	0.80	34.2	0.42	0.51	2	0.00	35.0
104.06	0.00	179.92	0.88					
24	232.83	0.78	34.2	0.42	0.51	2	0.00	35.0
101.64	0.00	175.74	0.88					
25	233.25	0.74	36.3	0.41	0.51	2	0.00	35.0
96.06	0.00	166.85	0.89					
26	233.67	0.71	36.3	0.41	0.51	2	0.00	35.0
92.54	0.00	160.72	0.89					
27	234.08	0.66	38.5	0.40	0.51	2	0.00	35.0
85.94	0.00	150.17	0.89					
28	234.48	0.63	38.5	0.40	0.51	2	0.00	35.0
81.39	0.00	142.20	0.89					
29	234.88	0.57	40.6	0.39	0.51	2	0.00	35.0
73.95	0.00	130.16	0.90					
30	235.27	0.53	40.6	0.39	0.51	2	0.00	35.0
68.43	0.00	120.45	0.90					
31	235.66	0.46	42.7	0.38	0.51	2	0.00	35.0
60.34	0.00	107.15	0.91					
32	236.03	0.42	42.7	0.38	0.51	2	0.00	35.0
53.95	0.00	95.80	0.91					
33	236.41	0.35	44.9	0.36	0.51	2	0.00	35.0
45.39	0.00	81.44	0.92					
34	236.77	0.29	44.9	0.36	0.51	2	0.00	35.0
38.22	0.00	68.57	0.92					
35	237.13	0.23	47.0	0.35	0.51	2	0.00	35.0
29.40	0.00	53.37	0.93					
36	237.48	0.17	47.0	0.35	0.51	2	0.00	35.0
21.54	0.00	39.11	0.93					
37	237.83	0.10	49.1	0.33	0.51	2	0.00	35.0
12.67	0.00	23.31	0.94					
38	238.17	0.03	49.1	0.33	0.51	2	0.00	35.0
4.22	0.00	7.77	0.94					

X-S Area:	21.67	Path Length:	19.44	X-S Weight:
2817.05				

DATA: Analysis 6 - 2023 Embankment Stability - 10FT Below Embankment Top - Seismic

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground:
0.000

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 5 - Bedrock

90.00	411.00	305.00	390.00
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Profile: 2 (4 points) Material beneath: 3 - Embankment (Existing)

230.80	396.60	251.00	407.00	262.00	407.00
305.00	393.00				

Profile: 3 (4 points) Material beneath: 4 - Soil Buttress

155.00	405.00	168.00	412.00	175.00	412.00
190.00	400.00				

Profile: 4 (2 points) Material beneath: 1 - Tailings

182.00	406.00	249.10	406.00
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Profile: 5 (4 points) Material beneath: 2 - Embankment (Proposed)

215.00	406.00	240.00	420.00	248.00	420.00
305.00	393.00				

Profile: 6 (2 points) Material beneath: 4 - Soil Buttress

179.50	408.00	222.40	408.00
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Profile: 7 (11 points) Material beneath: 6 - Tailings/Geomembrane Interface

90.10	410.90	155.00	404.40	168.00	411.80
175.20	411.70	181.80	405.60		
215.00	406.00	240.00	420.10	244.00	420.10

244.10 417.00 246.90 417.00
247.00 420.00

Slope Surface (5 points)

179.50 408.00 219.00 407.90 240.00 420.00
248.00 420.00 305.00 393.00

Piezometric Surfaces (1 surface)

Failure Surface (Critical, from previous analysis)

Initial circular surface for critical search defined by: XL, XR, R
Intersects: XL: 222.00 YL: 409.63 XR: 238.50 YR: 419.14
Centre: XC: 217.37 YC: 436.74 Radius: R: 27.50

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.050

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.80	5.00
Trial positions within range:	15	15	25

- - - - -
- - - - -

RESULTS: Analysis 6 - 2023 Embankment Stability - 10FT Below Embankment Top - Seismic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.163

There were: 4761 successful analyses from a total of 5625 trial surfaces
864 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.09

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre
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Radius	FoS					
1	227.00	412.51	233.10	416.02	215.18	440.08
30.00	1.094	<-- Critical Surface				
2	227.00	412.51	233.10	416.02	215.28	439.90
29.79	1.094					
3	227.00	412.51	233.10	416.02	215.39	439.72
29.58	1.094					
4	227.00	412.51	233.10	416.02	215.49	439.54
29.38	1.094					
5	227.00	412.51	233.10	416.02	215.60	439.35
29.17	1.094					
6	227.00	412.51	233.10	416.02	215.70	439.17
28.96	1.094					
7	227.00	412.51	233.10	416.02	215.80	438.99
28.75	1.095					
8	227.00	412.51	233.10	416.02	215.91	438.81
28.54	1.095					
9	227.00	412.51	233.10	416.02	216.01	438.63
28.33	1.095					
10	227.00	412.51	233.10	416.02	216.12	438.44
28.12	1.095					
11	227.00	412.51	233.10	416.02	216.22	438.26
27.92	1.095					
12	227.00	412.51	233.10	416.02	216.33	438.08
27.71	1.095					
13	227.00	412.51	233.10	416.02	216.43	437.90
27.50	1.095					
14	227.00	412.51	233.10	416.02	216.54	437.72
27.29	1.096					
15	227.00	412.51	233.10	416.02	216.64	437.53
27.08	1.096					
16	227.00	412.51	233.10	416.02	216.75	437.35
26.88	1.096					
17	226.29	412.10	233.10	416.02	214.84	439.83
30.00	1.096					
18	227.00	412.51	233.10	416.02	216.85	437.17
26.67	1.096					
19	226.29	412.10	233.10	416.02	214.95	439.65
29.79	1.096					
20	227.00	412.51	233.87	416.47	215.59	440.25
30.00	1.096					
21	226.29	412.10	233.10	416.02	215.05	439.47
29.58	1.096					
22	227.00	412.51	233.10	416.02	216.96	436.99
26.46	1.096					
23	227.00	412.51	233.87	416.47	215.69	440.07
29.79	1.096					
24	226.29	412.10	233.10	416.02	215.16	439.28
29.38	1.096					
25	227.00	412.51	233.87	416.47	215.80	439.89

29.58	1.096					
26	227.00	412.51	233.10	416.02	217.06	436.81
26.25	1.096					
27	226.29	412.10	233.10	416.02	215.26	439.10
29.17	1.097					
28	227.00	412.51	233.87	416.47	215.90	439.71
29.38	1.097					
29	227.00	412.51	233.10	416.02	217.17	436.62
26.04	1.097					
30	226.29	412.10	233.10	416.02	215.37	438.92
28.96	1.097					
31	227.00	412.51	233.87	416.47	216.01	439.53
29.17	1.097					
32	227.00	412.51	233.10	416.02	217.27	436.44
25.83	1.097					
33	226.29	412.10	233.10	416.02	215.47	438.74
28.75	1.097					
34	227.00	412.51	233.87	416.47	216.11	439.34
28.96	1.097					
35	227.00	412.51	233.10	416.02	217.38	436.26
25.62	1.097					
36	226.29	412.10	233.10	416.02	215.58	438.56
28.54	1.097					
37	227.00	412.51	233.87	416.47	216.22	439.16
28.75	1.097					
38	227.00	412.51	233.10	416.02	217.48	436.08
25.42	1.097					
39	226.29	412.10	233.10	416.02	215.68	438.37
28.33	1.097					
40	227.00	412.51	233.87	416.47	216.32	438.98
28.54	1.097					
41	227.00	412.51	233.10	416.02	217.59	435.89
25.21	1.097					
42	226.29	412.10	233.10	416.02	215.79	438.19
28.12	1.097					
43	227.00	412.51	233.87	416.47	216.43	438.80
28.33	1.097					
44	227.00	412.51	233.10	416.02	217.69	435.71
25.00	1.098					
45	226.29	412.10	233.10	416.02	215.89	438.01
27.92	1.098					
46	227.00	412.51	233.87	416.47	216.53	438.61
28.12	1.098					
47	226.29	412.10	233.10	416.02	216.00	437.83
27.71	1.098					
48	227.00	412.51	233.87	416.47	216.64	438.43
27.92	1.098					
49	226.29	412.10	233.10	416.02	216.10	437.64
27.50	1.098					
50	227.00	412.51	233.87	416.47	216.74	438.25

27.71	1.098					
51	226.29	412.10	233.10	416.02	216.21	437.46
27.29	1.098					
52	227.00	412.51	233.87	416.47	216.85	438.07
27.50	1.098					
53	225.57	411.69	233.10	416.02	214.52	439.58
30.00	1.098					
54	226.29	412.10	233.10	416.02	216.31	437.28
27.08	1.098					
55	227.00	412.51	233.87	416.47	216.96	437.89
27.29	1.098					
56	225.57	411.69	233.10	416.02	214.62	439.39
29.79	1.098					
57	226.29	412.10	233.87	416.47	215.26	440.00
30.00	1.098					
58	226.29	412.10	233.10	416.02	216.42	437.10
26.88	1.099					
59	227.00	412.51	233.87	416.47	217.06	437.70
27.08	1.099					
60	225.57	411.69	233.10	416.02	214.73	439.21
29.58	1.099					
61	226.29	412.10	233.87	416.47	215.37	439.82
29.79	1.099					
62	227.00	412.51	234.64	416.91	216.01	440.42
30.00	1.099					
63	226.29	412.10	233.10	416.02	216.53	436.91
26.67	1.099					
64	227.00	412.51	233.87	416.47	217.17	437.52
26.88	1.099					
65	225.57	411.69	233.10	416.02	214.83	439.03
29.38	1.099					
66	226.29	412.10	233.87	416.47	215.47	439.63
29.58	1.099					
67	227.00	412.51	234.64	416.91	216.11	440.24
29.79	1.099					
68	226.29	412.10	233.10	416.02	216.63	436.73
26.46	1.099					
69	227.00	412.51	233.87	416.47	217.27	437.34
26.67	1.099					
70	225.57	411.69	233.10	416.02	214.94	438.85
29.17	1.099					
71	226.29	412.10	233.87	416.47	215.58	439.45
29.38	1.099					
72	227.00	412.51	234.64	416.91	216.22	440.06
29.58	1.099					
73	226.29	412.10	233.10	416.02	216.74	436.55
26.25	1.099					
74	227.00	412.51	233.87	416.47	217.38	437.16
26.46	1.099					
75	225.57	411.69	233.10	416.02	215.04	438.66

28.96	1.099					
76	226.29	412.10	233.87	416.47	215.68	439.27
29.17	1.099					
77	227.00	412.51	234.64	416.91	216.32	439.88
29.38	1.099					
78	226.29	412.10	233.10	416.02	216.84	436.37
26.04	1.099					
79	227.00	412.51	233.87	416.47	217.48	436.97
26.25	1.099					
80	225.57	411.69	233.10	416.02	215.15	438.48
28.75	1.099					
81	226.29	412.10	233.87	416.47	215.79	439.09
28.96	1.099					
82	227.00	412.51	234.64	416.91	216.43	439.69
29.17	1.099					
83	226.29	412.10	233.10	416.02	216.95	436.18
25.83	1.100					
84	225.57	411.69	233.10	416.02	215.25	438.30
28.54	1.100					
85	226.29	412.10	233.87	416.47	215.89	438.90
28.75	1.100					
86	227.00	412.51	233.87	416.47	217.59	436.79
26.04	1.100					
87	227.00	412.51	234.64	416.91	216.53	439.51
28.96	1.100					
88	225.57	411.69	233.10	416.02	215.36	438.11
28.33	1.100					
89	226.29	412.10	233.87	416.47	216.00	438.72
28.54	1.100					
90	227.00	412.51	234.64	416.91	216.64	439.33
28.75	1.100					
91	226.29	412.10	233.10	416.02	217.05	436.00
25.62	1.100					
92	227.00	412.51	233.87	416.47	217.69	436.61
25.83	1.100					
93	225.57	411.69	233.10	416.02	215.46	437.93
28.12	1.100					
94	226.29	412.10	233.87	416.47	216.10	438.54
28.33	1.100					
95	227.00	412.51	234.64	416.91	216.74	439.14
28.54	1.100					
96	226.29	412.10	233.10	416.02	217.16	435.82
25.42	1.100					
97	227.00	412.51	233.87	416.47	217.80	436.42
25.62	1.100					
98	225.57	411.69	233.10	416.02	215.57	437.75
27.92	1.100					
99	226.29	412.10	233.87	416.47	216.21	438.36
28.12	1.100					

Critical Failure Surface (circle 1)

Intersects: XL: 227.00 YL: 412.51 XR: 233.10 YR:
416.02

Centre: XC: 215.18 YC: 440.08 Radius: R:
30.00

Generated failure surface: (20 points)

227.00	412.51	227.34	412.66	227.68	412.81
228.02	412.97	228.35	413.13		
228.68	413.29	229.01	413.46	229.34	413.64
229.67	413.81	229.99	414.00		
230.31	414.18	230.63	414.37	230.95	414.56
231.27	414.76	231.58	414.96		
231.89	415.17	232.19	415.38	232.50	415.59
232.80	415.80	233.10	416.02		

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice	PoreWater	X-S	Normal	Test	Base			
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Stress	Factor					
1	227.00	0.00	23.6	0.17	0.19	2	0.00	35.0
0.26	0.00	1.21	0.85					
2	227.17	0.01	23.6	0.17	0.19	2	0.00	35.0
0.79	0.00	3.63	0.85					
3	227.34	0.01	24.3	0.17	0.19	2	0.00	35.0
1.28	0.00	5.87	0.85					
4	227.51	0.01	24.3	0.17	0.19	2	0.00	35.0
1.75	0.00	8.01	0.85					
5	227.68	0.02	25.0	0.17	0.19	2	0.00	35.0
2.17	0.00	9.94	0.85					
6	227.85	0.02	25.0	0.17	0.19	2	0.00	35.0
2.58	0.00	11.80	0.85					
7	228.02	0.02	25.7	0.17	0.19	2	0.00	35.0
2.94	0.00	13.43	0.85					
8	228.18	0.03	25.7	0.17	0.19	2	0.00	35.0
3.28	0.00	15.00	0.85					
9	228.35	0.03	26.4	0.17	0.19	2	0.00	35.0
3.58	0.00	16.33	0.85					
10	228.52	0.03	26.4	0.17	0.19	2	0.00	35.0
3.87	0.00	17.64	0.85					
11	228.68	0.03	27.1	0.17	0.19	2	0.00	35.0
4.10	0.00	18.68	0.85					
12	228.85	0.03	27.1	0.17	0.19	2	0.00	35.0
4.33	0.00	19.71	0.85					
13	229.01	0.03	27.8	0.16	0.19	2	0.00	35.0
4.50	0.00	20.47	0.85					
14	229.18	0.04	27.8	0.16	0.19	2	0.00	35.0
4.67	0.00	21.24	0.85					

15	229.34	0.04	28.5	0.16	0.19	2	0.00	35.0
4.78	0.00	21.72	0.84					
16	229.51	0.04	28.5	0.16	0.19	2	0.00	35.0
4.89	0.00	22.24	0.84					
17	229.67	0.04	29.2	0.16	0.19	2	0.00	35.0
4.94	0.00	22.45	0.84					
18	229.83	0.04	29.2	0.16	0.19	2	0.00	35.0
5.00	0.00	22.70	0.84					
19	229.99	0.04	30.0	0.16	0.19	2	0.00	35.0
4.99	0.00	22.65	0.84					
20	230.15	0.04	30.0	0.16	0.19	2	0.00	35.0
4.99	0.00	22.65	0.84					
21	230.31	0.04	30.7	0.16	0.19	2	0.00	35.0
4.93	0.00	22.35	0.84					
22	230.47	0.04	30.7	0.16	0.19	2	0.00	35.0
4.87	0.00	22.10	0.84					
23	230.63	0.04	31.4	0.16	0.19	2	0.00	35.0
4.75	0.00	21.56	0.84					
24	230.79	0.04	31.4	0.16	0.19	2	0.00	35.0
4.64	0.00	21.06	0.84					
25	230.95	0.03	32.1	0.16	0.19	2	0.00	35.0
4.47	0.00	20.28	0.84					
26	231.11	0.03	32.1	0.16	0.19	2	0.00	35.0
4.31	0.00	19.54	0.84					
27	231.27	0.03	32.8	0.16	0.19	2	0.00	35.0
4.09	0.00	18.54	0.84					
28	231.42	0.03	32.8	0.16	0.19	2	0.00	35.0
3.87	0.00	17.56	0.84					
29	231.58	0.03	33.5	0.15	0.19	2	0.00	35.0
3.60	0.00	16.33	0.84					
30	231.73	0.03	33.5	0.15	0.19	2	0.00	35.0
3.33	0.00	15.12	0.84					
31	231.89	0.02	34.2	0.15	0.19	2	0.00	35.0
3.01	0.00	13.68	0.84					
32	232.04	0.02	34.2	0.15	0.19	2	0.00	35.0
2.70	0.00	12.24	0.84					
33	232.19	0.02	34.9	0.15	0.19	2	0.00	35.0
2.33	0.00	10.59	0.84					
34	232.35	0.02	34.9	0.15	0.19	2	0.00	35.0
1.97	0.00	8.92	0.84					
35	232.50	0.01	35.6	0.15	0.19	2	0.00	35.0
1.56	0.00	7.08	0.84					
36	232.65	0.01	35.6	0.15	0.19	2	0.00	35.0
1.14	0.00	5.19	0.84					
37	232.80	0.01	36.3	0.15	0.19	2	0.00	35.0
0.69	0.00	3.16	0.84					
38	232.95	0.00	36.3	0.15	0.19	2	0.00	35.0
0.23	0.00	1.05	0.84					

X-S Area: 0.97 Path Length: 7.06 X-S Weight: 126.17

DATA: Analysis 7 - 2023 Embankment Stability - Outslope

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400	Unit weight of water/medium above ground:
0.000	

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 5 - Bedrock

90.00	411.00	305.00	390.00
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Profile: 2 (4 points) Material beneath: 3 - Embankment (Existing)

230.80	396.60	251.00	407.00	262.00	407.00
305.00	393.00				

Profile: 3 (4 points) Material beneath: 4 - Soil Buttress

155.00	405.00	168.00	412.00	175.00	412.00
190.00	400.00				

Profile: 4 (2 points) Material beneath: 1 - Tailings

182.00	406.00	249.10	406.00
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Profile: 5 (11 points) Material beneath: 6 - Tailings/Geomembrane Interface

90.00	411.00	155.00	405.00	168.00	412.00
175.00	412.00	182.00	406.00		
219.00	406.00	240.00	420.00	244.00	420.00
244.10	417.00	246.90	417.00		
247.00	420.00				
Profile: 6 (4 points) Material beneath: 2 - Embankment (Proposed)					
219.00	406.00	240.00	420.00	248.00	420.00
305.00	393.00				
Profile: 7 (2 points) Material beneath: 1 - Tailings					
90.00	418.00	237.30	418.00		

Slope Surface (5 points)

90.00	418.00	237.30	418.00	240.10	420.00
248.00	420.00	305.00	393.00		

Piezometric Surfaces (1 surface)

Failure Surface

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

Intersects: XL: 255.70 YL: 416.35 XR: 295.50 YR: 397.50

Centre: XC: 294.82 YC: 447.50 Radius: R: 50.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	30.00	10.00	5.00
Trial positions within range:	15	15	25

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RESULTS: Analysis 7 - 2023 Embankment Stability - Outslope

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.432

There were: 5613 successful analyses from a total of 5625 trial surfaces
12 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.39

Results Summary - Lowest 99 Factor of Safety circles

Circle Radius	X-Left FoS	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre
1	262.13	413.31	300.50	395.13	301.87	447.61
52.50	1.391	<-- Critical Surface				
2	264.27	412.29	300.50	395.13	302.09	445.31
50.21	1.391					
3	264.27	412.29	300.50	395.13	303.06	447.36
52.29	1.391					
4	264.27	412.29	300.50	395.13	303.16	447.56
52.50	1.391					
5	262.13	413.31	300.50	395.13	301.77	447.41
52.29	1.391					
6	264.27	412.29	300.50	395.13	302.96	447.16
52.08	1.391					
7	264.27	412.29	300.50	395.13	302.87	446.95
51.88	1.391					
8	264.27	412.29	300.50	395.13	302.77	446.75
51.67	1.391					
9	264.27	412.29	300.50	395.13	302.67	446.54
51.46	1.391					
10	264.27	412.29	300.50	395.13	302.58	446.34
51.25	1.391					
11	262.13	413.31	300.50	395.13	301.67	447.20
52.08	1.391					
12	264.27	412.29	300.50	395.13	302.48	446.13
51.04	1.391					
13	264.27	412.29	300.50	395.13	302.38	445.93
50.83	1.391					
14	264.27	412.29	300.50	395.13	302.29	445.73
50.62	1.392					
15	264.27	412.29	300.50	395.13	301.99	445.11
50.00	1.392					
16	262.13	413.31	300.50	395.13	301.58	447.00
51.88	1.392					
17	264.27	412.29	300.50	395.13	302.19	445.52
50.42	1.392					
18	262.13	413.31	300.50	395.13	301.48	446.79
51.67	1.392					
19	264.27	412.29	300.50	395.13	301.90	444.90
49.79	1.392					
20	262.13	413.31	300.50	395.13	301.38	446.58
51.46	1.392					
21	264.27	412.29	300.50	395.13	301.80	444.70
49.58	1.392					
22	262.13	413.31	300.50	395.13	301.28	446.38
51.25	1.393					
23	264.27	412.29	300.50	395.13	301.70	444.49
49.38	1.393					

24	262.13	413.31	300.50	395.13	301.18	446.17
51.04	1.393					
25	264.27	412.29	300.50	395.13	301.60	444.29
49.17	1.393					
26	264.27	412.29	300.50	395.13	301.51	444.08
48.96	1.393					
27	266.41	411.28	300.50	395.13	304.34	447.28
52.29	1.393					
28	262.13	413.31	300.50	395.13	301.09	445.96
50.83	1.393					
29	266.41	411.28	300.50	395.13	303.09	444.65
49.58	1.394					
30	266.41	411.28	300.50	395.13	302.99	444.44
49.38	1.394					
31	266.41	411.28	300.50	395.13	303.18	444.85
49.79	1.394					
32	266.41	411.28	300.50	395.13	302.89	444.24
49.17	1.394					
33	266.41	411.28	300.50	395.13	302.80	444.04
48.96	1.394					
34	266.41	411.28	300.50	395.13	303.28	445.05
50.00	1.394					
35	266.41	411.28	300.50	395.13	302.70	443.83
48.75	1.394					
36	266.41	411.28	300.50	395.13	303.38	445.26
50.21	1.394					
37	266.41	411.28	300.50	395.13	303.47	445.46
50.42	1.394					
38	266.41	411.28	300.50	395.13	302.60	443.63
48.54	1.394					
39	266.41	411.28	300.50	395.13	303.57	445.66
50.62	1.394					
40	266.41	411.28	300.50	395.13	302.51	443.42
48.33	1.394					
41	266.41	411.28	300.50	395.13	303.67	445.87
50.83	1.394					
42	264.27	412.29	300.50	395.13	301.41	443.87
48.75	1.394					
43	266.41	411.28	300.50	395.13	302.41	443.22
48.12	1.394					
44	266.41	411.28	300.50	395.13	303.76	446.07
51.04	1.394					
45	266.41	411.28	300.50	395.13	302.31	443.01
47.92	1.394					
46	266.41	411.28	300.50	395.13	303.86	446.27
51.25	1.394					
47	266.41	411.28	300.50	395.13	302.22	442.81
47.71	1.394					
48	262.13	413.31	300.50	395.13	300.99	445.75
50.62	1.394					

49	266.41	411.28	300.50	395.13	303.95	446.47
51.46	1.394					
50	266.41	411.28	300.50	395.13	304.05	446.68
51.67	1.394					
51	266.41	411.28	300.50	395.13	304.24	447.08
52.08	1.394					
52	266.41	411.28	300.50	395.13	302.12	442.60
47.50	1.394					
53	264.27	412.29	300.50	395.13	301.31	443.67
48.54	1.394					
54	266.41	411.28	300.50	395.13	304.14	446.88
51.88	1.394					
55	259.99	414.32	300.50	395.13	300.57	447.63
52.50	1.394					
56	262.13	413.31	300.50	395.13	300.89	445.55
50.42	1.394					
57	264.27	412.29	300.50	395.13	301.21	443.46
48.33	1.394					
58	259.99	414.32	300.50	395.13	300.47	447.42
52.29	1.395					
59	264.27	412.29	300.50	395.13	301.12	443.25
48.12	1.395					
60	262.13	413.31	300.50	395.13	300.79	445.34
50.21	1.395					
61	266.41	411.28	300.50	395.13	304.43	447.48
52.50	1.395					
62	264.27	412.29	300.50	395.13	301.02	443.05
47.92	1.395					
63	259.99	414.32	300.50	395.13	300.37	447.21
52.08	1.395					
64	262.13	413.31	300.50	395.13	300.69	445.13
50.00	1.395					
65	264.27	412.29	300.50	395.13	300.92	442.84
47.71	1.396					
66	259.99	414.32	300.50	395.13	300.27	447.01
51.88	1.396					
67	262.13	413.31	299.79	395.47	301.00	446.71
51.25	1.396					
68	262.13	413.31	300.50	395.13	300.59	444.92
49.79	1.396					
69	262.13	413.31	299.79	395.47	301.59	447.94
52.50	1.396					
70	262.13	413.31	299.79	395.47	301.49	447.73
52.29	1.396					
71	264.27	412.29	300.50	395.13	300.82	442.63
47.50	1.396					
72	262.13	413.31	299.79	395.47	301.39	447.53
52.08	1.396					
73	262.13	413.31	299.79	395.47	301.29	447.32
51.88	1.396					

74	259.99	414.32	300.50	395.13	300.17	446.80
51.67	1.396					
75	262.13	413.31	300.50	395.13	300.50	444.71
49.58	1.396					
76	262.13	413.31	299.79	395.47	301.20	447.12
51.67	1.396					
77	262.13	413.31	299.79	395.47	301.10	446.91
51.46	1.397					
78	268.56	410.26	300.50	395.13	303.79	443.35
48.33	1.397					
79	262.13	413.31	299.79	395.47	300.90	446.50
51.04	1.397					
80	268.56	410.26	300.50	395.13	303.40	442.54
47.50	1.397					
81	268.56	410.26	300.50	395.13	303.50	442.75
47.71	1.397					
82	259.99	414.32	300.50	395.13	300.07	446.59
51.46	1.397					
83	268.56	410.26	300.50	395.13	303.59	442.95
47.92	1.397					
84	262.13	413.31	300.50	395.13	300.40	444.51
49.38	1.397					
85	268.56	410.26	300.50	395.13	303.69	443.15
48.12	1.397					
86	262.13	413.31	299.79	395.47	300.81	446.29
50.83	1.397					
87	259.99	414.32	299.79	395.47	300.29	447.97
52.50	1.397					
88	262.13	413.31	299.79	395.47	300.71	446.09
50.62	1.397					
89	259.99	414.32	300.50	395.13	299.97	446.38
51.25	1.397					
90	262.13	413.31	300.50	395.13	300.30	444.30
49.17	1.397					
91	259.99	414.32	299.79	395.47	300.19	447.76
52.29	1.398					
92	262.13	413.31	299.79	395.47	300.61	445.88
50.42	1.398					
93	259.99	414.32	300.50	395.13	299.87	446.17
51.04	1.398					
94	259.99	414.32	299.79	395.47	300.09	447.55
52.08	1.398					
95	268.56	410.26	300.50	395.13	303.88	443.56
48.54	1.398					
96	262.13	413.31	300.50	395.13	300.20	444.09
48.96	1.398					
97	262.13	413.31	299.79	395.47	300.51	445.67
50.21	1.398					
98	262.13	413.31	300.50	395.13	300.10	443.88
48.75	1.398					

99	268.56	410.26	300.50	395.13	303.98	443.76
48.75	1.398					

Critical Failure Surface (circle 1)

Intersects:	XL:	262.13	YL:	413.31	XR:	300.50	YR:
395.13							
Centre:	XC:	301.87	YC:	447.61		Radius:	R:
52.50							

Generated failure surface: (20 points)

262.13	413.31	263.67	411.60	265.28	409.96
266.97	408.39	268.72	406.90		
270.54	405.49	272.41	404.16	274.34	402.91
276.33	401.75	278.36	400.67		
280.44	399.69	282.56	398.79	284.72	397.99
286.91	397.29	289.13	396.68		
291.37	396.17	293.63	395.76	295.91	395.45
298.20	395.24	300.50	395.13		

Slice Geometry and Properties - Critical Failure Surface (circle 1, 39 slices)

Slice	PoreWater	X-S	Normal	Test	Base			
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Stress	Factor					
1	262.13	0.19	47.9	0.77	1.15	2	0.00	35.0
24.48	0.00	20.40	0.96					
2	262.90	0.57	47.9	0.77	1.15	2	0.00	35.0
73.46	0.00	61.20	0.96					
3	263.67	0.97	45.4	0.81	1.15	2	0.00	35.0
125.50	0.00	102.90	0.94					
4	264.48	1.32	45.4	0.81	1.15	2	0.00	35.0
171.40	0.00	140.52	0.94					
5	265.28	1.72	42.9	0.84	1.15	2	0.00	35.0
223.78	0.00	180.96	0.93					
6	266.13	2.05	42.9	0.84	1.15	2	0.00	35.0
265.87	0.00	214.99	0.93					
7	266.97	2.44	40.4	0.88	1.15	2	0.00	35.0
317.20	0.00	253.52	0.92					
8	267.84	2.73	40.4	0.88	1.15	2	0.00	35.0
354.85	0.00	283.62	0.92					
9	268.72	3.10	37.9	0.91	1.15	2	0.00	35.0
403.54	0.00	319.43	0.91					
10	269.63	3.36	37.9	0.91	1.15	2	0.00	35.0
436.17	0.00	345.25	0.91					
11	270.54	3.70	35.4	0.94	1.15	2	0.00	35.0
481.02	0.00	377.84	0.90					
12	271.47	3.91	35.4	0.94	1.15	2	0.00	35.0
508.08	0.00	399.11	0.90					
13	272.41	3.71	32.9	0.85	1.02	2	0.00	35.0

482.65	0.00	426.93	0.90				
14	273.26	3.84	32.9	0.85	1.02	2	0.00 35.0
498.97	0.00	441.38	0.90				
15	274.12	1.04	32.9	0.23	0.27	3	0.00 30.0
134.93	0.00	470.61	0.94				
16	274.34	4.63	30.4	0.99	1.15	3	0.00 30.0
600.90	0.00	487.04	0.93				
17	275.33	4.74	30.4	0.99	1.15	3	0.00 30.0
613.47	0.00	497.24	0.93				
18	276.33	4.95	27.9	1.02	1.15	3	0.00 30.0
638.01	0.00	514.53	0.93				
19	277.34	5.00	27.9	1.02	1.15	3	0.00 30.0
643.89	0.00	519.25	0.93				
20	278.36	5.14	25.3	1.04	1.15	3	0.00 30.0
660.63	0.00	531.11	0.92				
21	279.40	5.14	25.3	1.04	1.15	3	0.00 30.0
659.55	0.00	530.24	0.92				
22	280.44	5.21	22.8	1.06	1.15	3	0.00 30.0
667.82	0.00	536.25	0.92				
23	281.50	5.16	22.8	1.06	1.15	3	0.00 30.0
659.38	0.00	529.48	0.92				
24	282.56	5.16	20.3	1.08	1.15	3	0.00 30.0
658.61	0.00	529.25	0.92				
25	283.64	5.04	20.3	1.08	1.15	3	0.00 30.0
642.61	0.00	516.40	0.92				
26	284.72	4.96	17.8	1.10	1.15	3	0.00 30.0
632.43	0.00	509.57	0.93				
27	285.81	4.78	17.8	1.10	1.15	3	0.00 30.0
608.78	0.00	490.51	0.93				
28	286.91	4.62	15.3	1.11	1.15	3	0.00 30.0
588.96	0.00	476.74	0.93				
29	288.02	4.38	15.3	1.11	1.15	3	0.00 30.0
557.40	0.00	451.18	0.93				
30	289.13	4.15	12.8	1.12	1.15	3	0.00 30.0
527.86	0.00	430.09	0.94				
31	290.25	3.84	12.8	1.12	1.15	3	0.00 30.0
488.34	0.00	397.87	0.94				
32	291.37	3.53	10.3	1.13	1.15	3	0.00 30.0
449.20	0.00	369.12	0.95				
33	292.50	3.15	10.3	1.13	1.15	3	0.00 30.0
401.82	0.00	330.20	0.95				
34	293.63	2.77	7.8	1.14	1.15	3	0.00 30.0
353.17	0.00	293.29	0.96				
35	294.77	2.33	7.8	1.14	1.15	3	0.00 30.0
297.96	0.00	247.44	0.96				
36	295.91	1.78	5.3	1.08	1.09	3	0.00 30.0
228.87	0.00	203.42	0.97				
37	297.00	1.33	5.3	1.08	1.09	3	0.00 30.0
172.58	0.00	153.38	0.97				
38	298.08	0.94	3.0	1.21	1.21	2	0.00 35.0

121.61	0.00	97.88	0.98					
39	299.29	0.31	2.7	1.21	1.21	2	0.00	35.0
40.49	0.00	32.66	0.98					

X-S Area: 127.67 Path Length: 43.71 X-S Weight: 16416.23

DATA: Analysis 8 - 2023 Embankment Stability - Outslope

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 5 - Bedrock

90.00	411.00	305.00	390.00
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Profile: 2 (4 points) Material beneath: 3 - Embankment (Existing)

230.80	396.60	251.00	407.00	262.00	407.00
305.00	393.00				

Profile: 3 (4 points) Material beneath: 4 - Soil Buttress

155.00	405.00	168.00	412.00	175.00	412.00
190.00	400.00				
Profile: 4 (2 points)		Material beneath: 1 - Tailings			
182.00	406.00	249.10	406.00		
Profile: 5 (11 points)		Material beneath: 6 - Tailings/Geomembrane Interface			
90.00	411.00	155.00	405.00	168.00	412.00
175.00	412.00	182.00	406.00		
219.00	406.00	240.00	420.10	244.00	420.10
244.10	417.00	246.90	417.00		
247.00	420.00				
Profile: 6 (4 points)		Material beneath: 2 - Embankment (Proposed)			
219.00	406.00	240.00	420.00	248.00	420.00
305.00	393.00				
Profile: 7 (2 points)		Material beneath: 1 - Tailings			
90.00	418.00	237.30	418.00		

Slope Surface (5 points)

90.00	418.00	237.30	418.00	240.10	420.00
248.00	420.00	305.00	393.00		

Piezometric Surfaces (1 surface)

Failure Surface (Critical, from previous analysis)

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

Intersects: XL: 262.13 YL: 413.31 XR: 300.50 YR: 395.13

Centre: XC: 301.87 YC: 447.61 Radius: R: 52.50

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.050

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	30.00	10.00	5.00
Trial positions within range:	15	15	25

- - - - -

RESULTS: Analysis 8 - 2023 Embankment Stability - Outslope

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.231

There were: 5238 successful analyses from a total of 5625 trial surfaces
387 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.20

Results Summary - Lowest 99 Factor of Safety circles

Circle Radius	X-Left FoS	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre
1	272.84	408.23	304.79	393.10	309.69	444.74
51.88	1.199	<-- Critical Surface				
2	272.84	408.23	304.79	393.10	309.60	444.54
51.67	1.199					
3	270.70	409.25	304.79	393.10	309.86	447.87
55.00	1.200					
4	272.84	408.23	304.79	393.10	309.79	444.94
52.08	1.200					
5	272.84	408.23	304.79	393.10	309.88	445.14
52.29	1.200					
6	270.70	409.25	304.79	393.10	309.77	447.67
54.79	1.200					
7	272.84	408.23	304.79	393.10	309.50	444.34
51.46	1.200					
8	272.84	408.23	304.79	393.10	309.98	445.34
52.50	1.200					
9	272.84	408.23	304.79	393.10	310.07	445.54
52.71	1.200					
10	272.84	408.23	304.79	393.10	310.17	445.74
52.92	1.200					
11	272.84	408.23	304.79	393.10	310.26	445.94
53.12	1.200					
12	270.70	409.25	304.79	393.10	309.67	447.47
54.58	1.200					
13	272.84	408.23	304.79	393.10	310.36	446.14
53.33	1.200					
14	272.84	408.23	304.79	393.10	309.41	444.14
51.25	1.200					
15	272.84	408.23	304.79	393.10	310.45	446.34
53.54	1.200					
16	272.84	408.23	304.79	393.10	310.54	446.54
53.75	1.200					
17	272.84	408.23	304.79	393.10	309.31	443.94
51.04	1.200					
18	270.70	409.25	304.79	393.10	309.58	447.27
54.38	1.200					
19	272.84	408.23	304.79	393.10	310.64	446.74

53.96	1.200					
20	274.99	407.22	304.79	393.10	310.09	442.82
50.00	1.200					
21	272.84	408.23	304.79	393.10	310.73	446.94
54.17	1.200					
22	274.99	407.22	304.79	393.10	310.19	443.02
50.21	1.200					
23	272.84	408.23	304.79	393.10	310.83	447.14
54.38	1.200					
24	270.70	409.25	304.79	393.10	309.48	447.06
54.17	1.200					
25	272.84	408.23	304.79	393.10	309.22	443.74
50.83	1.200					
26	274.99	407.22	304.79	393.10	310.28	443.22
50.42	1.200					
27	272.84	408.23	304.79	393.10	310.92	447.34
54.58	1.200					
28	274.99	407.22	304.79	393.10	310.38	443.42
50.62	1.200					
29	272.84	408.23	304.79	393.10	311.02	447.54
54.79	1.200					
30	270.70	409.25	304.79	393.10	309.39	446.86
53.96	1.200					
31	274.99	407.22	304.79	393.10	310.47	443.62
50.83	1.200					
32	272.84	408.23	304.79	393.10	309.12	443.54
50.62	1.200					
33	272.84	408.23	304.79	393.10	311.11	447.74
55.00	1.200					
34	274.99	407.22	304.79	393.10	310.56	443.81
51.04	1.200					
35	270.70	409.25	304.79	393.10	309.29	446.66
53.75	1.200					
36	274.99	407.22	304.79	393.10	310.66	444.01
51.25	1.200					
37	272.84	408.23	304.79	393.10	309.03	443.34
50.42	1.200					
38	274.99	407.22	304.79	393.10	310.75	444.21
51.46	1.200					
39	270.70	409.25	304.79	393.10	309.19	446.46
53.54	1.201					
40	274.99	407.22	304.79	393.10	310.85	444.41
51.67	1.201					
41	272.84	408.23	304.79	393.10	308.93	443.14
50.21	1.201					
42	274.99	407.22	304.79	393.10	310.94	444.61
51.88	1.201					
43	270.70	409.25	304.79	393.10	309.10	446.26
53.33	1.201					
44	274.99	407.22	304.79	393.10	311.04	444.81

52.08	1.201					
45	272.84	408.23	304.79	393.10	308.84	442.94
50.00	1.201					
46	274.99	407.22	304.79	393.10	311.13	445.01
52.29	1.201					
47	270.70	409.25	304.79	393.10	309.00	446.06
53.12	1.201					
48	274.99	407.22	304.79	393.10	311.22	445.21
52.50	1.201					
49	270.70	409.25	304.79	393.10	308.91	445.86
52.92	1.201					
50	274.99	407.22	304.79	393.10	311.32	445.40
52.71	1.201					
51	274.99	407.22	304.79	393.10	311.41	445.60
52.92	1.201					
52	270.70	409.25	304.79	393.10	308.81	445.66
52.71	1.201					
53	274.99	407.22	304.79	393.10	311.50	445.80
53.12	1.201					
54	274.99	407.22	304.79	393.10	312.35	447.58
55.00	1.201					
55	274.99	407.22	304.79	393.10	311.60	446.00
53.33	1.201					
56	270.70	409.25	304.79	393.10	308.72	445.45
52.50	1.201					
57	274.99	407.22	304.79	393.10	311.69	446.20
53.54	1.201					
58	270.70	409.25	304.79	393.10	308.62	445.25
52.29	1.202					
59	274.99	407.22	304.79	393.10	311.79	446.39
53.75	1.202					
60	274.99	407.22	304.79	393.10	311.88	446.59
53.96	1.202					
61	274.99	407.22	304.79	393.10	312.25	447.38
54.79	1.202					
62	270.70	409.25	304.79	393.10	308.53	445.05
52.08	1.202					
63	277.13	406.20	304.79	393.10	311.71	443.46
50.83	1.202					
64	277.13	406.20	304.79	393.10	311.33	442.67
50.00	1.202					
65	274.99	407.22	304.79	393.10	311.97	446.79
54.17	1.202					
66	277.13	406.20	304.79	393.10	311.43	442.87
50.21	1.202					
67	270.70	409.25	304.79	393.10	308.43	444.85
51.88	1.202					
68	274.99	407.22	304.79	393.10	312.07	446.99
54.38	1.202					
69	268.56	410.26	304.79	393.10	308.60	447.97

55.00	1.202					
70	277.13	406.20	304.79	393.10	311.52	443.07
50.42	1.202					
71	274.99	407.22	304.79	393.10	312.16	447.18
54.58	1.202					
72	270.70	409.25	304.79	393.10	308.33	444.65
51.67	1.202					
73	277.13	406.20	304.79	393.10	311.62	443.26
50.62	1.202					
74	268.56	410.26	304.79	393.10	308.50	447.77
54.79	1.202					
75	270.70	409.25	304.79	393.10	308.24	444.44
51.46	1.202					
76	268.56	410.26	304.79	393.10	308.41	447.56
54.58	1.202					
77	270.70	409.25	304.79	393.10	308.14	444.24
51.25	1.203					
78	268.56	410.26	304.79	393.10	308.31	447.36
54.38	1.203					
79	277.13	406.20	304.79	393.10	311.80	443.66
51.04	1.203					
80	270.70	409.25	304.79	393.10	308.05	444.04
51.04	1.203					
81	268.56	410.26	304.79	393.10	308.21	447.16
54.17	1.203					
82	277.13	406.20	304.79	393.10	311.90	443.86
51.25	1.203					
83	270.70	409.25	304.79	393.10	307.95	443.84
50.83	1.203					
84	268.56	410.26	304.79	393.10	308.12	446.96
53.96	1.203					
85	270.70	409.25	304.79	393.10	307.86	443.63
50.62	1.203					
86	268.56	410.26	304.79	393.10	308.02	446.75
53.75	1.203					
87	277.13	406.20	304.79	393.10	311.99	444.05
51.46	1.203					
88	270.70	409.25	304.07	393.44	308.52	445.96
52.71	1.203					
89	268.56	410.26	304.79	393.10	307.93	446.55
53.54	1.203					
90	270.70	409.25	304.79	393.10	307.76	443.43
50.42	1.203					
91	277.13	406.20	304.79	393.10	312.08	444.25
51.67	1.204					
92	268.56	410.26	304.79	393.10	307.83	446.35
53.33	1.204					
93	270.70	409.25	304.79	393.10	307.66	443.23
50.21	1.204					
94	277.13	406.20	304.79	393.10	312.18	444.45

51.88	1.204					
95	270.70	409.25	304.07	393.44	308.42	445.76
52.50	1.204					
96	268.56	410.26	304.79	393.10	307.73	446.14
53.12	1.204					
97	270.70	409.25	304.79	393.10	307.57	443.02
50.00	1.204					
98	277.13	406.20	304.79	393.10	312.27	444.64
52.08	1.204					
99	268.56	410.26	304.79	393.10	307.64	445.94
52.92	1.204					

Critical Failure Surface (circle 1)

Intersects: XL: 272.84 YL: 408.23 XR: 304.79 YR: 393.10

Centre: XC: 309.69 YC: 444.74 Radius: R: 51.88

Generated failure surface: (20 points)

272.84	408.23	274.20	406.91	275.61	405.64
277.06	404.41	278.56	403.25		
280.10	402.14	281.68	401.08	283.30	400.09
284.95	399.15	286.63	398.28		
288.35	397.46	290.09	396.71	291.86	396.03
293.66	395.41	295.47	394.86		
297.31	394.37	299.16	393.95	301.02	393.60
302.90	393.32	304.79	393.10		

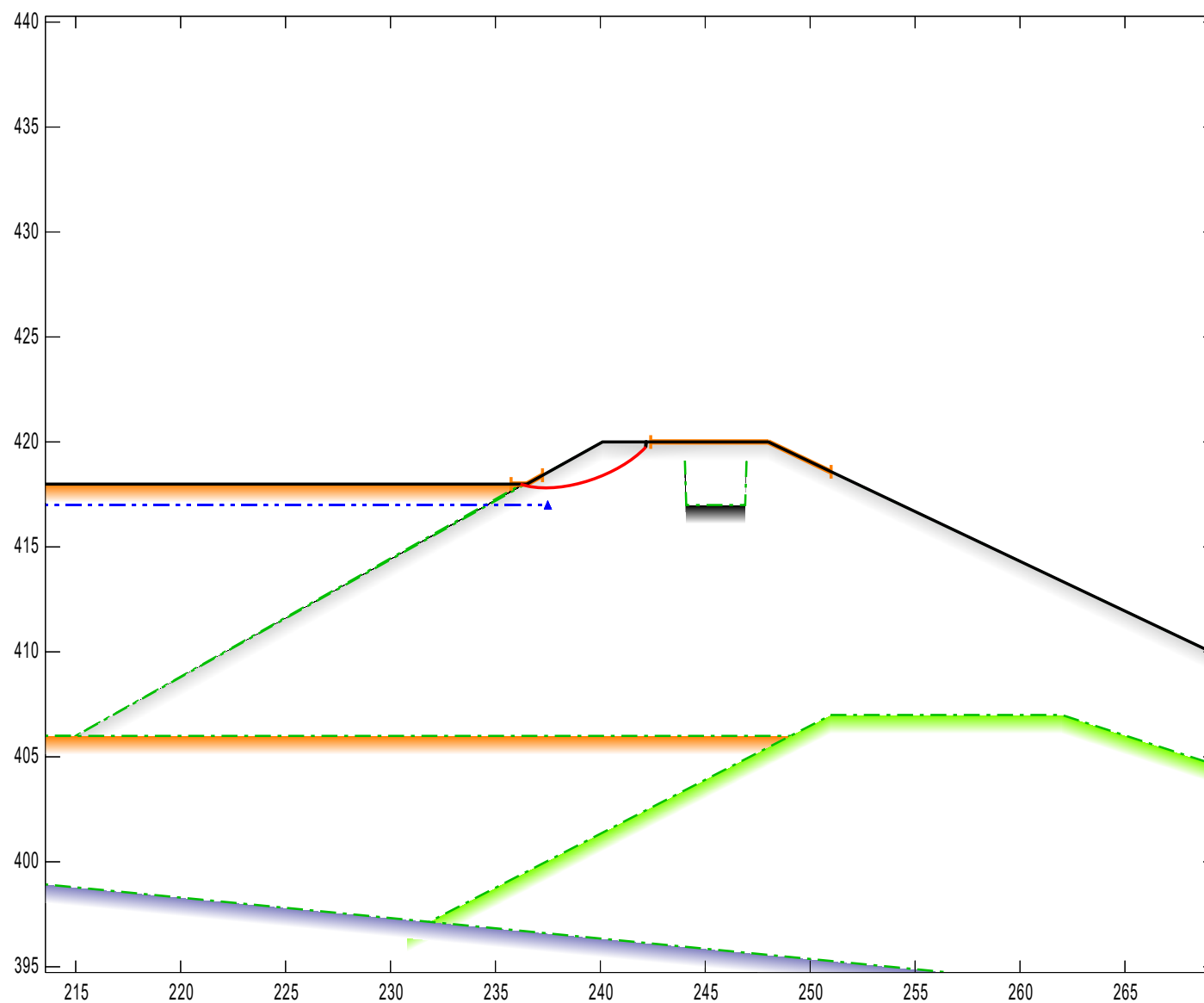
Slice Geometry and Properties - Critical Failure Surface (circle 1, 39 slices)

Slice	PoreWater	X-S	Normal	Test	Base			
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Stress	Factor					
1	272.84	0.12	44.2	0.68	0.95	2	0.00	35.0
15.00	0.00	14.06	0.89					
2	273.52	0.35	44.2	0.68	0.95	2	0.00	35.0
45.05	0.00	42.23	0.89					
3	274.20	0.58	42.1	0.70	0.95	2	0.00	35.0
76.02	0.00	70.67	0.88					
4	274.91	0.80	42.1	0.70	0.95	2	0.00	35.0
103.77	0.00	96.46	0.88					
5	275.61	1.03	40.0	0.73	0.95	2	0.00	35.0
134.02	0.00	123.72	0.88					
6	276.34	1.22	40.0	0.73	0.95	2	0.00	35.0
159.16	0.00	146.93	0.88					
7	277.06	1.45	37.9	0.75	0.95	2	0.00	35.0
188.00	0.00	172.59	0.87					
8	277.81	1.62	37.9	0.75	0.95	2	0.00	35.0
210.24	0.00	192.99	0.87					

9	278.56	1.82	35.8	0.77	0.95	2	0.00	35.0
237.13	0.00	216.77	0.87					
10	279.33	1.97	35.8	0.77	0.95	2	0.00	35.0
256.21	0.00	234.21	0.87					
11	280.10	2.16	33.7	0.79	0.95	2	0.00	35.0
280.49	0.00	255.66	0.87					
12	280.89	2.28	33.7	0.79	0.95	2	0.00	35.0
296.19	0.00	269.97	0.87					
13	281.68	2.44	31.6	0.81	0.95	2	0.00	35.0
317.34	0.00	288.81	0.86					
14	282.49	2.53	31.6	0.81	0.95	2	0.00	35.0
329.40	0.00	299.79	0.86					
15	283.30	2.67	29.5	0.83	0.95	3	0.00	30.0
346.44	0.00	329.62	0.90					
16	284.12	2.73	29.5	0.83	0.95	3	0.00	30.0
353.55	0.00	336.38	0.90					
17	284.95	2.84	27.4	0.84	0.95	3	0.00	30.0
365.91	0.00	347.50	0.90					
18	285.79	2.87	27.4	0.84	0.95	3	0.00	30.0
369.14	0.00	350.59	0.90					
19	286.63	2.94	25.3	0.86	0.95	3	0.00	30.0
377.19	0.00	358.08	0.90					
20	287.49	2.94	25.3	0.86	0.95	3	0.00	30.0
376.40	0.00	357.33	0.90					
21	288.35	2.97	23.2	0.87	0.95	3	0.00	30.0
379.85	0.00	360.93	0.90					
22	289.22	2.94	23.2	0.87	0.95	3	0.00	30.0
374.94	0.00	356.27	0.90					
23	290.09	2.93	21.2	0.89	0.95	3	0.00	30.0
373.47	0.00	355.66	0.90					
24	290.98	2.86	21.2	0.89	0.95	3	0.00	30.0
364.34	0.00	346.96	0.90					
25	291.86	2.81	19.1	0.90	0.95	3	0.00	30.0
357.83	0.00	342.00	0.91					
26	292.76	2.71	19.1	0.90	0.95	3	0.00	30.0
344.32	0.00	329.07	0.91					
27	293.66	2.62	17.0	0.91	0.95	3	0.00	30.0
332.60	0.00	319.46	0.91					
28	294.56	2.48	17.0	0.91	0.95	3	0.00	30.0
314.65	0.00	302.22	0.91					
29	295.47	2.35	14.9	0.92	0.95	3	0.00	30.0
297.63	0.00	287.68	0.92					
30	296.39	2.17	14.9	0.92	0.95	3	0.00	30.0
275.23	0.00	266.03	0.92					
31	297.31	2.00	12.8	0.93	0.95	3	0.00	30.0
252.90	0.00	246.34	0.92					
32	298.23	1.79	12.8	0.93	0.95	3	0.00	30.0
226.01	0.00	220.15	0.92					
33	299.16	1.57	10.7	0.93	0.95	3	0.00	30.0
198.45	0.00	195.07	0.93					

34	300.09	1.32	10.7	0.93	0.95	3	0.00	30.0
167.02	0.00		164.18	0.93				
35	301.02	1.06	8.6	0.94	0.95	3	0.00	30.0
134.30	0.00		133.42	0.94				
36	301.96	0.78	8.6	0.94	0.95	3	0.00	30.0
98.38	0.00		97.74	0.94				
37	302.90	0.45	6.5	0.87	0.87	3	0.00	30.0
57.32	0.00		62.60	0.95				
38	303.77	0.18	6.5	0.87	0.87	3	0.00	30.0
23.17	0.00		25.30	0.95				
39	304.64	0.00	6.5	0.15	0.15	2	0.00	35.0
0.52	0.00		3.29	0.94				

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X-S Area:	73.36	Path Length:	36.07
9409.58			X-S Weight:



Material Keys

1: Tailings

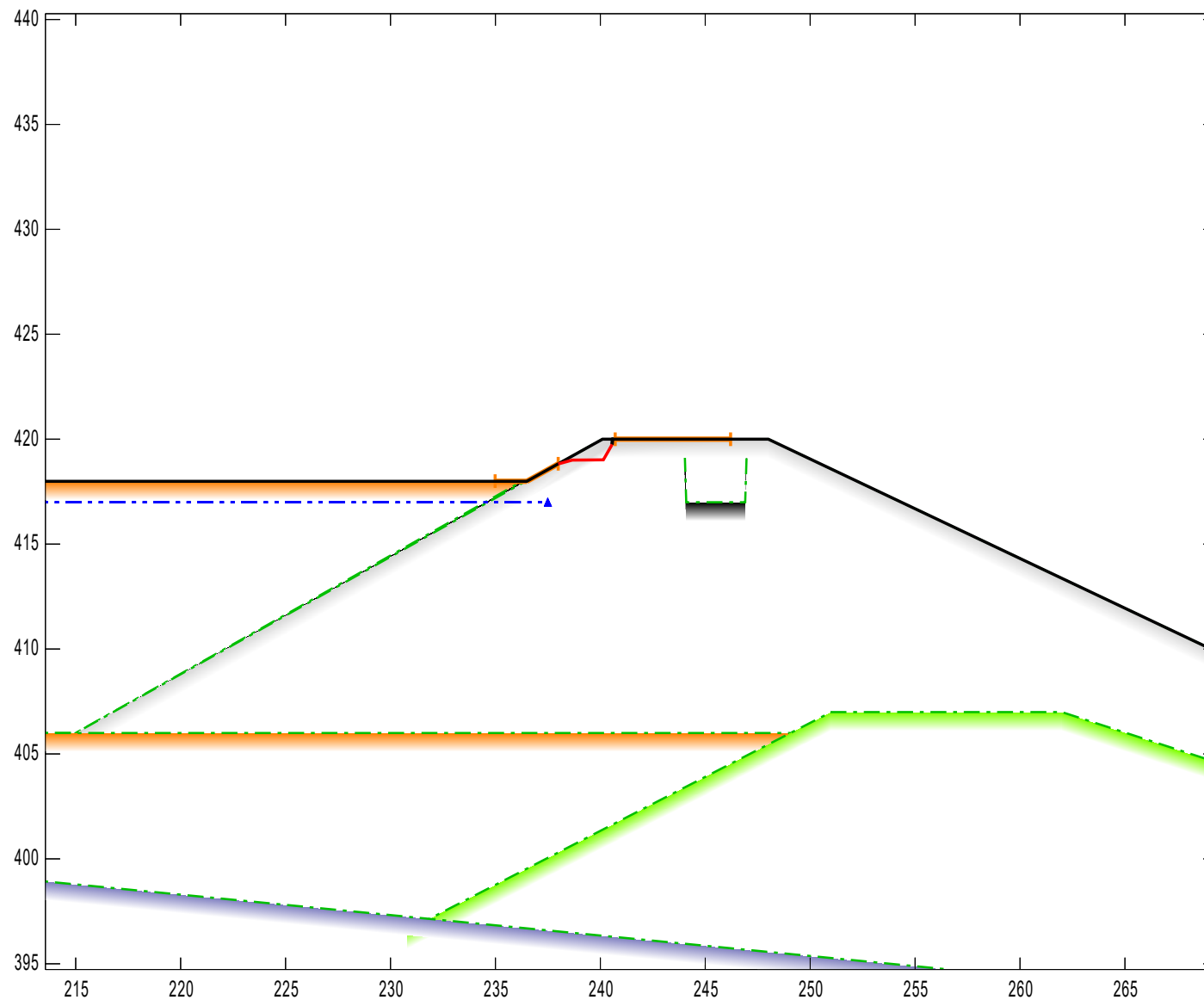
2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttress

5: Bedrock

6: Tailings/Geomembrane Interface



GALENA Version 7.1

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Analysis 2

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Non-Circular

Results

Critical Factor of Safety: 3.28

Interslice Force (Final) Angle: 22.3°

Edited: 13 Nov 2023

Processed: 13 Nov 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 2FT Below Top of Embankment

File: E:\Work\GL...\Lewicki_GHM-Tailings Storage Facility COMBINED-Spencer Wright_CT-2.gmf



Material Keys

1: Tailings

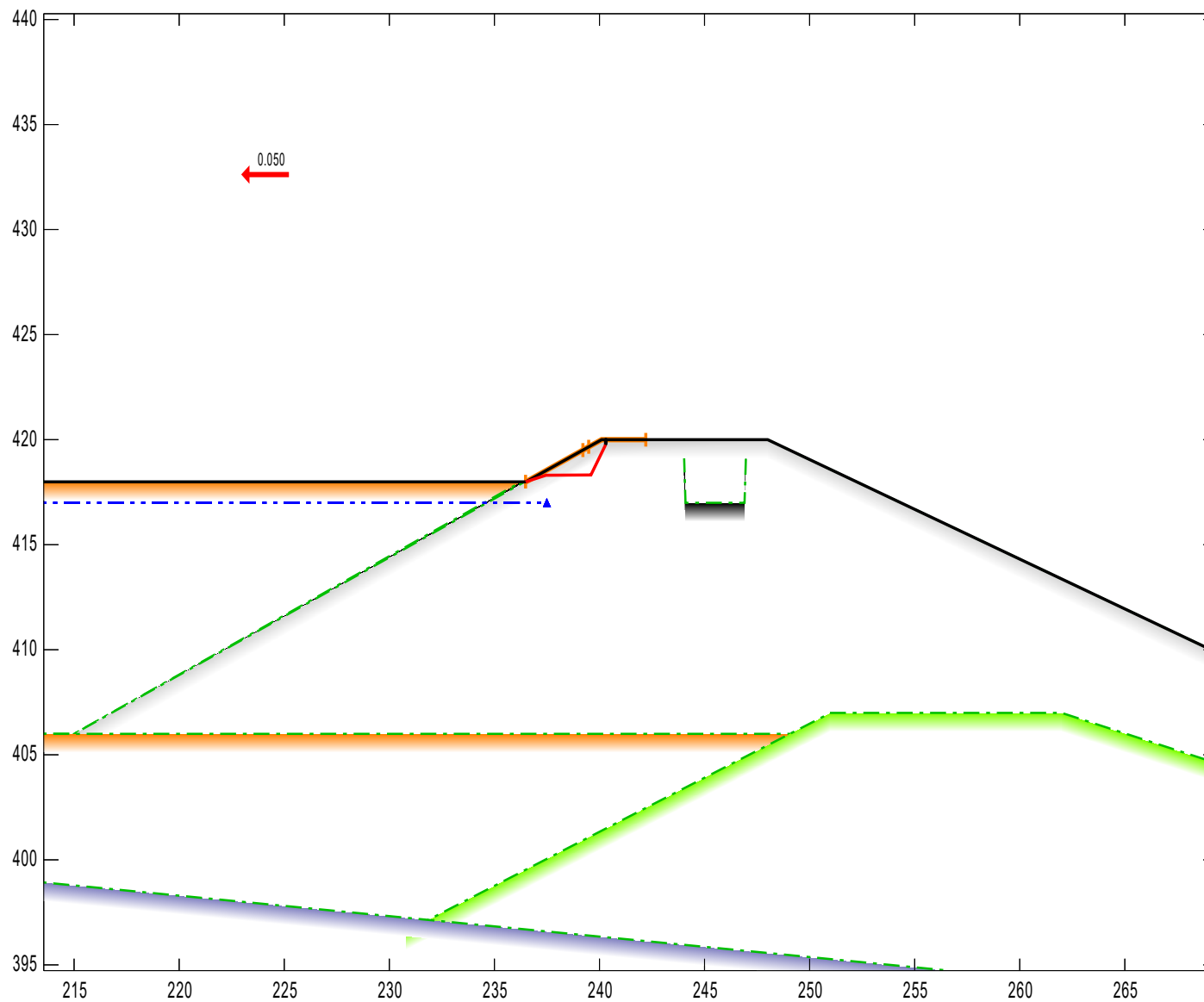
2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttress

5: Bedrock

6: Tailings/Geomembrane Interface



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Analysis 3

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Non-Circular (Critical Seed)

Results

Critical Factor of Safety: 2.52

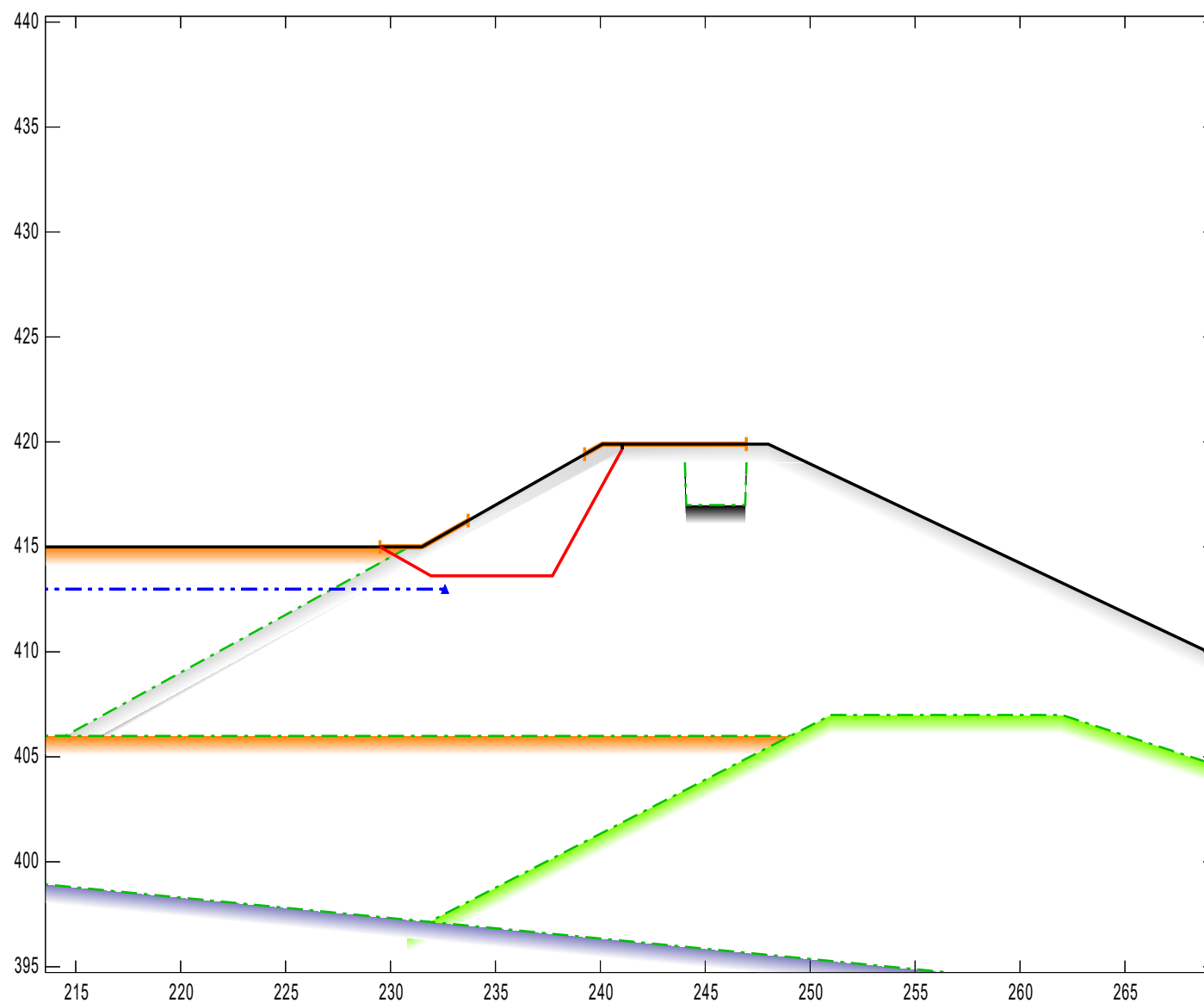
Interslice Force (Final) Angle: 28.3°

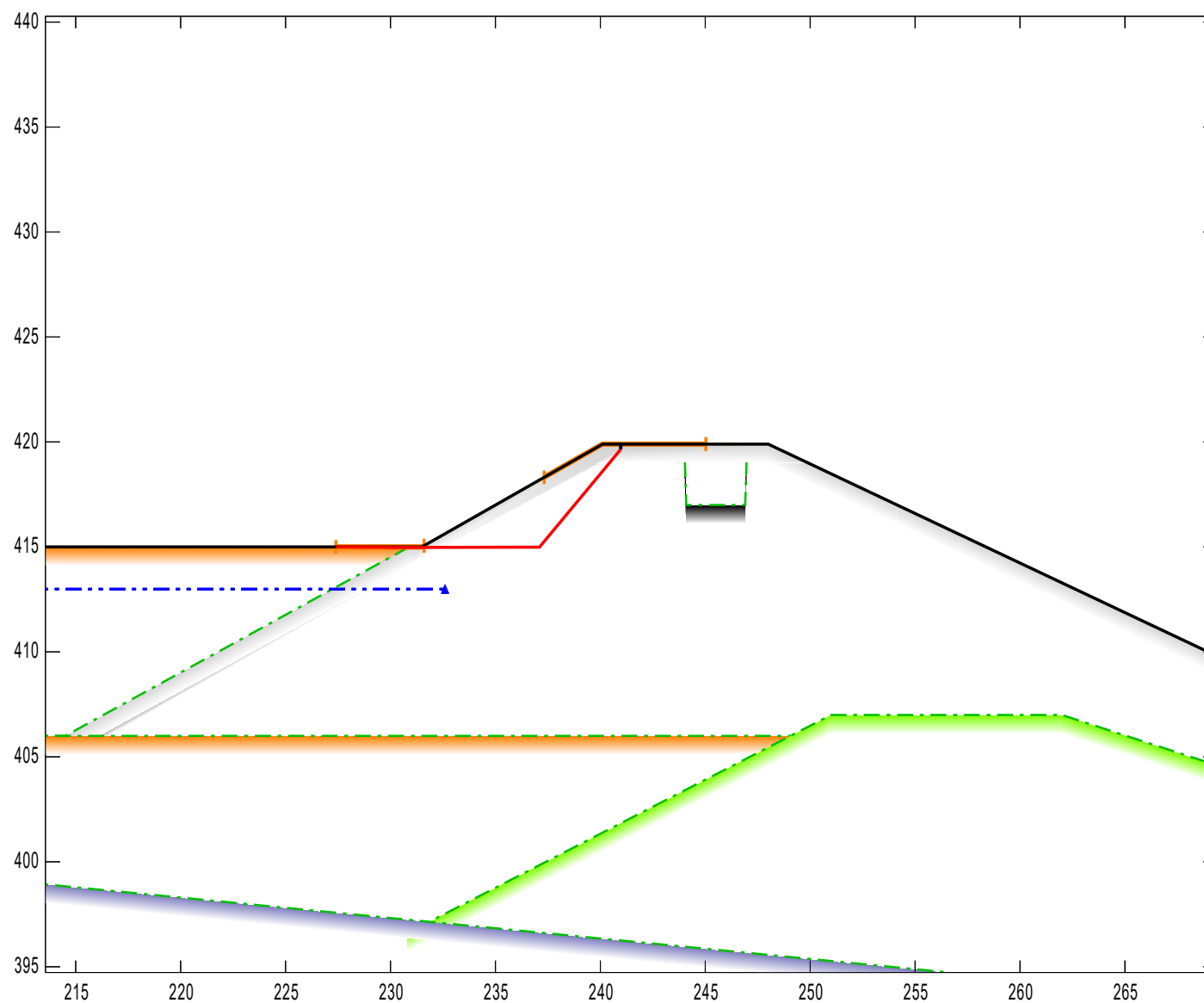
Edited: 13 Nov 2023
Processed: 13 Nov 2023

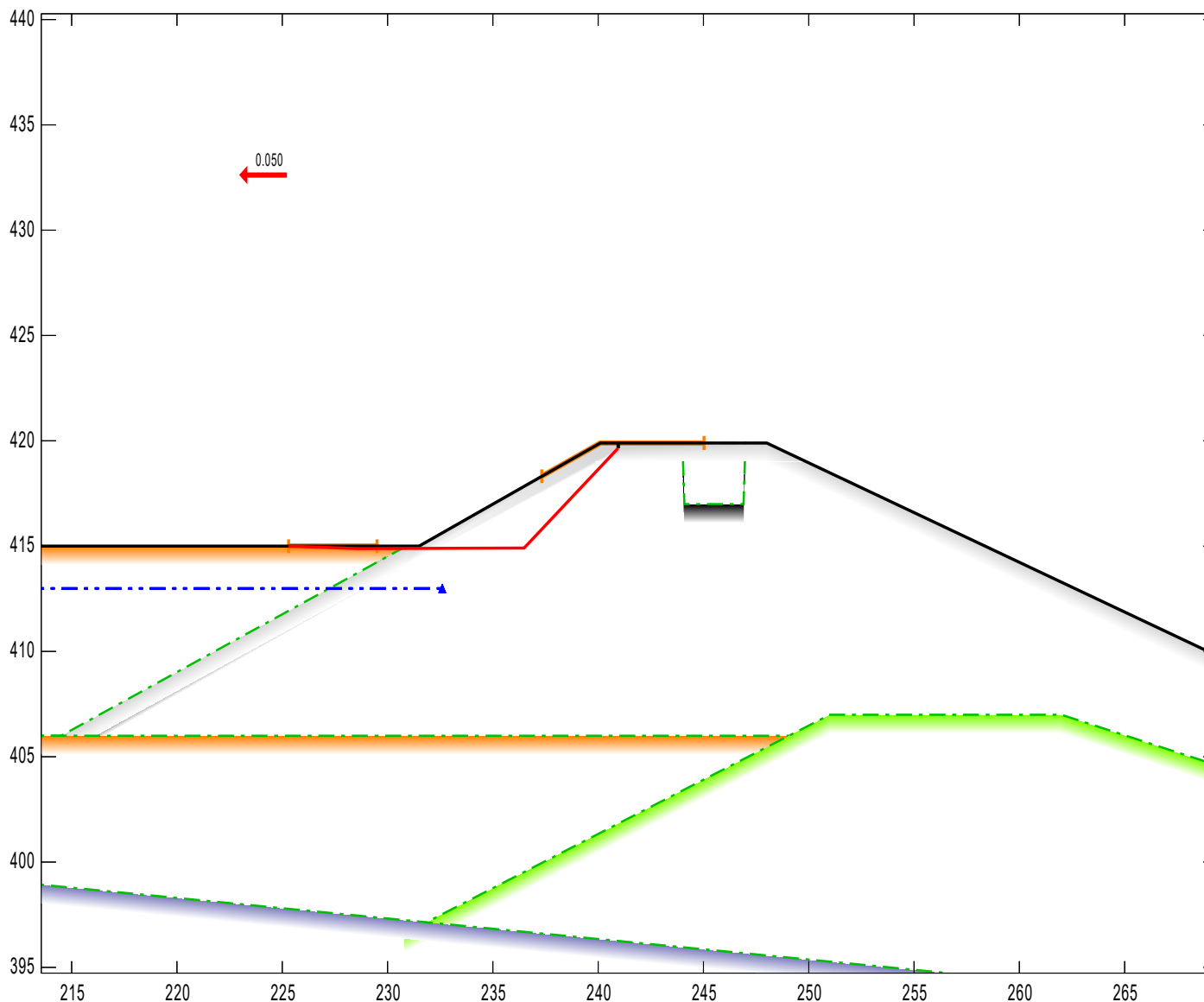


Project GHM - Tailings Storage Facility
2023 Embankment Stability - 2FT Below Top of Embankment - Seismic

File: E:\Work\GL...\Lewicki_GHM-Tailings Storage Facility COMBINED-Spencer Wright_CT-2.gmf







Material Keys

- 1: Tailings
- 2: Embankment (Proposed)
- 3: Embankment (Existing)
- 4: Soil Buttress
- 5: Bedrock
- 6: Tailings/Geomembrane Interface

Analysis 6

Multiple Stability Analysis
 Method: Spencer-Wright
 Surface: Non-Circular (Critical Seed)

Results

Critical Factor of Safety: 1.90
 Interslice Force (Final) Angle: 19.0°

Project GHM - Tailings Storage Facility
 2023 Embankment Stability - 5FT Below Top of Embankment - Seismic
 File: E:\Work\GL...\Lewicki_GHM-Tailings Storage Facility COMBINED-Spencer Wright_CT-2.gmf

Edited: 13 Nov 2023
 Processed: 13 Nov 2023



Material Keys

1: Tailings

2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttrass

5: Bedrock

6: Tailings/Geomembrane Interface

Analysis 7

Multiple Stability Analysis

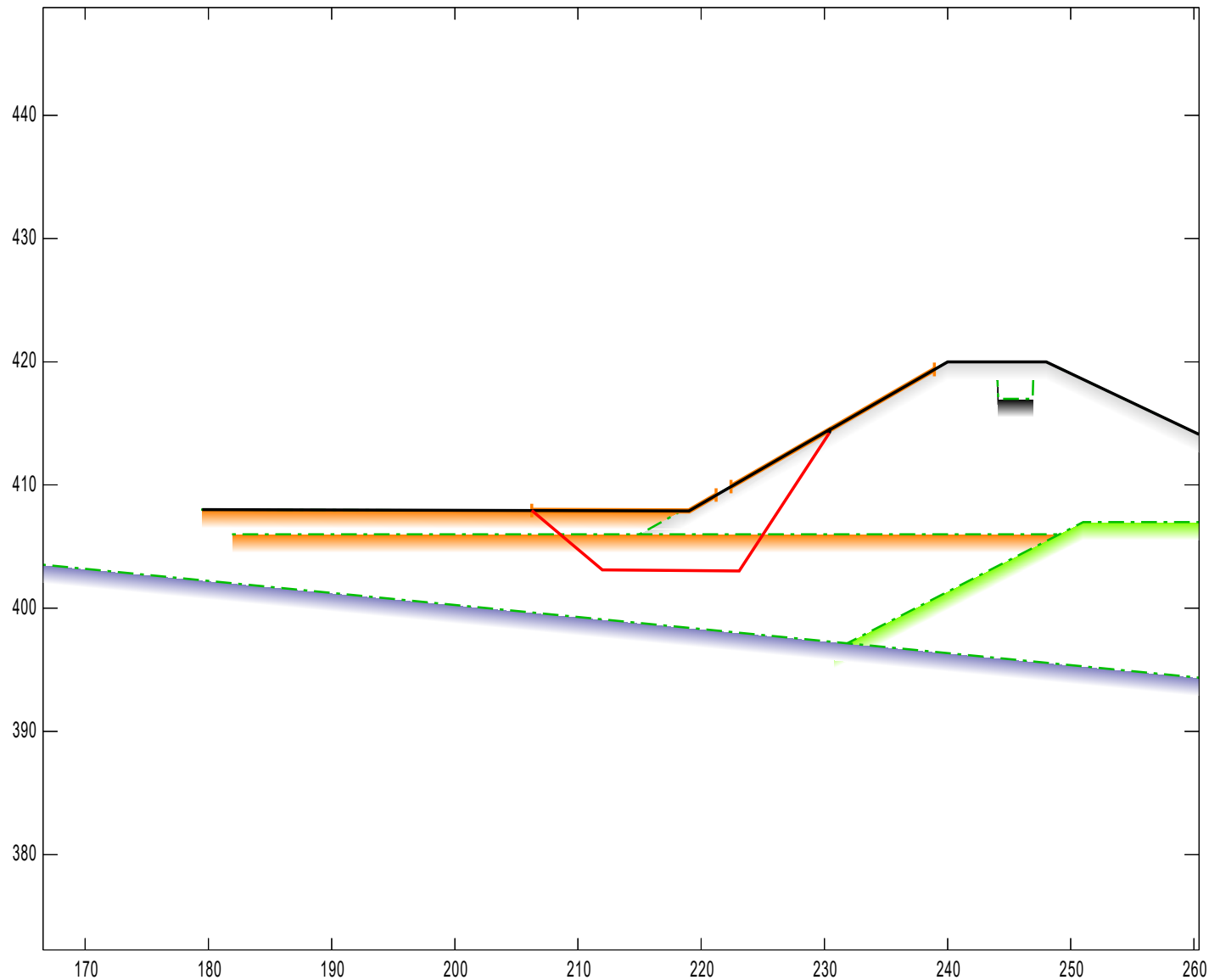
Method: Spencer-Wright

Surface: Non-Circular

Results

Critical Factor of Safety: 2.87
Interslice Force (Final) Angle: 11.4°

Edited: 13 Nov 2023
Processed: 13 Nov 2023



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Project GHM - Tailings Storage Facility
2023 Embankment Stability - 10FT Below Embankment Top

File: E:\Work\GL...\Lewicki_GHM-Tailings Storage Facility COMBINED-Spencer Wright_CT-2.gmf

Material Keys

1: Tailings

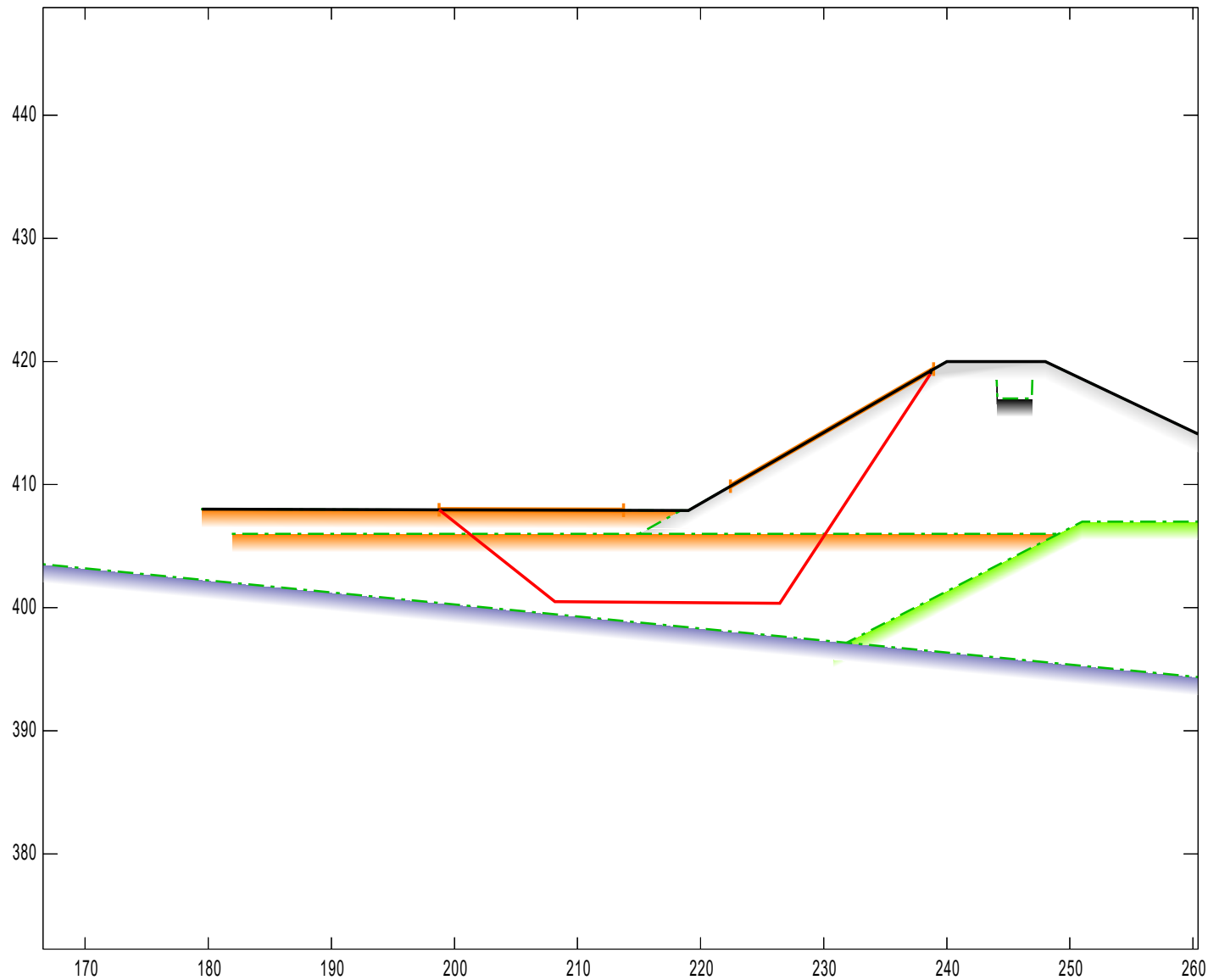
2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttress

5: Bedrock

6: Tailings/Geomembrane Interface



Analysis 8

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Non-Circular (Critical Seed)

Results

Critical Factor of Safety: 2.48

Interslice Force (Final) Angle: 12.2°

Edited: 13 Nov 2023

Processed: 13 Nov 2023



Project GHM - Tailings Storage Facility
2023 Embankment Stability - 10FT Below Embankment Top

File: E:\Work\GL...\Lewicki_GHM-Tailings Storage Facility COMBINED-Spencer Wright_CT-2.gmf

Material Keys

1: Tailings

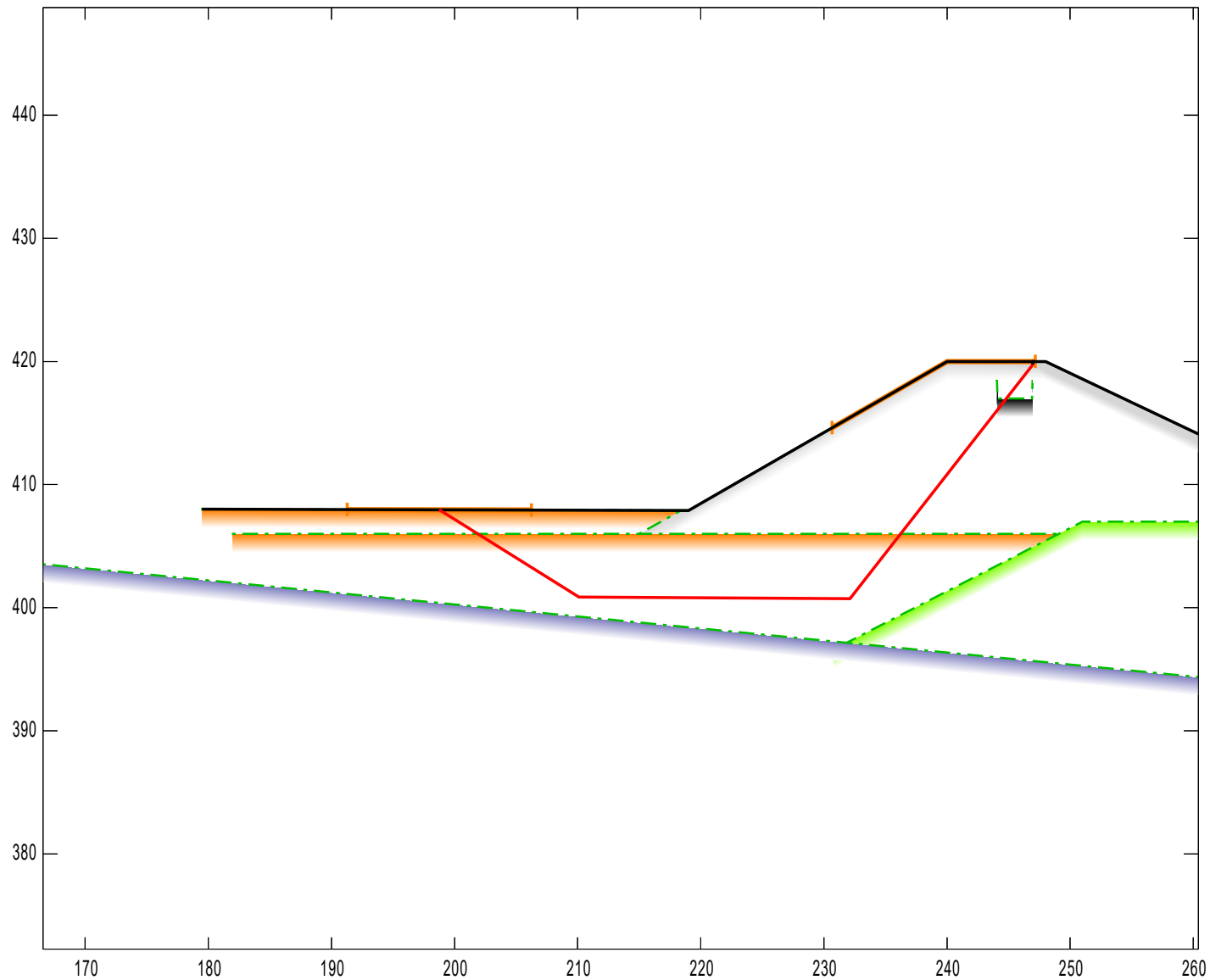
2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttress

5: Bedrock

6: Tailings/Geomembrane Interface



Analysis 9

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Non-Circular (Critical Seed)

Results

Critical Factor of Safety: 1.87

Interslice Force (Final) Angle: 13.2°

Edited: 13 Nov 2023

Processed: 13 Nov 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 10FT Below Embankment Top

File: E:\Work\GL...\Lewicki_GHM-Tailings Storage Facility COMBINED-Spencer Wright_CT-2.gmf



Material Keys

1: Tailings

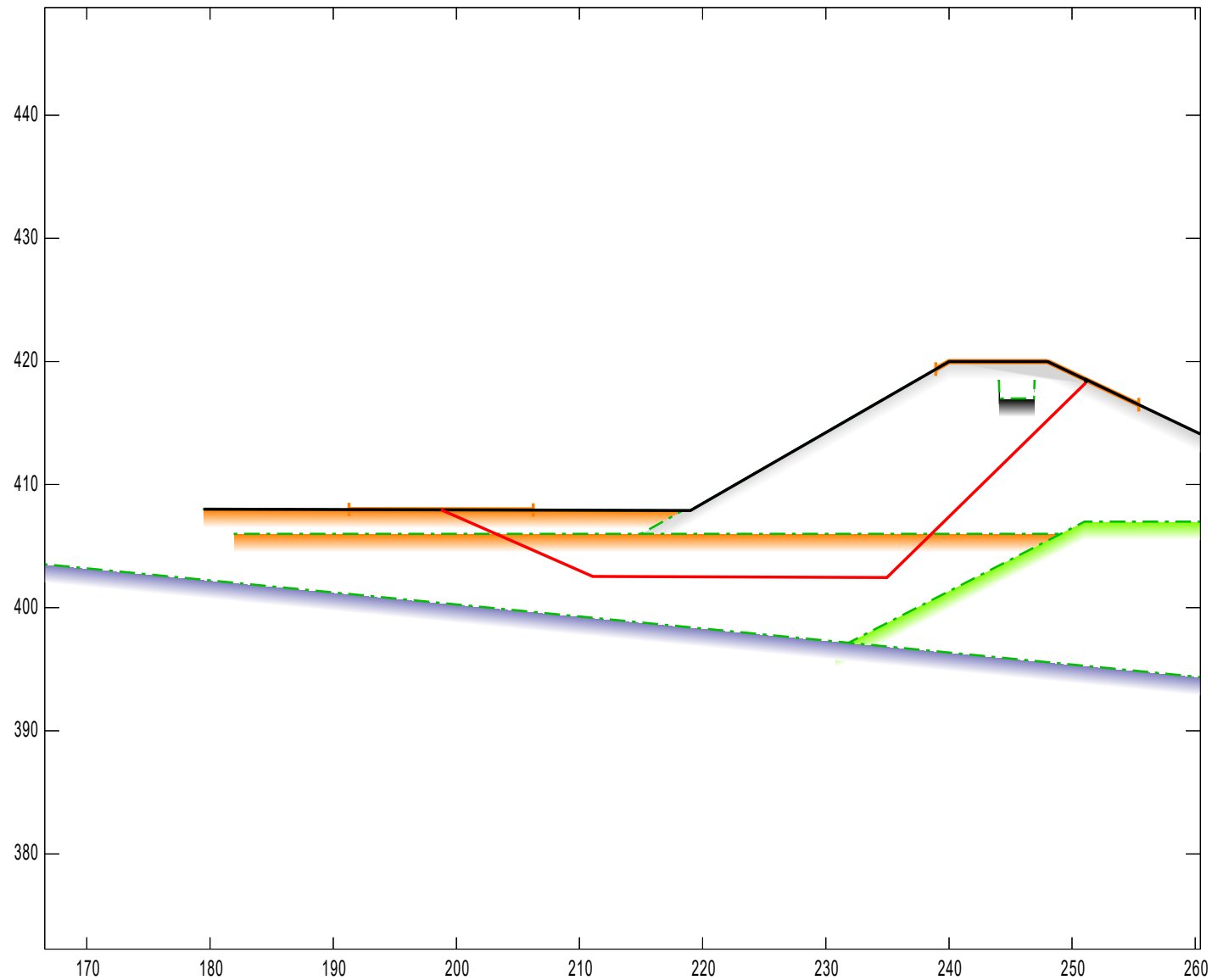
2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Butress

5: Bedrock

6: Tailings/Geomembrane Interface



GALENA Version 7.1

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Analysis 10

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Non-Circular (Critical Seed)

Results

Critical Factor of Safety: 1.76

Interslice Force (Final) Angle: 12.7°

Edited: 13 Nov 2023

Processed: 13 Nov 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 10FT Below Embankment Top

File: E:\Work\GL...\Lewicki_GHM-Tailings Storage Facility COMBINED-Spencer Wright_CT-2.gmf



Material Keys

1: Tailings

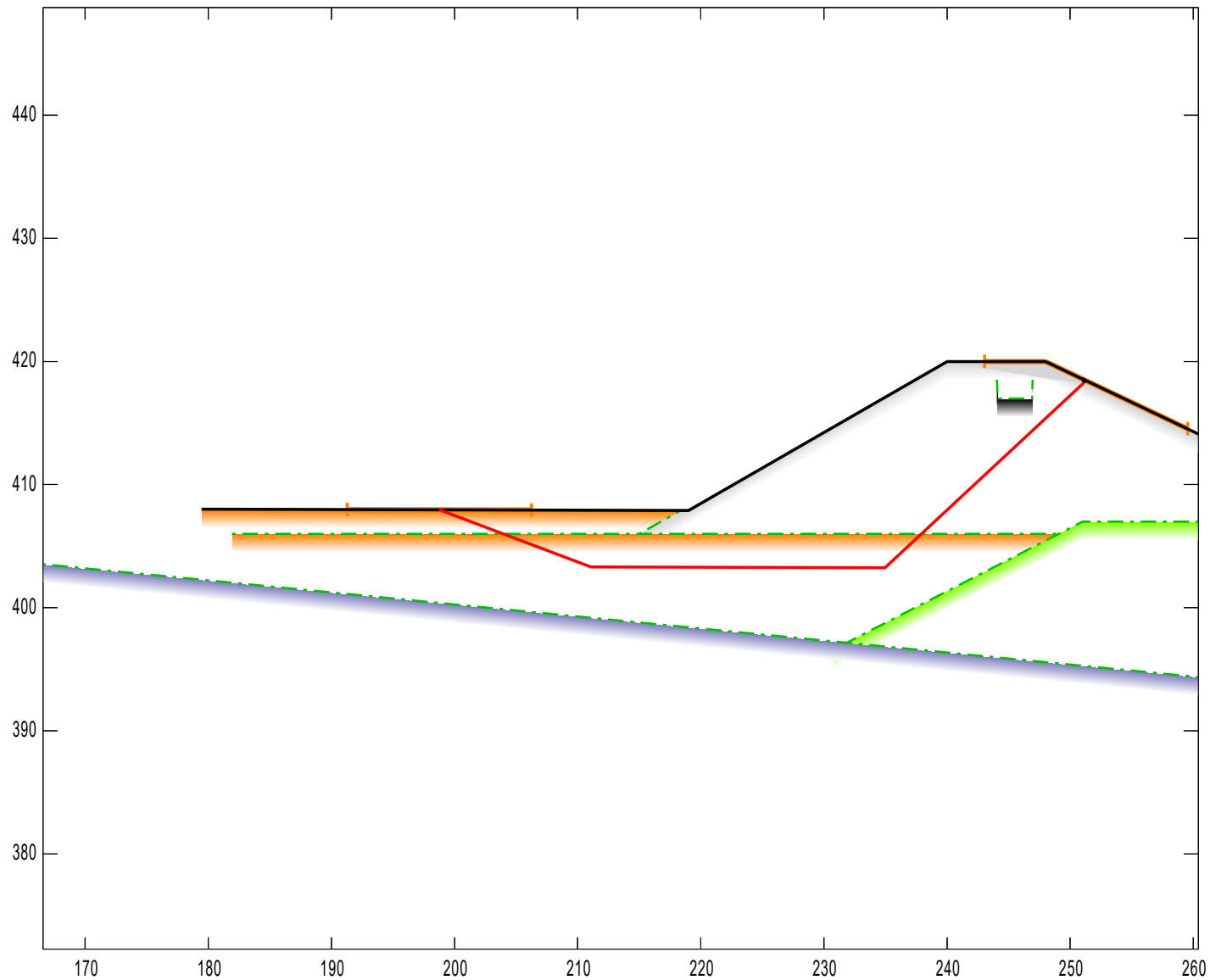
2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttrass

5: Bedrock

6: Tailings/Geomembrane Interface



Analysis 11

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Non-Circular (Critical Seed)

Results

Critical Factor of Safety: 1.75

Interslice Force (Final) Angle: 13.0°

Edited: 13 Nov 2023
Processed: 13 Nov 2023



Project GHM - Tailings Storage Facility
2023 Embankment Stability - 10FT Below Embankment Top

File: E:\Work\GL...\Lewicki_GHM-Tailings Storage Facility COMBINED-Spencer Wright_CT-2.gmf

Material Keys

1: Tailings

2: Embankment (Proposed)

3: Embankment (Existing)

4: Soil Buttress

5: Bedrock

6: Tailings/Geomembrane Interface

Analysis 12

Multiple Stability Analysis

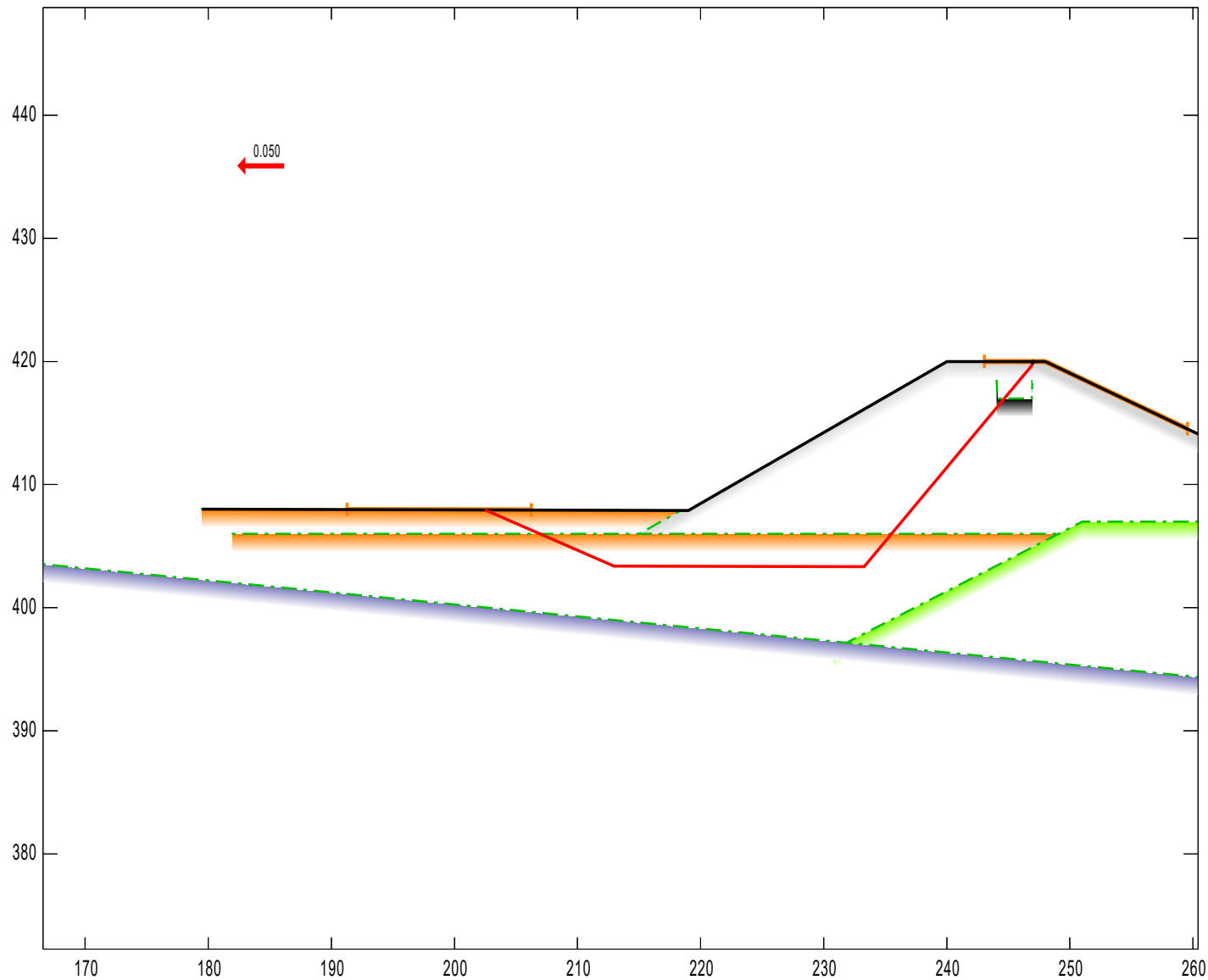
Method: Spencer-Wright

Surface: Non-Circular (Critical Seed)

Results

Critical Factor of Safety: 1.47

Interslice Force (Final) Angle: 15.2°



GALENA Version 7.1

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Project GHM - Tailings Storage Facility
2023 Embankment Stability - 10FT Below Embankment Top - Seismic

File: E:\Work\GL...\Lewicki_GHM-Tailings Storage Facility COMBINED-Spencer Wright_CT-2.gmf

Edited: 13 Nov 2023

Processed: 13 Nov 2023



Project: GHM - Tailings Storage Facility

File: E:\Work\GLA Dropbox\Ben Langenfeld\Colorado Mi...\Lewicki_GHM-Tailings
Storage Facility COMBINED-Spencer Wright_CT-2.gmf

Processed: 13 Nov 2023 08:57:30

DATA: Analysis 1 - 2023 Embankment Stability - 2FT Below Top of Embankment

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400
0.000

Unit weight of water/medium above ground:

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 1 - Tailings

90.00	420.00	237.30	420.00
-------	--------	--------	--------

Profile: 2 (11 points) Material beneath: 6 - Tailings/Geomembrane Interface

90.00	411.00	155.00	405.00	168.00	412.00
175.00	412.00	182.00	406.00		

215.00	406.00	240.00	420.10	244.00	420.10
244.10	417.00	246.90	417.00		
247.00	420.00				
Profile: 3 (4 points) Material beneath: 2 - Embankment (Proposed)					
215.00	406.00	240.00	420.00	248.00	420.00
305.00	393.00				
Profile: 4 (2 points) Material beneath: 1 - Tailings					
182.00	406.00	249.10	406.00		
Profile: 5 (4 points) Material beneath: 3 - Embankment (Existing)					
230.80	396.60	251.00	407.00	262.00	407.00
305.00	393.00				
Profile: 6 (4 points) Material beneath: 4 - Soil Buttress					
155.00	405.00	168.00	412.00	175.00	412.00
190.00	400.00				
Profile: 7 (2 points) Material beneath: 5 - Bedrock					
90.00	411.00	305.00	390.00		

Slope Surface (5 points)

90.00	418.00	236.50	418.00	240.10	420.00
248.00	420.00	305.00	393.00		

Piezometric Surfaces (1 surface)

Surface within profile: 1 (2 points) - Tailings

89.90	417.00	237.50	417.00
-------	--------	--------	--------

Failure Surface

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

Intersects:	XL:	236.50	YL:	418.00	XR:	246.70	YR:
420.00							
Centre:	XC:	240.14	YC:	426.45	Radius:	R:	
9.20							

Tension Crack

Automatically-generated crack depth: 0.25

Variable Restraints

Horizontal range around X-Left:	1.50	Trial positions within range:	11
Horizontal range around X-Right:	8.60	Trial positions within range:	11
Vertical range around Mid-Point:	1.50	Trial positions within range:	20

- - - - -

- - - - -

RESULTS: Analysis 1 - 2023 Embankment Stability - 2FT Below Top of Embankment

Spencer-Wright Method of Analysis - Non-Circular Failure Surface from Circular Seed

Critical Failure Surface Search using Multiple Surface Generation Techniques

Factor of Safety for initial failure surface approximation: 4.899

There were: 2356 successful analyses from a total of 2421 trial surfaces
 44 analyses terminated due to unacceptable geometry
 12 analyses rejected due to Theta out of valid range
 9 analyses failed to produce a result

Critical (minimum) Factor of Safety: 2.24
 Interslice Forces: 17.0 degrees

Final Angle of

Negative interslice forces exist on one or more slices; examine slice data and consult the GALENA Help utility
 Effective stress line-of-thrust is not within one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety surfaces

Surface Theta	X-Left	Y-Left	X-Right	Y-Right	Y-Deflection	FoS
1	236.20	418.00	242.17	419.75	0.75	2.244
17.0	<-- Critical Surface					
2	236.05	418.00	242.16	419.75	0.75	2.247
16.7						
3	236.35	418.00	242.17	419.75	0.75	2.250
17.2						
4	235.90	418.00	242.16	419.75	0.75	2.255
16.3						
5	235.75	418.00	242.15	419.75	0.75	2.265
16.0						
6	236.05	418.00	242.17	419.75	0.67	2.272
16.7						
7	236.50	418.00	242.18	419.75	0.75	2.273
17.2						
8	235.90	418.00	242.17	419.75	0.67	2.275
16.3						
9	236.20	418.00	242.18	419.75	0.67	2.277
16.9						
10	235.75	418.00	242.16	419.75	0.67	2.282
16.0						
11	236.35	418.00	242.19	419.75	0.67	2.290
17.1						
12	236.65	418.08	242.17	419.75	0.75	2.296
17.0						
13	235.90	418.00	242.18	419.75	0.59	2.303
16.3						

14	235.75	418.00	242.17	419.75	0.59	2.304
16.0						
15	236.05	418.00	242.18	419.75	0.59	2.306
16.5						
16	236.20	418.00	242.19	419.75	0.59	2.316
16.8						
17	236.50	418.00	242.19	419.75	0.67	2.319
17.0						
18	236.80	418.17	242.16	419.75	0.75	2.323
16.8						
19	235.75	418.00	242.18	419.75	0.51	2.332
15.9						
20	236.35	418.00	242.19	419.75	0.59	2.334
16.9						
21	235.90	418.00	242.19	419.75	0.51	2.335
16.2						
22	236.65	418.08	242.18	419.75	0.67	2.341
16.8						
23	236.05	418.00	242.19	419.75	0.51	2.345
16.4						
24	236.95	418.25	242.15	419.75	0.75	2.355
16.5						
25	236.20	418.00	242.20	419.75	0.51	2.359
16.6						
26	235.75	418.00	242.19	419.75	0.43	2.364
15.8						
27	236.80	418.17	242.18	419.75	0.67	2.368
16.6						
28	236.50	418.00	242.20	419.75	0.59	2.369
16.8						
29	235.90	418.00	242.20	419.75	0.43	2.373
16.1						
30	236.35	418.00	242.20	419.75	0.51	2.384
16.7						
31	236.05	418.00	242.20	419.75	0.43	2.388
16.3						
32	236.65	418.08	242.19	419.75	0.59	2.392
16.6						
33	237.10	418.33	242.13	419.75	0.75	2.392
16.3						
34	236.95	418.25	242.16	419.75	0.67	2.399
16.3						
35	235.75	418.00	242.20	419.75	0.36	2.402
15.7						
36	236.20	418.00	242.21	419.75	0.43	2.408
16.4						
37	235.90	418.00	242.20	419.75	0.36	2.416
15.9						
38	236.80	418.17	242.19	419.75	0.59	2.418
16.4						

39	236.50	418.00	242.21	419.75	0.51	2.426
16.5						
40	237.10	418.33	242.15	419.75	0.67	2.435
16.1						
41	236.05	418.00	242.21	419.75	0.36	2.436
16.1						
42	237.25	418.42	242.12	419.75	0.75	2.436
15.9						
43	236.35	418.00	242.21	419.75	0.43	2.439
16.5						
44	235.75	418.00	242.21	419.75	0.28	2.444
15.6						
45	236.65	418.08	242.20	419.75	0.51	2.448
16.4						
46	236.95	418.25	242.18	419.75	0.59	2.449
16.1						
47	235.90	418.00	242.21	419.75	0.28	2.464
15.8						
48	236.80	418.17	242.20	419.75	0.51	2.475
16.1						
49	237.25	418.42	242.14	419.75	0.67	2.478
15.8						
50	237.10	418.33	242.17	419.75	0.59	2.485
15.9						
51	236.50	418.00	242.22	419.75	0.43	2.487
16.3						
52	236.05	418.00	242.22	419.75	0.28	2.489
15.9						
53	235.75	418.00	242.21	419.75	0.20	2.493
15.5						
54	236.35	418.00	242.22	419.75	0.36	2.500
16.2						
55	236.95	418.25	242.19	419.75	0.51	2.506
15.9						
56	236.65	418.08	242.21	419.75	0.43	2.510
16.1						
57	235.90	418.00	242.22	419.75	0.20	2.516
15.6						
58	236.20	418.00	242.22	419.75	0.28	2.522
16.0						
59	237.25	418.42	242.15	419.75	0.59	2.528
15.6						
60	236.80	418.17	242.21	419.75	0.43	2.537
15.9						
61	237.10	418.33	242.18	419.75	0.51	2.542
15.7						
62	235.75	418.00	242.22	419.75	0.12	2.546
15.3						
63	236.05	418.00	242.22	419.75	0.20	2.547
15.8						

64	236.50	418.00	242.22	419.75	0.36	2.555
16.1						
65	236.35	418.00	242.22	419.75	0.28	2.566
16.0						
66	236.95	418.25	242.20	419.75	0.43	2.569
15.7						
67	235.90	418.00	242.22	419.75	0.12	2.574
15.5						
68	236.65	418.08	242.22	419.75	0.36	2.579
15.9						
69	237.25	418.42	242.17	419.75	0.51	2.584
15.4						
70	236.20	418.00	242.23	419.75	0.20	2.586
15.8						
71	236.05	418.00	242.99	419.75	0.75	2.587
14.9						
72	236.20	418.00	243.00	419.75	0.75	2.589
15.1						
73	235.90	418.00	242.99	419.75	0.75	2.590
14.7						
74	236.35	418.00	243.00	419.75	0.75	2.598
15.2						
75	235.75	418.00	242.98	419.75	0.75	2.598
14.4						
76	237.10	418.33	242.19	419.75	0.43	2.605
15.5						
77	236.80	418.17	242.21	419.75	0.36	2.606
15.7						
78	235.90	418.00	243.00	419.75	0.67	2.611
14.7						
79	236.05	418.00	242.23	419.75	0.12	2.611
15.6						
80	235.75	418.00	242.99	419.75	0.67	2.613
14.4						
81	236.05	418.00	243.00	419.75	0.67	2.614
14.9						
82	236.20	418.00	243.01	419.75	0.67	2.621
15.0						
83	236.50	418.00	243.01	419.75	0.75	2.622
15.2						
84	236.50	418.00	242.23	419.75	0.28	2.628
15.8						
85	235.75	418.00	243.00	419.75	0.59	2.633
14.4						
86	236.35	418.00	243.01	419.75	0.67	2.636
15.1						
87	235.90	418.00	243.01	419.75	0.59	2.637
14.6						
88	235.90	418.00	242.23	419.75	0.04	2.637
15.3						

89	236.35	418.00	242.23	419.75	0.20	2.638
15.8						
90	236.95	418.25	242.21	419.75	0.36	2.639
15.5						
91	236.05	418.00	243.01	419.75	0.59	2.642
14.8						
92	237.25	418.42	242.18	419.75	0.43	2.648
15.2						
93	236.65	418.08	242.23	419.75	0.28	2.653
15.7						
94	236.20	418.00	242.23	419.75	0.12	2.657
15.6						
95	236.20	418.00	243.02	419.75	0.59	2.657
14.9						
96	235.75	418.00	243.02	419.75	0.51	2.658
14.4						
97	236.65	418.08	243.00	419.75	0.75	2.664
14.9						
98	235.75	418.00	242.23	419.75	-0.04	2.666
15.0						
99	236.50	418.00	243.02	419.75	0.67	2.666
15.0						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 20 points), adjusted for tension crack

236.20	418.00	236.53	417.91	236.87	417.85
237.21	417.82	237.55	417.82		
237.91	417.84	238.26	417.88	238.61	417.94
238.96	418.02	239.31	418.12		
239.66	418.23	240.00	418.36	240.34	418.50
240.67	418.66	240.98	418.83		
241.29	419.03	241.59	419.24	241.87	419.47
242.14	419.72	242.17	419.75		

Slice Geometry and Properties - Critical Failure Surface (surface 1, 42 slices)

Slice	X-S	Base						
	PoreWater	--- Left Hand Side ---						
Weight	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
	Force	Side	Force	l/h	l'/h			
1	236.20	0.00	-15.3	0.05	0.05	1	40.00	20.0
0.03	0.00		0.00	0.00	0.00			
2	236.25	0.00	-15.3	0.03	0.03	6	30.00	17.0
0.04	0.00		1.28	1.06	1.06			
3	236.28	0.00	-15.3	0.08	0.08	6	30.00	17.0
0.24	0.00		1.75	1.12	1.12			
4	236.35	0.00	-15.3	0.08	0.08	2	0.00	35.0
0.46	0.00		3.25	1.11	1.11			

5	236.43	0.01	-15.3	0.07	0.07	2	0.00	35.0
0.67	0.00		3.64	1.33	1.33			
6	236.50	0.00	-15.3	0.03	0.03	2	0.00	35.0
0.35	0.00		4.20	1.35	1.35			
7	236.53	0.03	-9.9	0.17	0.17	2	0.00	35.0
3.66	0.00		4.49	1.13	1.13			
8	236.70	0.05	-9.9	0.17	0.17	2	0.00	35.0
6.35	0.00		6.84	0.64	0.64			
9	236.87	0.07	-5.0	0.17	0.17	2	0.00	35.0
9.06	0.00		10.90	0.45	0.45			
10	237.04	0.09	-5.0	0.17	0.17	2	0.00	35.0
11.51	0.00		15.35	0.37	0.37			
11	237.21	0.11	-0.6	0.17	0.17	2	0.00	35.0
14.02	0.00		21.02	0.32	0.32			
12	237.38	0.12	-0.6	0.17	0.17	2	0.00	35.0
16.24	0.00		26.29	0.29	0.29			
13	237.55	0.14	3.3	0.18	0.18	2	0.00	35.0
18.52	0.00		32.40	0.27	0.27			
14	237.73	0.16	3.3	0.18	0.18	2	0.00	35.0
20.51	0.00		37.64	0.26	0.26			
15	237.91	0.17	6.8	0.18	0.18	2	0.00	35.0
22.52	0.00		43.45	0.24	0.24			
16	238.08	0.19	6.8	0.18	0.18	2	0.00	35.0
24.28	0.00		48.10	0.24	0.24			
17	238.26	0.20	9.9	0.18	0.18	2	0.00	35.0
25.98	0.00		53.13	0.23	0.23			
18	238.43	0.21	9.9	0.18	0.18	2	0.00	35.0
27.53	0.00		56.82	0.22	0.22			
19	238.61	0.22	12.8	0.18	0.18	2	0.00	35.0
28.90	0.00		60.73	0.21	0.21			
20	238.79	0.23	12.8	0.18	0.18	2	0.00	35.0
30.23	0.00		63.21	0.21	0.21			
21	238.96	0.24	15.4	0.18	0.18	2	0.00	35.0
31.26	0.00		65.80	0.20	0.20			
22	239.14	0.25	15.4	0.18	0.18	2	0.00	35.0
32.38	0.00		66.90	0.19	0.19			
23	239.31	0.25	18.0	0.17	0.18	2	0.00	35.0
33.05	0.00		68.04	0.19	0.19			
24	239.49	0.26	18.0	0.17	0.18	2	0.00	35.0
33.95	0.00		67.64	0.18	0.18			
25	239.66	0.26	20.5	0.17	0.18	2	0.00	35.0
34.25	0.00		67.24	0.17	0.17			
26	239.83	0.27	20.5	0.17	0.18	2	0.00	35.0
34.94	0.00		65.27	0.17	0.17			
27	240.00	0.16	23.1	0.10	0.11	2	0.00	35.0
20.17	0.00		63.25	0.16	0.16			
28	240.10	0.19	23.1	0.12	0.13	2	0.00	35.0
24.38	0.00		61.18	0.16	0.16			
29	240.22	0.18	23.1	0.12	0.13	2	0.00	35.0
23.59	0.00		58.67	0.16	0.16			

30	240.34	0.24	25.9	0.16	0.18	2	0.00	35.0
31.08	0.00		56.24	0.17	0.17			
31	240.50	0.23	25.9	0.16	0.18	2	0.00	35.0
29.39	0.00		51.57	0.17	0.17			
32	240.67	0.21	28.8	0.16	0.18	2	0.00	35.0
26.85	0.00		47.16	0.17	0.17			
33	240.83	0.19	28.8	0.16	0.18	2	0.00	35.0
25.04	0.00		41.80	0.18	0.18			
34	240.98	0.17	32.0	0.15	0.18	2	0.00	35.0
22.39	0.00		36.79	0.18	0.18			
35	241.14	0.16	32.0	0.15	0.18	2	0.00	35.0
20.46	0.00		31.13	0.18	0.18			
36	241.29	0.14	35.4	0.15	0.18	2	0.00	35.0
17.75	0.00		25.96	0.18	0.18			
37	241.44	0.12	35.4	0.15	0.18	2	0.00	35.0
15.72	0.00		20.45	0.18	0.18			
38	241.59	0.10	39.1	0.14	0.18	2	0.00	35.0
13.00	0.00		15.57	0.18	0.18			
39	241.73	0.08	39.1	0.14	0.18	2	0.00	35.0
10.86	0.00		10.72	0.17	0.17			
40	241.87	0.06	43.1	0.14	0.19	2	0.00	35.0
8.21	0.00		6.67	0.16	0.16			
41	242.01	0.05	43.1	0.14	0.19	2	0.00	35.0
5.98	0.00		3.06	0.12	0.12			
42	242.14	0.01	47.3	0.02	0.04	2	0.00	35.0
0.85	0.00		0.42	0.03	0.03			
RHS	242.17	-----			-----			
-----			-0.01	0.00	0.00			
X-S Area:		5.82	Path Length:	6.49			X-S Weight:	
756.67								

DATA: Analysis 2 - 2023 Embankment Stability - 2FT Below Top of Embankment

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400
0.000

Unit weight of water/medium above ground:

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 1 - Tailings

90.00	420.00	237.30	420.00
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Profile: 2 (11 points) Material beneath: 6 - Tailings/Geomembrane Interface

90.00	411.00	155.00	405.00	168.00	412.00
175.00	412.00	182.00	406.00		
215.00	406.00	240.00	420.10	244.00	420.10
244.10	417.00	246.90	417.00		
247.00	420.00				

Profile: 3 (4 points) Material beneath: 2 - Embankment (Proposed)

215.00	406.00	240.00	420.00	248.00	420.00
305.00	393.00				

Profile: 4 (2 points) Material beneath: 1 - Tailings

182.00	406.00	249.10	406.00
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Profile: 5 (4 points) Material beneath: 3 - Embankment (Existing)

230.80	396.60	251.00	407.00	262.00	407.00
305.00	393.00				

Profile: 6 (4 points) Material beneath: 4 - Soil Buttress

155.00	405.00	168.00	412.00	175.00	412.00
190.00	400.00				

Profile: 7 (2 points) Material beneath: 5 - Bedrock

90.00	411.00	305.00	390.00
-------	--------	--------	--------

Slope Surface (5 points)

90.00	418.00	236.50	418.00	240.10	420.00
248.00	420.00	305.00	393.00		

Piezometric Surfaces (1 surface)

Surface within profile: 1 (2 points) - Tailings

89.90	417.00	237.50	417.00
-------	--------	--------	--------

Failure Surface

```

-----
Initial non-circular surface for critical search (4 points)
      236.49      418.00      238.20      416.10      242.00      416.10
      243.46      420.00

```

Tension Crack

```

-----
Automatically-generated crack depth:      0.25

```

Variable Restraints

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-----
Horizontal range around X-Left:      3.00      Trial positions within range:  11
Horizontal range around X-Right:     5.50      Trial positions within range:  11
Vertical range around Mid-Point:     3.00      Trial positions within range:  20

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RESULTS: Analysis 2 - 2023 Embankment Stability - 2FT Below Top of Embankment

Spencer-Wright Method of Analysis - Non-Circular Failure Surface

Critical Failure Surface Search using Multiple Surface Generation Techniques

Solution did not converge for initial failure surface approximation
Last calculated Factor of Safety was *****

There were: 1434 successful analyses from a total of 2421 trial surfaces
987 analyses failed to produce a result

Critical (minimum) Factor of Safety: 3.28 Final Angle of
Interslice Forces: 22.3 degrees

Negative interslice forces exist on one or more slices; examine slice data and consult the GALENA Help utility
Effective stress line-of-thrust is not within one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety surfaces

Surface	X-Left	Y-Left	X-Right	Y-Right	Y-Deflection	FoS
Theta						
1	237.99	418.83	240.57	419.75	1.50	3.280
22.3	<-- Critical Surface					
2	237.69	418.66	240.59	419.75	1.50	3.395
23.1						
3	237.99	418.83	240.58	419.75	1.34	3.446
22.4						
4	234.99	418.00	240.59	419.75	1.50	3.475

18.9						
5	234.99	418.00	241.13	419.75	1.50	3.529
17.7						
6	235.29	418.00	240.60	419.75	1.50	3.590
19.5						
7	237.39	418.49	240.60	419.75	1.50	3.633
22.5						
8	235.29	418.00	241.14	419.75	1.50	3.653
18.2						
9	237.69	418.66	240.60	419.75	1.34	3.662
21.9						
10	234.99	418.00	240.60	419.75	1.34	3.715
18.1						
11	234.99	418.00	241.14	419.75	1.34	3.721
17.1						
12	237.99	418.83	240.60	419.75	1.18	3.722
21.3						
13	235.59	418.00	240.61	419.75	1.50	3.753
20.0						
14	234.99	418.00	241.67	419.75	1.50	3.781
16.8						
15	235.59	418.00	241.15	419.75	1.50	3.826
18.6						
16	237.69	418.66	241.12	419.75	1.50	3.860
19.6						
17	235.29	418.00	240.61	419.75	1.34	3.861
18.7						
18	235.29	418.00	241.15	419.75	1.34	3.870
17.5						
19	237.99	418.83	241.09	419.75	1.50	3.882
18.2						
20	235.29	418.00	241.68	419.75	1.50	3.907
17.2						
21	234.99	418.00	241.68	419.75	1.34	3.946
16.3						
22	234.99	418.00	241.15	419.75	1.18	3.955
16.5						
23	237.09	418.33	240.61	419.75	1.50	3.966
21.4						
24	237.99	418.83	241.11	419.75	1.34	3.977
18.4						
25	237.39	418.49	241.14	419.75	1.50	3.993
19.7						
26	235.89	418.00	240.61	419.75	1.50	3.995
20.3						
27	237.39	418.49	240.61	419.75	1.34	4.008
21.0						
28	234.99	418.00	240.61	419.75	1.18	4.011
17.4						
29	234.99	418.00	242.21	419.75	1.50	4.033

15.8						
30	235.89	418.00	241.15	419.75	1.50	4.065
18.8						
31	237.69	418.66	240.61	419.75	1.18	4.069
20.3						
32	235.59	418.00	240.61	419.75	1.34	4.073
19.0						
33	235.59	418.00	241.68	419.75	1.50	4.074
17.5						
34	237.69	418.66	241.13	419.75	1.34	4.079
18.9						
35	235.59	418.00	241.15	419.75	1.34	4.083
17.8						
36	235.29	418.00	241.69	419.75	1.34	4.096
16.7						
37	235.29	418.00	241.15	419.75	1.18	4.136
16.8						
38	234.99	418.00	241.69	419.75	1.18	4.146
15.8						
39	235.29	418.00	242.22	419.75	1.50	4.154
16.1						
40	237.99	418.83	240.61	419.75	1.03	4.170
19.6						
41	234.99	418.00	242.22	419.75	1.34	4.176
15.5						
42	237.99	418.83	241.12	419.75	1.18	4.196
17.9						
43	235.29	418.00	240.61	419.75	1.18	4.200
17.8						
44	237.09	418.33	241.15	419.75	1.50	4.215
19.2						
45	234.99	418.00	241.15	419.75	1.03	4.236
15.8						
46	234.99	418.00	242.75	419.75	1.50	4.278
14.9						
47	237.69	418.66	241.65	419.75	1.50	4.282
16.7						
48	235.89	418.00	241.69	419.75	1.50	4.290
17.5						
49	235.59	418.00	241.69	419.75	1.34	4.298
16.8						
50	237.39	418.49	241.15	419.75	1.34	4.304
18.6						
51	235.59	418.00	242.22	419.75	1.50	4.310
16.3						
52	235.29	418.00	242.22	419.75	1.34	4.320
15.7						
53	235.29	418.00	241.69	419.75	1.18	4.326
16.1						
54	237.39	418.49	241.67	419.75	1.50	4.335

17.2						
55	236.19	418.00	240.62	419.75	1.50	4.344
20.2						
56	234.99	418.00	242.23	419.75	1.18	4.352
15.0						
57	234.99	418.00	240.61	419.75	1.03	4.372
16.6						
58	236.19	418.00	241.16	419.75	1.50	4.383
18.7						
59	235.89	418.00	241.16	419.75	1.34	4.383
17.9						
60	234.99	418.00	241.69	419.75	1.03	4.387
15.2						
61	236.79	418.16	240.62	419.75	1.50	4.388
20.4						
62	235.89	418.00	240.62	419.75	1.34	4.394
19.2						
63	235.29	418.00	242.76	419.75	1.50	4.395
15.1						
64	235.59	418.00	241.16	419.75	1.18	4.401
17.0						
65	234.99	418.00	242.76	419.75	1.34	4.403
14.6						
66	237.69	418.66	241.14	419.75	1.18	4.414
17.8						
67	237.99	418.83	241.61	419.75	1.50	4.424
15.1						
68	237.09	418.33	240.62	419.75	1.34	4.457
19.9						
69	235.29	418.00	241.16	419.75	1.03	4.460
16.1						
70	237.69	418.66	241.66	419.75	1.34	4.467
16.3						
71	237.99	418.83	241.63	419.75	1.34	4.470
15.4						
72	235.59	418.00	240.62	419.75	1.18	4.477
18.0						
73	237.09	418.33	241.68	419.75	1.50	4.487
17.3						
74	236.79	418.16	241.16	419.75	1.50	4.505
18.7						
75	235.59	418.00	242.23	419.75	1.34	4.508
15.8						
76	235.89	418.00	242.23	419.75	1.50	4.510
16.3						
77	234.99	418.00	243.29	419.75	1.50	4.522
14.0						
78	235.29	418.00	242.23	419.75	1.18	4.524
15.2						
79	235.29	418.00	242.76	419.75	1.34	4.543

14.8						
80	235.59	418.00	242.76	419.75	1.50	4.544
15.1						
81	237.39	418.49	240.62	419.75	1.18	4.554
19.3						
82	237.99	418.83	241.14	419.75	1.03	4.558
16.9						
83	234.99	418.00	242.77	419.75	1.18	4.560
14.3						
84	234.99	418.00	242.23	419.75	1.03	4.564
14.6						
85	235.89	418.00	241.70	419.75	1.34	4.565
16.8						
86	236.19	418.00	241.70	419.75	1.50	4.571
17.4						
87	234.99	418.00	241.16	419.75	0.87	4.571
15.2						
88	235.59	418.00	241.70	419.75	1.18	4.573
16.2						
89	237.39	418.49	241.68	419.75	1.34	4.605
16.5						
90	235.29	418.00	241.70	419.75	1.03	4.606
15.5						
91	237.09	418.33	241.16	419.75	1.34	4.611
18.1						
92	235.29	418.00	240.62	419.75	1.03	4.620
16.9						
93	234.99	418.00	243.30	419.75	1.34	4.632
13.8						
94	235.29	418.00	243.30	419.75	1.50	4.636
14.1						
95	237.99	418.83	241.65	419.75	1.18	4.646
15.1						
96	234.99	418.00	241.70	419.75	0.87	4.674
14.7						
97	237.39	418.49	242.20	419.75	1.50	4.675
15.2						
98	237.69	418.66	240.62	419.75	1.03	4.684
18.6						
99	237.69	418.66	242.17	419.75	1.50	4.700
14.4						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

237.99	418.83	238.66	419.01	240.14	419.02
240.57	419.75				

Slice Geometry and Properties - Critical Failure Surface (surface 1, 31 slices)

Slice		X-S		Base -----					
	PoreWater	--- Left Hand Side ----							
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	
Weight	Force	Side	Force	l/h	l'/h				
1	237.99	0.00	15.4	0.08	0.09	2	0.00	35.0	
0.13	0.00		0.00	0.00	0.00				
2	238.07	0.00	15.3	0.08	0.09	2	0.00	35.0	
0.38	0.00		-0.01	0.24	0.24				
3	238.16	0.00	15.4	0.08	0.09	2	0.00	35.0	
0.64	0.00		-0.03	0.18	0.18				
4	238.24	0.01	15.3	0.08	0.09	2	0.00	35.0	
0.89	0.00		-0.07	0.17	0.17				
5	238.32	0.01	15.3	0.08	0.09	2	0.00	35.0	
1.14	0.00		-0.12	0.17	0.17				
6	238.41	0.01	15.4	0.08	0.09	2	0.00	35.0	
1.40	0.00		-0.19	0.17	0.17				
7	238.49	0.01	15.3	0.08	0.09	2	0.00	35.0	
1.65	0.00		-0.28	0.16	0.16				
8	238.57	0.01	15.4	0.08	0.09	2	0.00	35.0	
1.91	0.00		-0.38	0.16	0.16				
9	238.66	0.02	0.2	0.08	0.08	2	0.00	35.0	
2.33	0.00		-0.50	0.16	0.16				
10	238.74	0.02	0.2	0.08	0.08	2	0.00	35.0	
2.84	0.00		0.08	-1.19	-1.19				
11	238.83	0.03	0.2	0.08	0.08	2	0.00	35.0	
3.36	0.00		0.78	-0.03	-0.03				
12	238.91	0.03	0.2	0.08	0.08	2	0.00	35.0	
3.88	0.00		1.62	0.06	0.06				
13	239.00	0.03	0.2	0.08	0.08	2	0.00	35.0	
4.39	0.00		2.58	0.11	0.11				
14	239.08	0.04	0.2	0.08	0.08	2	0.00	35.0	
4.91	0.00		3.67	0.14	0.14				
15	239.17	0.04	0.2	0.08	0.08	2	0.00	35.0	
5.43	0.00		4.88	0.16	0.16				
16	239.25	0.05	0.2	0.08	0.08	2	0.00	35.0	
5.94	0.00		6.23	0.17	0.17				
17	239.34	0.05	0.2	0.08	0.08	2	0.00	35.0	
6.46	0.00		7.70	0.18	0.18				
18	239.42	0.05	0.2	0.08	0.08	2	0.00	35.0	
6.97	0.00		9.30	0.19	0.19				
19	239.51	0.06	0.2	0.08	0.08	2	0.00	35.0	
7.49	0.00		11.03	0.20	0.20				
20	239.59	0.06	0.2	0.08	0.08	2	0.00	35.0	
8.01	0.00		12.88	0.20	0.20				
21	239.68	0.07	0.2	0.08	0.08	2	0.00	35.0	
8.52	0.00		14.86	0.21	0.21				
22	239.76	0.07	0.2	0.08	0.08	2	0.00	35.0	
9.04	0.00		16.97	0.21	0.21				
23	239.85	0.07	0.2	0.08	0.08	2	0.00	35.0	

9.56	0.00	19.22	0.22	0.22			
24	239.93	0.08	0.2	0.08	0.08	2	0.00 35.0
10.07	0.00	21.59	0.22	0.22			
25	240.02	0.08	0.2	0.08	0.08	2	0.00 35.0
10.59	0.00	24.08	0.22	0.22			
26	240.10	0.04	0.2	0.04	0.04	2	0.00 35.0
5.14	0.00	26.70	0.22	0.22			
27	240.14	0.08	59.9	0.08	0.17	2	0.00 35.0
10.05	0.00	27.98	0.23	0.23			
28	240.23	0.06	59.9	0.08	0.17	2	0.00 35.0
8.43	0.00	19.72	0.22	0.22			
29	240.31	0.05	59.9	0.08	0.17	2	0.00 35.0
6.81	0.00	12.79	0.21	0.21			
30	240.40	0.04	59.9	0.08	0.17	2	0.00 35.0
5.19	0.00	7.19	0.19	0.19			
31	240.48	0.03	59.9	0.08	0.17	2	0.00 35.0
3.57	0.00	2.93	0.14	0.14			
RHS	240.57	-----			-----		
-----			-0.01	0.00	0.00		
X-S Area:	1.21	Path Length:	3.02			X-S Weight:	
157.13							

DATA: Analysis 3 - 2023 Embankment Stability - 2FT Below Top of Embankment - Seismic

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru

0.00 33.0 110.00 Auto

Water Properties

Unit weight of water: 62.400
0.000

Unit weight of water/medium above ground:

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 1 - Tailings

90.00 420.00 237.30 420.00

Profile: 2 (11 points) Material beneath: 6 - Tailings/Geomembrane Interface

90.00 411.00 155.00 405.00 168.00 412.00

175.00 412.00 182.00 406.00

215.00 406.00 240.00 420.10 244.00 420.10

244.10 417.00 246.90 417.00

247.00 420.00

Profile: 3 (4 points) Material beneath: 2 - Embankment (Proposed)

215.00 406.00 240.00 420.00 248.00 420.00

305.00 393.00

Profile: 4 (2 points) Material beneath: 1 - Tailings

182.00 406.00 249.10 406.00

Profile: 5 (4 points) Material beneath: 3 - Embankment (Existing)

230.80 396.60 251.00 407.00 262.00 407.00

305.00 393.00

Profile: 6 (4 points) Material beneath: 4 - Soil Buttress

155.00 405.00 168.00 412.00 175.00 412.00

190.00 400.00

Profile: 7 (2 points) Material beneath: 5 - Bedrock

90.00 411.00 305.00 390.00

Slope Surface (5 points)

90.00 418.00 236.50 418.00 240.10 420.00

248.00 420.00 305.00 393.00

Piezometric Surfaces (1 surface)

Surface within profile: 1 (2 points) - Tailings

89.90 417.00 237.50 417.00

Failure Surface (Critical, from previous analysis)

Initial non-circular surface for critical search (4 points)

237.99 418.83 238.66 419.01 240.14 419.02

240.71 420.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.050

Tension Crack

Automatically-generated crack depth: 0.25

Variable Restraints

Horizontal range around X-Left:	3.00	Trial positions within range:	11
Horizontal range around X-Right:	3.00	Trial positions within range:	11
Vertical range around Mid-Point:	3.00	Trial positions within range:	11

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RESULTS: Analysis 3 - 2023 Embankment Stability - 2FT Below Top of Embankment - Seismic

Spencer-Wright Method of Analysis - Non-Circular Failure Surface

Critical Failure Surface Search using Multiple Surface Generation Techniques

Factor of Safety for initial failure surface approximation: 2.718

There were: 476 successful analyses from a total of 1331 trial surfaces
585 analyses terminated due to unacceptable geometry
8 analyses rejected due to Theta out of valid range
262 analyses failed to produce a result

Critical (minimum) Factor of Safety:	2.52	Final Angle of
Interslice Forces:	28.3 degrees	

Negative interslice forces exist on one or more slices; examine slice data and consult the GALENA Help utility
Effective stress line-of-thrust is not within one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety surfaces

Surface	X-Left	Y-Left	X-Right	Y-Right	Y-Deflection	FoS
Theta						
1	236.49	418.00	240.29	419.75	0.00	2.521
28.3	<-- Critical Surface					
2	236.79	418.16	240.29	419.75	0.00	2.525
28.0						
3	237.09	418.33	240.29	419.75	0.00	2.526
27.6						
4	237.39	418.49	240.28	419.75	0.00	2.528
27.1						
5	236.49	418.00	240.58	419.75	0.00	2.528

26.0						
6	237.69	418.66	240.28	419.75	0.00	2.534
26.4						
7	236.79	418.16	240.58	419.75	0.00	2.544
25.5						
8	237.99	418.83	240.28	419.75	0.00	2.550
25.5						
9	237.09	418.33	240.57	419.75	0.00	2.563
24.9						
10	236.79	418.16	240.84	419.75	0.30	2.569
21.2						
11	238.29	418.99	240.28	419.75	0.00	2.580
24.3						
12	237.39	418.49	240.57	419.75	0.00	2.594
24.2						
13	236.49	418.00	239.96	419.67	0.00	2.604
29.5						
14	236.79	418.16	239.96	419.67	0.00	2.610
29.3						
15	236.49	418.00	239.66	419.51	0.00	2.611
29.2						
16	237.09	418.33	239.96	419.67	0.00	2.614
29.0						
17	236.49	418.00	239.36	419.34	0.00	2.615
28.9						
18	236.79	418.16	239.66	419.51	0.00	2.619
29.0						
19	236.49	418.00	240.87	419.75	0.00	2.619
24.0						
20	237.39	418.49	239.96	419.67	0.00	2.623
28.7						
21	236.49	418.00	239.06	419.17	0.00	2.625
28.6						
22	236.79	418.16	239.36	419.34	0.00	2.628
28.7						
23	237.09	418.33	239.66	419.51	0.00	2.628
28.7						
24	237.69	418.66	239.96	419.67	0.00	2.633
28.2						
25	237.09	418.33	239.36	419.34	0.00	2.639
28.2						
26	237.39	418.49	239.66	419.51	0.00	2.639
28.2						
27	236.79	418.16	239.06	419.17	0.00	2.639
28.2						
28	237.69	418.66	240.57	419.75	0.00	2.643
23.4						
29	238.59	419.16	240.27	419.75	0.00	2.644
22.5						
30	237.99	418.83	239.96	419.67	0.00	2.649

27.5						
31	237.09	418.33	239.06	419.17	0.00	2.656
27.5						
32	237.39	418.49	239.36	419.34	0.00	2.656
27.5						
33	237.69	418.66	239.66	419.51	0.00	2.656
27.5						
34	236.79	418.16	240.87	419.75	0.00	2.662
23.6						
35	238.29	418.99	239.96	419.67	0.00	2.679
26.4						
36	237.39	418.49	239.06	419.17	0.00	2.687
26.4						
37	237.99	418.83	239.66	419.51	0.00	2.687
26.4						
38	237.69	418.66	239.36	419.34	0.00	2.687
26.4						
39	236.49	418.00	240.60	419.75	-0.30	2.706
25.6						
40	237.09	418.33	240.86	419.75	0.00	2.712
23.0						
41	236.49	418.00	240.30	419.75	-0.30	2.716
27.7						
42	237.99	418.83	240.57	419.75	0.00	2.718
22.4						
43	236.79	418.16	240.60	419.75	-0.30	2.737
25.1						
44	236.79	418.16	240.30	419.75	-0.30	2.739
27.3						
45	238.59	419.16	239.96	419.67	0.00	2.740
24.6						
46	237.69	418.66	239.06	419.17	0.00	2.750
24.6						
47	237.99	418.83	239.36	419.34	0.00	2.750
24.6						
48	238.29	418.99	239.66	419.51	0.00	2.750
24.6						
49	236.79	418.16	241.13	419.75	0.30	2.756
19.7						
50	236.49	418.00	241.16	419.75	0.00	2.757
22.6						
51	237.09	418.33	240.31	419.75	-0.30	2.762
26.7						
52	237.39	418.49	240.86	419.75	0.00	2.772
22.2						
53	237.09	418.33	240.60	419.75	-0.30	2.772
24.3						
54	236.49	418.00	240.89	419.75	-0.30	2.775
23.8						
55	237.39	418.49	240.31	419.75	-0.30	2.793

26.0						
56	238.89	419.33	240.27	419.75	0.00	2.796
20.0						
57	236.79	418.16	241.16	419.75	0.00	2.807
22.0						
58	236.49	418.00	239.99	419.69	-0.30	2.809
28.9						
59	238.29	418.99	240.56	419.75	0.00	2.820
21.1						
60	237.39	418.49	240.60	419.75	-0.30	2.825
23.6						
61	236.79	418.16	240.89	419.75	-0.30	2.829
23.3						
62	236.79	418.16	239.99	419.69	-0.30	2.836
28.5						
63	236.49	418.00	239.69	419.52	-0.30	2.836
28.5						
64	237.09	418.33	241.12	419.75	0.30	2.837
18.7						
65	237.69	418.66	240.31	419.75	-0.30	2.839
25.0						
66	237.69	418.66	240.86	419.75	0.00	2.845
21.2						
67	236.49	418.00	241.42	419.75	0.30	2.846
19.3						
68	237.09	418.33	241.15	419.75	0.00	2.865
21.3						
69	237.09	418.33	239.99	419.69	-0.30	2.866
28.0						
70	236.49	418.00	239.39	419.36	-0.30	2.866
28.0						
71	236.79	418.16	239.69	419.52	-0.30	2.870
28.0						
72	236.49	418.00	241.45	419.75	0.00	2.880
21.2						
73	238.89	419.33	239.96	419.67	0.00	2.885
21.3						
74	237.09	418.33	240.89	419.75	-0.30	2.890
22.6						
75	236.49	418.00	241.18	419.75	-0.30	2.891
22.4						
76	237.69	418.66	240.60	419.75	-0.30	2.898
22.5						
77	238.29	418.99	239.36	419.34	0.00	2.900
21.4						
78	237.99	418.83	239.06	419.17	0.00	2.900
21.4						
79	238.59	419.16	239.66	419.51	0.00	2.901
21.4						
80	237.99	418.83	240.31	419.75	-0.30	2.904

23.8						
81	236.49	418.00	239.09	419.19	-0.30	2.906
27.3						
82	237.39	418.49	239.99	419.69	-0.30	2.906
27.3						
83	236.79	418.16	239.39	419.36	-0.30	2.910
27.4						
84	237.09	418.33	239.69	419.52	-0.30	2.910
27.4						
85	236.79	418.16	241.41	419.75	0.30	2.918
18.4						
86	237.39	418.49	241.15	419.75	0.00	2.934
20.4						
87	236.79	418.16	241.45	419.75	0.00	2.935
20.5						
88	237.99	418.83	240.85	419.75	0.00	2.940
20.1						
89	237.39	418.49	241.11	419.75	0.30	2.945
17.4						
90	236.79	418.16	241.18	419.75	-0.30	2.949
21.8						
91	237.69	418.66	240.00	419.69	-0.30	2.961
26.5						
92	237.39	418.49	240.89	419.75	-0.30	2.965
21.7						
93	237.09	418.33	239.40	419.36	-0.30	2.966
26.5						
94	237.39	418.49	239.70	419.53	-0.30	2.966
26.5						
95	236.79	418.16	239.10	419.19	-0.30	2.966
26.5						
96	238.59	419.16	240.55	419.75	0.00	2.969
19.2						
97	236.49	418.00	240.61	419.75	-0.60	2.980
23.4						
98	236.49	418.00	241.71	419.75	0.30	2.984
18.1						
99	236.49	418.00	241.74	419.75	0.00	2.993
19.8						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

236.49 418.00 237.45 418.31 239.59 418.32
240.29 419.75

Slice Geometry and Properties - Critical Failure Surface (surface 1, 32 slices)

Slice X-S ----- Base -----

Weight	PoreWater	--- Left Hand Side ----				Matl	Cohesion	Phi
	X-Left Force	Area Side	Angle Force	Width l/h	Length l'/h			
1	236.49	0.00	18.0	0.12	0.13	2	0.00	35.0
0.13	0.00		0.00	0.00	0.00			
2	236.61	0.00	18.0	0.12	0.13	2	0.00	35.0
0.56	0.00		-0.01	0.58	0.58			
3	236.73	0.01	18.0	0.12	0.13	2	0.00	35.0
1.00	0.00		-0.07	0.35	0.35			
4	236.85	0.01	18.0	0.12	0.13	2	0.00	35.0
1.43	0.00		-0.18	0.33	0.33			
5	236.97	0.01	18.0	0.12	0.13	2	0.00	35.0
1.86	0.00		-0.32	0.32	0.32			
6	237.09	0.02	18.0	0.12	0.13	2	0.00	35.0
2.29	0.00		-0.52	0.31	0.31			
7	237.21	0.02	18.0	0.12	0.13	2	0.00	35.0
2.73	0.00		-0.75	0.31	0.31			
8	237.33	0.02	18.0	0.12	0.13	2	0.00	35.0
3.16	0.00		-1.04	0.31	0.31			
9	237.45	0.03	0.3	0.13	0.13	2	0.00	35.0
4.10	0.00		-1.37	0.31	0.31			
10	237.58	0.04	0.3	0.13	0.13	2	0.00	35.0
5.23	0.00		-0.15	3.30	3.30			
11	237.70	0.05	0.3	0.13	0.13	2	0.00	35.0
6.36	0.00		1.40	-0.20	-0.20			
12	237.83	0.06	0.3	0.13	0.13	2	0.00	35.0
7.49	0.00		3.28	0.04	0.04			
13	237.95	0.07	0.3	0.13	0.13	2	0.00	35.0
8.62	0.00		5.51	0.13	0.13			
14	238.08	0.08	0.3	0.13	0.13	2	0.00	35.0
9.76	0.00		8.06	0.18	0.18			
15	238.21	0.08	0.3	0.13	0.13	2	0.00	35.0
10.89	0.00		10.96	0.21	0.21			
16	238.33	0.09	0.3	0.13	0.13	2	0.00	35.0
12.02	0.00		14.18	0.23	0.23			
17	238.46	0.10	0.3	0.13	0.13	2	0.00	35.0
13.15	0.00		17.75	0.25	0.25			
18	238.58	0.11	0.3	0.13	0.13	2	0.00	35.0
14.29	0.00		21.65	0.26	0.26			
19	238.71	0.12	0.3	0.13	0.13	2	0.00	35.0
15.42	0.00		25.88	0.27	0.27			
20	238.83	0.13	0.3	0.13	0.13	2	0.00	35.0
16.55	0.00		30.45	0.27	0.27			
21	238.96	0.14	0.3	0.13	0.13	2	0.00	35.0
17.68	0.00		35.36	0.28	0.28			
22	239.09	0.14	0.3	0.13	0.13	2	0.00	35.0
18.81	0.00		40.60	0.28	0.28			
23	239.21	0.15	0.3	0.13	0.13	2	0.00	35.0
19.95	0.00		46.18	0.29	0.29			
24	239.34	0.16	0.3	0.13	0.13	2	0.00	35.0

21.08	0.00	52.09	0.29	0.29			
25	239.46	0.17	0.3	0.13	0.13	2	0.00 35.0
22.21	0.00	58.34	0.30	0.30			
26	239.59	0.13	63.9	0.10	0.23	2	0.00 35.0
17.51	0.00	64.92	0.30	0.30			
27	239.69	0.12	63.9	0.10	0.23	2	0.00 35.0
15.49	0.00	50.36	0.29	0.29			
28	239.79	0.10	63.9	0.10	0.23	2	0.00 35.0
13.47	0.00	37.48	0.28	0.28			
29	239.90	0.09	63.9	0.10	0.23	2	0.00 35.0
11.45	0.00	26.27	0.26	0.26			
30	240.00	0.07	63.9	0.10	0.23	2	0.00 35.0
9.43	0.00	16.75	0.24	0.24			
31	240.10	0.05	63.9	0.09	0.21	2	0.00 35.0
6.56	0.00	8.91	0.20	0.20			
32	240.19	0.03	63.9	0.09	0.21	2	0.00 35.0
4.22	0.00	3.46	0.16	0.16			
RHS	240.29	-----			-----		
-----			-0.05	0.00	0.00		
X-S Area:	2.42	Path Length:	4.74			X-S Weight:	
314.89							

DATA: Analysis 4 - 2023 Embankment Stability - 5FT Below Embankment Top

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400
0.000

Unit weight of water/medium above ground:

Material Profiles (7 profiles)

Profile: 1 (2 points)	Material beneath: 1 - Tailings
90.00 420.00	237.30 420.00
Profile: 2 (11 points)	Material beneath: 6 - Tailings/Geomembrane Interface
90.00 411.00	155.00 405.00 168.00 412.00
175.00 412.00	182.00 406.00
215.00 406.00	240.00 420.10 244.00 420.10
244.10 417.00	246.90 417.00
247.00 420.00	
Profile: 3 (4 points)	Material beneath: 2 - Embankment (Proposed)
214.50 406.00	240.00 420.00 248.00 420.00
305.00 393.00	
Profile: 4 (2 points)	Material beneath: 1 - Tailings
182.00 406.00	249.10 406.00
Profile: 5 (4 points)	Material beneath: 3 - Embankment (Existing)
230.80 396.60	251.00 407.00 262.00 407.00
305.00 393.00	
Profile: 6 (4 points)	Material beneath: 4 - Soil Buttress
155.00 405.00	168.00 412.00 175.00 412.00
190.00 400.00	
Profile: 7 (2 points)	Material beneath: 5 - Bedrock
90.00 411.00	305.00 390.00

Slope Surface (5 points)

90.00 415.00	231.50 415.00	240.10 419.90
248.00 419.90	305.00 393.00	

Piezometric Surfaces (1 surface)

Surface within profile: 1 (2 points) - Tailings	
89.80 413.00	232.60 413.00

Failure Surface

Initial non-circular surface for critical search (4 points)		
231.60 415.06	234.00 412.20	239.70 412.20
243.10 419.90		

Tension Crack

Automatically-generated crack depth: 0.25

Variable Restraints

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Horizontal range around X-Left:      4.20      Trial positions within range:    5
Horizontal range around X-Right:     7.70      Trial positions within range:    5
Vertical range around Mid-Point:     3.50      Trial positions within range:   20

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RESULTS: Analysis 4 - 2023 Embankment Stability - 5FT Below Embankment Top

Spencer-Wright Method of Analysis - Non-Circular Failure Surface

Critical Failure Surface Search using Multiple Surface Generation Techniques

Factor of Safety for initial failure surface approximation: 6.418

There were: 269 successful analyses from a total of 501 trial surfaces
5 analyses rejected due to Theta out of valid range
227 analyses failed to produce a result

Critical (minimum) Factor of Safety: 2.80 Final Angle of
Interslice Forces: 23.9 degrees

Results Summary - Lowest 99 Factor of Safety surfaces

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Surface   X-Left   Y-Left   X-Right   Y-Right   Y-Deflection   FoS
Theta
1         229.50   415.00   241.04   419.65     1.75          2.802
23.9  <-- Critical Surface
2         229.50   415.00   239.06   419.06     1.75          2.807
24.0
3         229.50   415.00   242.94   419.65     1.75          2.834
21.5
4         229.50   415.00   241.04   419.65     1.57          2.886
23.3
5         229.50   415.00   242.94   419.65     1.57          2.891
21.2
6         229.50   415.00   239.07   419.06     1.57          2.904
23.2
7         229.50   415.00   242.95   419.65     1.38          2.955
20.9
8         229.50   415.00   241.04   419.65     1.38          2.981
22.7
9         229.50   415.00   239.08   419.07     1.38          3.017
22.4
10        229.50   415.00   242.95   419.65     1.20          3.026
20.4

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11	230.55	415.00	242.95	419.65	1.75	3.062
21.7						
12	229.50	415.00	241.05	419.65	1.20	3.090
22.0						
13	229.50	415.00	242.95	419.65	1.01	3.105
20.0						
14	230.55	415.00	241.05	419.65	1.75	3.109
24.3						
15	229.50	415.00	244.84	419.65	1.75	3.117
19.3						
16	230.55	415.00	239.09	419.07	1.75	3.140
25.2						
17	230.55	415.00	242.96	419.65	1.57	3.141
21.3						
18	229.50	415.00	239.08	419.07	1.20	3.150
21.7						
19	229.50	415.00	244.85	419.65	1.57	3.160
19.2						
20	233.70	416.25	239.09	419.07	1.75	3.181
26.4						
21	229.50	415.00	242.96	419.65	0.83	3.191
19.6						
22	233.70	416.25	241.05	419.65	1.75	3.207
23.4						
23	229.50	415.00	244.85	419.65	1.38	3.207
19.0						
24	229.50	415.00	241.05	419.65	1.01	3.213
21.4						
25	230.55	415.00	242.96	419.65	1.38	3.229
20.9						
26	230.55	415.00	241.05	419.65	1.57	3.232
23.6						
27	229.50	415.00	244.85	419.65	1.20	3.261
18.7						
28	229.50	415.00	242.96	419.65	0.64	3.288
19.2						
29	230.55	415.00	239.10	419.08	1.57	3.290
24.3						
30	229.50	415.00	239.09	419.07	1.01	3.305
20.9						
31	229.50	415.00	244.86	419.65	1.01	3.320
18.5						
32	230.55	415.00	242.96	419.65	1.20	3.328
20.5						
33	229.50	415.00	241.05	419.65	0.83	3.351
20.8						
34	230.55	415.00	241.06	419.65	1.38	3.375
23.0						
35	233.70	416.25	242.94	419.65	1.75	3.379
19.5						

36	229.50	415.00	244.86	419.65	0.83	3.384
18.2						
37	229.50	415.00	242.96	419.65	0.46	3.394
18.8						
38	230.55	415.00	244.85	419.65	1.75	3.407
19.0						
39	230.55	415.00	242.97	419.65	1.01	3.439
20.1						
40	229.50	415.00	246.74	419.65	1.75	3.443
17.4						
41	233.70	416.25	241.05	419.65	1.57	3.443
22.4						
42	229.50	415.00	244.87	419.65	0.64	3.456
17.9						
43	230.55	415.00	239.10	419.08	1.38	3.471
23.4						
44	233.70	416.25	239.10	419.08	1.57	3.473
24.9						
45	229.50	415.00	246.75	419.65	1.57	3.474
17.4						
46	230.55	415.00	244.86	419.65	1.57	3.481
18.8						
47	229.50	415.00	239.10	419.08	0.83	3.484
20.1						
48	232.65	415.66	242.95	419.65	1.75	3.492
19.5						
49	229.50	415.00	241.06	419.65	0.64	3.507
20.2						
50	229.50	415.00	246.75	419.65	1.38	3.509
17.3						
51	229.50	415.00	242.97	419.65	0.28	3.511
18.3						
52	231.60	415.06	242.96	419.65	1.75	3.520
20.3						
53	233.70	416.25	242.94	419.65	1.57	3.526
19.0						
54	229.50	415.00	244.87	419.65	0.46	3.534
17.6						
55	230.55	415.00	241.06	419.65	1.20	3.539
22.3						
56	229.50	415.00	246.76	419.65	1.20	3.549
17.1						
57	230.55	415.00	242.97	419.65	0.83	3.563
19.6						
58	230.55	415.00	244.86	419.65	1.38	3.565
18.6						
59	232.65	415.66	241.05	419.65	1.75	3.575
22.4						
60	229.50	415.00	246.76	419.65	1.01	3.595
17.0						

61	229.50	415.00	244.87	419.65	0.28	3.620
17.3						
62	229.50	415.00	242.97	419.65	0.09	3.639
17.9						
63	232.65	415.66	239.10	419.08	1.75	3.646
24.4						
64	229.50	415.00	246.77	419.65	0.83	3.646
16.8						
65	231.60	415.06	241.06	419.65	1.75	3.649
23.3						
66	230.55	415.00	244.87	419.65	1.20	3.658
18.3						
67	232.65	415.66	242.96	419.65	1.57	3.659
18.9						
68	231.60	415.06	239.11	419.09	1.75	3.659
24.8						
69	231.60	415.06	242.97	419.65	1.57	3.679
19.9						
70	229.50	415.00	241.06	419.65	0.46	3.684
19.6						
71	230.55	415.00	239.11	419.08	1.20	3.688
22.5						
72	229.50	415.00	239.10	419.08	0.64	3.690
19.4						
73	230.55	415.00	242.97	419.65	0.64	3.700
19.2						
74	233.70	416.25	242.95	419.65	1.38	3.702
18.4						
75	229.50	415.00	246.77	419.65	0.64	3.702
16.6						
76	229.50	415.00	244.88	419.65	0.09	3.713
17.0						
77	230.55	415.00	241.06	419.65	1.01	3.727
21.7						
78	233.70	416.25	241.05	419.65	1.38	3.738
21.4						
79	230.55	415.00	246.76	419.65	1.75	3.748
16.8						
80	230.55	415.00	244.87	419.65	1.01	3.762
18.0						
81	229.50	415.00	246.78	419.65	0.46	3.764
16.4						
82	229.50	415.00	242.97	419.65	-0.09	3.779
17.5						
83	231.60	415.06	244.86	419.65	1.75	3.812
17.9						
84	229.50	415.00	244.88	419.65	-0.09	3.814
16.7						
85	230.55	415.00	246.76	419.65	1.57	3.815
16.7						

86	232.65	415.66	244.85	419.65	1.75	3.832
17.1						
87	229.50	415.00	246.78	419.65	0.28	3.832
16.2						
88	233.70	416.25	244.83	419.65	1.75	3.833
16.6						
89	230.55	415.00	242.97	419.65	0.46	3.852
18.7						
90	232.65	415.66	242.96	419.65	1.38	3.853
18.4						
91	232.65	415.66	241.06	419.65	1.57	3.858
21.6						
92	231.60	415.06	242.97	419.65	1.38	3.861
19.4						
93	230.55	415.00	244.87	419.65	0.83	3.878
17.7						
94	233.70	416.25	239.11	419.08	1.38	3.878
23.4						
95	229.50	415.00	241.06	419.65	0.28	3.884
19.1						
96	230.55	415.00	246.77	419.65	1.38	3.892
16.5						
97	229.50	415.00	246.78	419.65	0.09	3.907
16.0						
98	233.70	416.25	242.95	419.65	1.20	3.910
17.8						
99	229.50	415.00	244.88	419.65	-0.28	3.922
16.4						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

	229.50	415.00	231.94	413.62	237.72	413.63	
	241.04	419.65					

Slice Geometry and Properties - Critical Failure Surface (surface 1, 35 slices)

Slice		X-S			Base			
	PoreWater	---	Left Hand Side	----				
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Side	Force	l/h	l'/h			
1	229.50	0.03	-29.6	0.34	0.39	1	40.00	20.0
3.12	0.00		0.00	0.00	0.00			
2	229.84	0.10	-29.6	0.34	0.39	1	40.00	20.0
9.36	0.00		15.30	0.89	0.89			
3	230.19	0.17	-29.6	0.35	0.41	6	30.00	17.0
17.11	0.00		38.31	0.80	0.80			
4	230.54	0.24	-29.6	0.35	0.41	6	30.00	17.0
24.56	0.00		66.73	0.78	0.78			

5	230.89	0.05	-29.6	0.06	0.07	6	30.00	17.0
5.25	0.00	103.77	0.75	0.75				
6	230.96	0.24	-29.6	0.27	0.31	6	30.00	17.0
24.49	0.00	111.43	0.74	0.74				
7	231.23	0.29	-29.6	0.27	0.31	6	30.00	17.0
28.66	0.00	146.41	0.72	0.72				
8	231.50	0.27	-29.6	0.22	0.25	6	30.00	17.0
27.45	0.00	186.22	0.71	0.71				
9	231.72	0.33	-29.6	0.22	0.25	6	30.00	17.0
32.86	0.00	223.34	0.63	0.63				
10	231.94	0.63	0.1	0.36	0.36	6	30.00	17.0
62.66	0.00	266.74	0.57	0.57				
11	232.30	0.70	0.1	0.36	0.36	6	30.00	17.0
70.08	0.00	278.89	0.57	0.57				
12	232.66	0.78	0.1	0.36	0.36	6	30.00	17.0
77.51	0.00	291.94	0.57	0.57				
13	233.02	0.85	0.1	0.36	0.36	6	30.00	17.0
84.93	0.00	305.91	0.56	0.56				
14	233.38	0.92	0.1	0.36	0.36	2	0.00	35.0
120.07	0.00	320.79	0.55	0.55				
15	233.74	1.00	0.1	0.36	0.36	2	0.00	35.0
129.72	0.00	357.33	0.52	0.52				
16	234.11	1.07	0.1	0.36	0.36	2	0.00	35.0
139.38	0.00	396.81	0.48	0.48				
17	234.47	1.15	0.1	0.36	0.36	2	0.00	35.0
149.03	0.00	439.23	0.46	0.46				
18	234.83	1.22	0.1	0.36	0.36	2	0.00	35.0
158.69	0.00	484.59	0.44	0.44				
19	235.19	1.29	0.1	0.36	0.36	2	0.00	35.0
168.34	0.00	532.88	0.42	0.42				
20	235.55	1.37	0.1	0.36	0.36	2	0.00	35.0
177.98	0.00	584.12	0.40	0.40				
21	235.91	1.44	0.1	0.36	0.36	2	0.00	35.0
187.65	0.00	638.28	0.39	0.39				
22	236.28	1.52	0.1	0.36	0.36	2	0.00	35.0
197.29	0.00	695.39	0.37	0.37				
23	236.64	1.59	0.1	0.36	0.36	2	0.00	35.0
206.95	0.00	755.44	0.36	0.36				
24	237.00	1.67	0.1	0.36	0.36	2	0.00	35.0
216.60	0.00	818.42	0.35	0.35				
25	237.36	1.74	0.1	0.36	0.36	2	0.00	35.0
226.26	0.00	884.34	0.35	0.35				
26	237.72	1.60	61.2	0.34	0.70	2	0.00	35.0
207.60	0.00	953.20	0.34	0.34				
27	238.06	1.45	61.2	0.34	0.70	2	0.00	35.0
188.92	0.00	787.64	0.33	0.33				
28	238.40	1.31	61.2	0.34	0.70	2	0.00	35.0
170.24	0.00	636.98	0.33	0.33				
29	238.74	1.17	61.2	0.34	0.70	2	0.00	35.0
151.55	0.00	501.21	0.32	0.32				

30	239.08	1.02	61.2	0.34	0.70	2	0.00	35.0
132.88	0.00		380.35	0.31	0.31			
31	239.42	0.88	61.2	0.34	0.70	2	0.00	35.0
114.20	0.00		274.38	0.30	0.30			
32	239.76	0.73	61.2	0.34	0.70	2	0.00	35.0
95.52	0.00		183.31	0.28	0.28			
33	240.10	0.52	61.2	0.31	0.65	2	0.00	35.0
67.78	0.00		107.13	0.25	0.25			
34	240.41	0.34	61.2	0.31	0.65	2	0.00	35.0
44.73	0.00		53.08	0.26	0.26			
35	240.72	0.17	61.2	0.31	0.65	2	0.00	35.0
21.68	0.00		17.41	0.26	0.26			
RHS	241.04	-----						
-----			0.12	0.00	0.00			
X-S Area:	29.86		Path Length:	15.46			X-S Weight:	
3741.11								

DATA: Analysis 5 - 2023 Embankment Stability - 5FT Below Embankment Top

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400
0.000

Unit weight of water/medium above ground:

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 1 - Tailings						
90.00	420.00	237.30	420.00			
Profile: 2 (11 points) Material beneath: 6 - Tailings/Geomembrane Interface						
90.00	411.00	155.00	405.00	168.00	412.00	
175.00	412.00	182.00	406.00			
215.00	406.00	240.00	420.10	244.00	420.10	
244.10	417.00	246.90	417.00			
247.00	420.00					
Profile: 3 (4 points) Material beneath: 2 - Embankment (Proposed)						
214.50	406.00	240.00	420.00	248.00	420.00	
305.00	393.00					
Profile: 4 (2 points) Material beneath: 1 - Tailings						
182.00	406.00	249.10	406.00			
Profile: 5 (4 points) Material beneath: 3 - Embankment (Existing)						
230.80	396.60	251.00	407.00	262.00	407.00	
305.00	393.00					
Profile: 6 (4 points) Material beneath: 4 - Soil Buttress						
155.00	405.00	168.00	412.00	175.00	412.00	
190.00	400.00					
Profile: 7 (2 points) Material beneath: 5 - Bedrock						
90.00	411.00	305.00	390.00			

Slope Surface (5 points)

90.00	415.00	231.50	415.00	240.10	419.90	
248.00	419.90	305.00	393.00			

Piezometric Surfaces (1 surface)

Surface within profile: 1 (2 points) - Tailings						
89.80	413.00	232.60	413.00			

Failure Surface (Critical, from previous analysis)

Initial non-circular surface for critical search (4 points)						
229.50	415.00	231.94	413.62	237.72	413.63	
241.18	419.90					

Tension Crack

Automatically-generated crack depth:	0.25		

Variable Restraints

Horizontal range around X-Left:	4.20	Trial positions within range:	5
Horizontal range around X-Right:	7.70	Trial positions within range:	5
Vertical range around Mid-Point:	3.50	Trial positions within range:	20

RESULTS: Analysis 5 - 2023 Embankment Stability - 5FT Below Embankment Top

Spencer-Wright Method of Analysis - Non-Circular Failure Surface

Critical Failure Surface Search using Multiple Surface Generation Techniques

Factor of Safety for initial failure surface approximation: 2.802

There were: 418 successful analyses from a total of 501 trial surfaces
36 analyses terminated due to unacceptable geometry
2 analyses rejected due to Theta out of valid range
45 analyses failed to produce a result

Critical (minimum) Factor of Safety: 2.23
Interslice Forces: 22.7 degrees

Final Angle of

Negative interslice forces exist on one or more slices; examine slice data and consult the GALENA Help utility
Effective stress line-of-thrust is not within one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety surfaces

Surface X-Left Y-Left X-Right Y-Right Y-Deflection FoS
Theta
1 227.40 415.00 240.97 419.65 1.57 2.234
22.7 <-- Critical Surface
2 227.40 415.00 240.97 419.65 1.38 2.258
23.0
3 227.40 415.00 240.98 419.65 1.20 2.285
23.1
4 227.40 415.00 238.89 418.96 1.38 2.303
21.0
5 228.45 415.00 240.98 419.65 1.57 2.312
24.2
6 227.40 415.00 240.99 419.65 1.01 2.315
23.1
7 227.40 415.00 238.91 418.97 1.20 2.320
21.4
8 228.45 415.00 240.99 419.65 1.38 2.340
24.5
9 227.40 415.00 238.93 418.99 1.01 2.343
21.5
10 227.40 415.00 240.99 419.65 0.83 2.348
23.0

11	228.45	415.00	241.00	419.65	1.20	2.372
24.6						
12	228.45	415.00	238.95	418.99	1.38	2.372
23.5						
13	227.40	415.00	238.95	419.00	0.83	2.373
21.5						
14	227.40	415.00	242.86	419.65	1.57	2.378
20.1						
15	227.40	415.00	241.00	419.65	0.64	2.384
22.7						
16	227.40	415.00	236.93	417.84	0.83	2.387
17.1						
17	227.40	415.00	236.96	417.86	0.64	2.388
17.2						
18	228.45	415.00	236.97	417.87	1.01	2.391
19.7						
19	229.50	415.00	241.00	419.65	1.57	2.393
25.8						
20	227.40	415.00	242.87	419.65	1.38	2.394
20.4						
21	228.45	415.00	237.00	417.88	0.83	2.397
20.2						
22	228.45	415.00	238.96	419.00	1.20	2.399
23.8						
23	227.40	415.00	236.89	417.82	1.01	2.405
16.6						
24	228.45	415.00	241.00	419.65	1.01	2.406
24.6						
25	227.40	415.00	236.99	417.88	0.46	2.407
17.2						
26	227.40	415.00	238.97	419.00	0.64	2.410
21.2						
27	227.40	415.00	242.88	419.65	1.20	2.413
20.5						
28	229.50	415.00	237.04	417.91	1.01	2.417
23.1						
29	228.45	415.00	238.98	419.01	1.01	2.418
23.9						
30	228.45	415.00	237.03	417.90	0.64	2.420
20.3						
31	229.50	415.00	241.00	419.65	1.38	2.424
26.1						
32	227.40	415.00	241.00	419.65	0.46	2.425
22.4						
33	227.40	415.00	242.88	419.65	1.01	2.434
20.6						
34	229.50	415.00	237.06	417.92	0.83	2.439
23.6						
35	227.40	415.00	237.01	417.89	0.28	2.441
17.1						

36	228.45	415.00	241.01	419.65	0.83	2.444
24.4						
37	228.45	415.00	242.88	419.65	1.57	2.444
21.1						
38	227.40	415.00	238.98	419.01	0.46	2.454
20.9						
39	228.45	415.00	238.99	419.02	0.83	2.455
23.8						
40	229.50	415.00	238.99	419.02	1.38	2.457
26.0						
41	229.50	415.00	241.01	419.65	1.20	2.457
26.2						
42	227.40	415.00	242.89	419.65	0.83	2.458
20.6						
43	228.45	415.00	237.05	417.91	0.46	2.459
20.1						
44	228.45	415.00	242.89	419.65	1.38	2.460
21.4						
45	227.40	415.00	241.01	419.65	0.28	2.470
22.1						
46	229.50	415.00	237.08	417.93	0.64	2.476
23.5						
47	228.45	415.00	242.89	419.65	1.20	2.478
21.6						
48	227.40	415.00	242.90	419.65	0.64	2.485
20.6						
49	228.45	415.00	241.01	419.65	0.64	2.486
24.2						
50	229.50	415.00	239.01	419.03	1.20	2.489
26.3						
51	227.40	415.00	237.03	417.90	0.09	2.491
16.8						
52	229.50	415.00	241.01	419.65	1.01	2.495
26.2						
53	228.45	415.00	242.90	419.65	1.01	2.500
21.7						
54	228.45	415.00	239.01	419.03	0.64	2.500
23.4						
55	228.45	415.00	237.06	417.92	0.28	2.514
19.7						
56	227.40	415.00	242.90	419.65	0.46	2.515
20.4						
57	227.40	415.00	241.01	419.65	0.09	2.520
21.7						
58	230.55	415.00	241.01	419.65	1.57	2.524
26.9						
59	228.45	415.00	242.90	419.65	0.83	2.524
21.7						
60	229.50	415.00	239.02	419.03	1.01	2.526
26.3						

61	229.50	415.00	237.10	417.94	0.46	2.530
23.1						
62	228.45	415.00	241.01	419.65	0.46	2.533
23.8						
63	229.50	415.00	241.02	419.65	0.83	2.536
26.0						
64	227.40	415.00	238.99	419.02	0.28	2.541
20.5						
65	229.50	415.00	242.90	419.65	1.57	2.541
21.9						
66	227.40	415.00	242.91	419.65	0.28	2.548
20.3						
67	228.45	415.00	242.91	419.65	0.64	2.552
21.6						
68	228.45	415.00	239.02	419.03	0.46	2.553
23.0						
69	230.55	415.00	237.10	417.94	1.01	2.561
26.9						
70	229.50	415.00	242.90	419.65	1.38	2.561
22.1						
71	230.55	415.00	241.02	419.65	1.38	2.567
27.1						
72	229.50	415.00	239.03	419.04	0.83	2.571
26.1						
73	231.60	415.06	237.07	417.93	1.75	2.573
25.9						
74	227.40	415.00	241.01	419.65	-0.09	2.576
21.2						
75	229.50	415.00	241.02	419.65	0.64	2.583
25.7						
76	227.40	415.00	242.91	419.65	0.09	2.584
20.0						
77	228.45	415.00	242.92	419.65	0.46	2.584
21.5						
78	229.50	415.00	242.91	419.65	1.20	2.585
22.3						
79	228.45	415.00	237.08	417.93	0.09	2.585
19.3						
80	228.45	415.00	241.02	419.65	0.28	2.586
23.4						
81	227.40	415.00	237.05	417.91	-0.09	2.590
16.5						
82	231.60	415.06	241.02	419.65	1.75	2.595
27.7						
83	229.50	415.00	237.11	417.95	0.28	2.602
22.5						
84	227.40	415.00	239.00	419.03	0.09	2.603
20.1						
85	231.60	415.06	237.10	417.94	1.57	2.603
27.3						

86	230.55	415.00	237.11	417.95	0.83	2.608
27.1						
87	229.50	415.00	242.91	419.65	1.01	2.612
22.4						
88	230.55	415.00	241.02	419.65	1.20	2.614
27.1						
89	228.45	415.00	239.03	419.04	0.28	2.615
22.5						
90	230.55	415.00	239.03	419.04	1.38	2.615
28.2						
91	228.45	415.00	242.92	419.65	0.28	2.619
21.3						
92	229.50	415.00	239.04	419.05	0.64	2.623
25.7						
93	227.40	415.00	242.92	419.65	-0.09	2.624
19.8						
94	229.50	415.00	241.03	419.65	0.46	2.636
25.2						
95	227.40	415.00	241.02	419.65	-0.28	2.639
20.7						
96	229.50	415.00	242.92	419.65	0.83	2.643
22.4						
97	228.45	415.00	241.02	419.65	0.09	2.645
22.9						
98	231.60	415.06	241.03	419.65	1.57	2.651
27.7						
99	231.60	415.06	237.11	417.95	1.38	2.653
28.3						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

227.40	415.00	230.27	414.97	237.10	414.99	
240.97	419.65					

Slice Geometry and Properties - Critical Failure Surface (surface 1, 34 slices)

Slice		X-S	----- Base -----					
	PoreWater	---	Left Hand Side ----					
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Side	Force	l/h	l'/h			
1	227.40	0.00	-0.6	0.41	0.41	1	40.00	20.0
0.08	0.00		0.00	0.00	0.00			
2	227.81	0.00	-0.6	0.41	0.41	1	40.00	20.0
0.25	0.00		8.62	20.75	20.75			
3	228.22	0.00	-0.6	0.41	0.41	1	40.00	20.0
0.41	0.00		17.26	20.73	20.73			
4	228.63	0.01	-0.6	0.41	0.41	1	40.00	20.0
0.57	0.00		25.95	20.71	20.71			

5	229.04	0.01	-0.6	0.41	0.41	1	40.00	20.0
0.74	0.00	34.66	20.70	20.70				
6	229.45	0.01	-0.6	0.41	0.41	1	40.00	20.0
0.90	0.00	43.41	20.68	20.68				
7	229.86	0.01	-0.6	0.41	0.41	1	40.00	20.0
1.06	0.00	52.19	20.67	20.67				
8	230.27	0.01	0.2	0.28	0.28	1	40.00	20.0
0.78	0.00	61.01	20.66	20.66				
9	230.56	0.01	0.2	0.28	0.28	1	40.00	20.0
0.75	0.00	67.05	23.35	23.35				
10	230.84	0.00	0.2	0.07	0.07	2	0.00	35.0
0.21	0.00	73.08	26.22	26.22				
11	230.91	0.01	0.2	0.30	0.30	6	30.00	17.0
0.80	0.00	73.17	27.42	27.42				
12	231.20	0.01	0.2	0.30	0.30	6	30.00	17.0
0.77	0.00	77.84	31.24	31.24				
13	231.50	0.06	0.2	0.43	0.43	6	30.00	17.0
6.36	0.00	82.51	35.31	35.31				
14	231.93	0.17	0.2	0.43	0.43	6	30.00	17.0
16.88	0.00	90.12	3.70	3.70				
15	232.36	0.27	0.2	0.43	0.43	6	30.00	17.0
27.39	0.00	99.34	2.09	2.09				
16	232.79	0.38	0.2	0.43	0.43	6	30.00	17.0
37.91	0.00	110.17	1.50	1.50				
17	233.22	0.48	0.2	0.43	0.43	2	0.00	35.0
62.96	0.00	122.61	1.19	1.19				
18	233.65	0.59	0.2	0.43	0.43	2	0.00	35.0
76.63	0.00	146.88	0.93	0.93				
19	234.09	0.69	0.2	0.43	0.43	2	0.00	35.0
90.31	0.00	176.42	0.76	0.76				
20	234.52	0.80	0.2	0.43	0.43	2	0.00	35.0
103.98	0.00	211.23	0.64	0.64				
21	234.95	0.91	0.2	0.43	0.43	2	0.00	35.0
117.65	0.00	251.31	0.55	0.55				
22	235.38	1.01	0.2	0.43	0.43	2	0.00	35.0
131.33	0.00	296.66	0.49	0.49				
23	235.81	1.12	0.2	0.43	0.43	2	0.00	35.0
145.00	0.00	347.28	0.45	0.45				
24	236.24	1.22	0.2	0.43	0.43	2	0.00	35.0
158.68	0.00	403.18	0.41	0.41				
25	236.67	1.33	0.2	0.43	0.43	2	0.00	35.0
172.35	0.00	464.34	0.38	0.38				
26	237.10	1.31	50.3	0.43	0.67	2	0.00	35.0
170.50	0.00	530.77	0.36	0.36				
27	237.53	1.20	50.3	0.43	0.67	2	0.00	35.0
155.35	0.00	436.63	0.35	0.35				
28	237.96	1.08	50.3	0.43	0.67	2	0.00	35.0
140.22	0.00	350.86	0.34	0.34				
29	238.39	0.96	50.3	0.43	0.67	2	0.00	35.0
125.08	0.00	273.44	0.33	0.33				

30	238.82	0.85	50.3	0.43	0.67	2	0.00	35.0
109.94	0.00		204.38	0.31	0.31			
31	239.24	0.73	50.3	0.43	0.67	2	0.00	35.0
94.80	0.00		143.67	0.29	0.29			
32	239.67	0.61	50.3	0.43	0.67	2	0.00	35.0
79.67	0.00		91.33	0.26	0.26			
33	240.10	0.45	50.3	0.43	0.68	2	0.00	35.0
58.29	0.00		47.34	0.22	0.22			
34	240.53	0.22	50.3	0.43	0.68	2	0.00	35.0
28.83	0.00		15.16	0.22	0.22			
RHS	240.97	-----			-----			
-----			-0.76	0.00	0.00			
X-S Area:	16.51	Path Length:	15.75				X-S Weight:	
2117.45								

DATA: Analysis 6 - 2023 Embankment Stability - 5FT Below Top of Embankment - Seismic

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400
0.000

Unit weight of water/medium above ground:

Material Profiles (7 profiles)

Profile: 1 (2 points)	Material beneath: 1 - Tailings					
90.00	420.00	237.30	420.00			
Profile: 2 (11 points)	Material beneath: 6 - Tailings/Geomembrane Interface					
90.00	411.00	155.00	405.00	168.00	412.00	
175.00	412.00	182.00	406.00			
215.00	406.00	240.00	420.10	244.00	420.10	
244.10	417.00	246.90	417.00			
247.00	420.00					
Profile: 3 (4 points)	Material beneath: 2 - Embankment (Proposed)					
214.50	406.00	240.00	420.00	248.00	420.00	
305.00	393.00					
Profile: 4 (2 points)	Material beneath: 1 - Tailings					
182.00	406.00	249.10	406.00			
Profile: 5 (4 points)	Material beneath: 3 - Embankment (Existing)					
230.80	396.60	251.00	407.00	262.00	407.00	
305.00	393.00					
Profile: 6 (4 points)	Material beneath: 4 - Soil Buttress					
155.00	405.00	168.00	412.00	175.00	412.00	
190.00	400.00					
Profile: 7 (2 points)	Material beneath: 5 - Bedrock					
90.00	411.00	305.00	390.00			

Slope Surface (5 points)

90.00	415.00	231.50	415.00	240.10	419.90	
248.00	419.90	305.00	393.00			

Piezometric Surfaces (1 surface)

Surface within profile: 1 (2 points) - Tailings						
89.80	413.00	232.60	413.00			

Failure Surface (Critical, from previous analysis)

Initial non-circular surface for critical search (4 points)						
227.40	415.00	230.27	414.97	237.10	414.99	
241.17	419.90					

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.050

Tension Crack

Automatically-generated crack depth: 0.25

Variable Restraints

Horizontal range around X-Left:	4.20	Trial positions within range:	5
Horizontal range around X-Right:	7.70	Trial positions within range:	5
Vertical range around Mid-Point:	3.50	Trial positions within range:	20

RESULTS: Analysis 6 - 2023 Embankment Stability - 5FT Below Top of Embankment - Seismic

Critical Failure Surface Search using Multiple Surface Generation Techniques

There were: 251 successful analyses from a total of 501 trial surfaces
250 analyses terminated due to unacceptable geometry

Negative interslice forces exist on one or more slices; examine slice data and consult the GALENA Help utility

Effective stress line-of-thrust is not within one or more slices; examine slice data and consult the GALENA Help utility

Surface Theta	X-Left	Y-Left	X-Right	Y-Right	Y-Deflection	FoS
19.0	225.30	415.00	240.94	419.65	-0.09	1.898
19.3	225.30	415.00	240.95	419.65	-0.28	1.907
19.4	225.30	415.00	240.95	419.65	-0.46	1.919
20.7	226.35	415.00	240.96	419.65	-0.09	1.924
19.5	225.30	415.00	240.96	419.65	-0.64	1.933
20.9	226.35	415.00	240.96	419.65	-0.28	1.937
19.4	225.30	415.00	240.97	419.65	-0.83	1.950
21.1	226.35	415.00	240.97	419.65	-0.46	1.952
22.2	227.40	415.00	240.97	419.65	0.00	1.965

10	226.35	415.00	240.97	419.65	-0.64	1.969
21.1						
11	225.30	415.00	240.97	419.65	-1.01	1.970
19.3						
12	227.40	415.00	240.97	419.65	-0.09	1.972
22.3						
13	225.30	415.00	242.84	419.65	-0.09	1.989
17.8						
14	227.40	415.00	240.98	419.65	-0.28	1.989
22.6						
15	226.35	415.00	240.98	419.65	-0.83	1.990
21.0						
16	225.30	415.00	240.98	419.65	-1.20	1.993
19.0						
17	225.30	415.00	242.84	419.65	-0.28	1.995
18.0						
18	225.30	415.00	242.85	419.65	-0.46	2.004
18.2						
19	227.40	415.00	240.98	419.65	-0.46	2.009
22.7						
20	226.35	415.00	240.99	419.65	-1.01	2.014
20.8						
21	225.30	415.00	242.86	419.65	-0.64	2.016
18.4						
22	225.30	415.00	240.98	419.65	-1.38	2.019
18.8						
23	226.35	415.00	242.85	419.65	-0.09	2.026
18.8						
24	225.30	415.00	242.87	419.65	-0.83	2.029
18.4						
25	227.40	415.00	240.99	419.65	-0.64	2.032
22.7						
26	228.45	415.00	240.99	419.65	-0.09	2.033
23.9						
27	227.40	415.00	238.90	418.97	-0.09	2.034
20.5						
28	226.35	415.00	242.86	419.65	-0.28	2.036
19.1						
29	226.35	415.00	238.84	418.93	-0.09	2.040
18.2						
30	226.35	415.00	240.99	419.65	-1.20	2.041
20.5						
31	227.40	415.00	238.92	418.98	-0.28	2.042
20.9						
32	226.35	415.00	238.87	418.95	-0.28	2.043
18.6						
33	225.30	415.00	242.87	419.65	-1.01	2.044
18.3						
34	226.35	415.00	242.87	419.65	-0.46	2.048
19.3						

35	225.30	415.00	240.99	419.65	-1.57	2.048
18.5						
36	226.35	415.00	238.89	418.96	-0.46	2.052
18.8						
37	228.45	415.00	240.99	419.65	-0.28	2.054
24.2						
38	225.30	415.00	238.80	418.91	-0.28	2.055
16.6						
39	225.30	415.00	238.83	418.93	-0.46	2.056
16.8						
40	227.40	415.00	240.99	419.65	-0.83	2.057
22.6						
41	227.40	415.00	238.94	418.99	-0.46	2.057
21.0						
42	226.35	415.00	242.87	419.65	-0.64	2.062
19.4						
43	225.30	415.00	242.88	419.65	-1.20	2.062
18.2						
44	225.30	415.00	238.77	418.89	-0.09	2.063
16.2						
45	225.30	415.00	238.86	418.94	-0.64	2.064
16.8						
46	226.35	415.00	238.91	418.97	-0.64	2.068
18.8						
47	227.40	415.00	242.87	419.65	-0.09	2.070
19.9						
48	226.35	415.00	241.00	419.65	-1.38	2.071
20.2						
49	225.30	415.00	238.90	418.97	-1.01	2.071
16.6						
50	227.40	415.00	238.96	419.00	-0.64	2.077
21.0						
51	225.30	415.00	238.88	418.96	-0.83	2.078
16.8						
52	226.35	415.00	242.88	419.65	-0.83	2.078
19.4						
53	228.45	415.00	241.00	419.65	-0.46	2.078
24.3						
54	225.30	415.00	242.88	419.65	-1.38	2.082
18.1						
55	225.30	415.00	240.99	419.65	-1.75	2.083
18.2						
56	227.40	415.00	242.87	419.65	-0.28	2.083
20.1						
57	228.45	415.00	238.95	419.00	-0.09	2.084
23.0						
58	227.40	415.00	241.00	419.65	-1.01	2.085
22.3						
59	226.35	415.00	238.93	418.98	-0.83	2.089
18.7						

60	228.45	415.00	238.97	419.01	-0.28	2.092
23.4						
61	229.50	415.00	241.00	419.65	-0.09	2.095
25.6						
62	225.30	415.00	238.92	418.98	-1.20	2.096
16.4						
63	226.35	415.00	242.89	419.65	-1.01	2.096
19.3						
64	227.40	415.00	242.88	419.65	-0.46	2.097
20.3						
65	227.40	415.00	236.97	417.87	-0.46	2.099
16.7						
66	225.30	415.00	242.89	419.65	-1.57	2.104
17.9						
67	227.40	415.00	238.97	419.01	-0.83	2.104
20.7						
68	228.45	415.00	241.00	419.65	-0.64	2.105
24.2						
69	226.35	415.00	241.00	419.65	-1.57	2.105
19.9						
70	227.40	415.00	236.99	417.88	-0.64	2.106
16.7						
71	227.40	415.00	236.94	417.85	-0.28	2.107
16.6						
72	228.45	415.00	237.01	417.89	-0.28	2.108
19.6						
73	228.45	415.00	236.98	417.87	-0.09	2.111
19.1						
74	227.40	415.00	242.89	419.65	-0.64	2.113
20.4						
75	228.45	415.00	238.98	419.01	-0.46	2.114
23.4						
76	226.35	415.00	238.95	418.99	-1.01	2.116
18.5						
77	227.40	415.00	241.00	419.65	-1.20	2.117
22.0						
78	226.35	415.00	242.89	419.65	-1.20	2.117
19.2						
79	229.50	415.00	241.01	419.65	-0.28	2.118
25.9						
80	229.50	415.00	237.05	417.91	-0.09	2.119
22.6						
81	228.45	415.00	242.88	419.65	-0.09	2.119
20.9						
82	228.45	415.00	237.03	417.90	-0.46	2.121
19.7						
83	225.30	415.00	238.94	418.99	-1.38	2.125
16.1						
84	227.40	415.00	237.02	417.89	-0.83	2.128
16.5						

85	225.30	415.00	242.90	419.65	-1.75	2.129
17.7						
86	228.45	415.00	242.89	419.65	-0.28	2.131
21.2						
87	227.40	415.00	242.89	419.65	-0.83	2.132
20.4						
88	229.50	415.00	237.07	417.92	-0.28	2.132
23.0						
89	228.45	415.00	241.01	419.65	-0.83	2.135
24.1						
90	227.40	415.00	236.90	417.83	-0.09	2.135
16.1						
91	226.35	415.00	242.90	419.65	-1.38	2.140
19.0						
92	228.45	415.00	239.00	419.02	-0.64	2.142
23.3						
93	226.35	415.00	241.00	419.65	-1.75	2.143
19.4						
94	229.50	415.00	241.01	419.65	-0.46	2.145
26.0						
95	229.50	415.00	239.00	419.02	-0.09	2.145
25.6						
96	228.45	415.00	242.90	419.65	-0.46	2.146
21.4						
97	228.45	415.00	237.05	417.91	-0.64	2.148
19.5						
98	226.35	415.00	238.96	419.00	-1.20	2.149
18.2						
99	227.40	415.00	241.01	419.65	-1.38	2.152
21.6						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

225.30	415.00	228.61	414.89	236.48	414.91	
240.94	419.65					

Slice Geometry and Properties - Critical Failure Surface (surface 1, 36 slices)

Slice		X-S	----- Base -----					
	PoreWater	---	Left Hand Side ----					
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Side	Force	l/h	l'/h			
1	225.30	0.00	-1.9	0.47	0.47	1	40.00	20.0
0.35	0.00		0.00	0.00	0.00			
2	225.77	0.01	-1.9	0.47	0.47	1	40.00	20.0
1.04	0.00		11.58	5.73	5.73			
3	226.25	0.02	-1.9	0.47	0.47	1	40.00	20.0
1.73	0.00		23.31	5.71	5.71			

4	226.72	0.03	-1.9	0.47	0.47	1	40.00	20.0
2.43	0.00	35.17	5.70	5.70				
5	227.19	0.03	-1.9	0.47	0.47	1	40.00	20.0
3.12	0.00	47.17	5.69	5.69				
6	227.67	0.04	-1.9	0.47	0.47	1	40.00	20.0
3.81	0.00	59.31	5.67	5.67				
7	228.14	0.05	-1.9	0.47	0.47	1	40.00	20.0
4.51	0.00	71.60	5.66	5.66				
8	228.61	0.05	0.2	0.42	0.42	1	40.00	20.0
4.27	0.00	84.02	5.65	5.65				
9	229.03	0.04	0.2	0.42	0.42	1	40.00	20.0
4.22	0.00	94.66	6.32	6.32				
10	229.45	0.04	0.2	0.42	0.42	1	40.00	20.0
4.18	0.00	105.29	7.02	7.02				
11	229.87	0.04	0.2	0.42	0.42	1	40.00	20.0
4.13	0.00	115.91	7.74	7.74				
12	230.29	0.04	0.2	0.42	0.42	1	40.00	20.0
4.08	0.00	126.52	8.49	8.49				
13	230.70	0.01	0.2	0.07	0.07	2	0.00	35.0
0.73	0.00	137.13	9.25	9.25				
14	230.77	0.01	0.2	0.12	0.12	6	30.00	17.0
1.32	0.00	137.41	9.49	9.49				
15	230.89	0.01	0.2	0.06	0.06	6	30.00	17.0
0.70	0.00	139.65	9.76	9.76				
16	230.96	0.03	0.2	0.27	0.27	6	30.00	17.0
2.77	0.00	140.87	9.90	9.90				
17	231.23	0.03	0.2	0.27	0.27	6	30.00	17.0
2.75	0.00	146.00	10.52	10.52				
18	231.50	0.12	0.2	0.50	0.50	6	30.00	17.0
12.06	0.00	151.12	11.15	11.15				
19	232.00	0.26	0.2	0.50	0.50	6	30.00	17.0
26.13	0.00	161.38	3.18	3.18				
20	232.50	0.40	0.2	0.50	0.50	6	30.00	17.0
40.19	0.00	173.34	1.95	1.95				
21	232.99	0.54	0.2	0.50	0.50	6	30.00	17.0
54.26	0.00	186.99	1.44	1.44				
22	233.49	0.68	0.2	0.50	0.50	2	0.00	35.0
88.83	0.00	202.35	1.16	1.16				
23	233.99	0.82	0.2	0.50	0.50	2	0.00	35.0
107.11	0.00	236.26	0.91	0.91				
24	234.49	0.96	0.2	0.50	0.50	2	0.00	35.0
125.40	0.00	277.16	0.74	0.74				
25	234.99	1.11	0.2	0.50	0.50	2	0.00	35.0
143.69	0.00	325.03	0.62	0.62				
26	235.49	1.25	0.2	0.50	0.50	2	0.00	35.0
161.97	0.00	379.88	0.54	0.54				
27	235.98	1.39	0.2	0.50	0.50	2	0.00	35.0
180.25	0.00	441.73	0.47	0.47				
28	236.48	1.45	46.7	0.52	0.75	2	0.00	35.0
188.00	0.00	510.54	0.42	0.42				

29	237.00	1.31	46.7	0.52	0.75	2	0.00	35.0
170.89	0.00		417.46	0.41	0.41			
30	237.52	1.18	46.7	0.52	0.75	2	0.00	35.0
153.77	0.00		332.85	0.40	0.40			
31	238.03	1.05	46.7	0.52	0.75	2	0.00	35.0
136.66	0.00		256.72	0.38	0.38			
32	238.55	0.92	46.7	0.52	0.75	2	0.00	35.0
119.54	0.00		189.06	0.36	0.36			
33	239.07	0.79	46.7	0.52	0.75	2	0.00	35.0
102.43	0.00		129.87	0.32	0.32			
34	239.58	0.66	46.7	0.52	0.75	2	0.00	35.0
85.31	0.00		79.16	0.28	0.28			
35	240.10	0.39	46.7	0.42	0.61	2	0.00	35.0
50.16	0.00		36.92	0.22	0.22			
36	240.52	0.20	46.7	0.42	0.61	2	0.00	35.0
25.82	0.00		12.09	0.22	0.22			
RHS	240.94	-----						
-----			-0.69	0.00	0.00			
X-S Area:	15.96		Path Length:	17.69			X-S Weight:	
2018.58								

DATA: Analysis 7 - 2023 Embankment Stability - 10FT Below Embankment Top

Material Properties (7 materials)

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-----
Material: 1 (Mohr-Coulomb Isotropic) - Tailings
  Cohesion  Phi  UnitWeight  Ru
    40.00   20.0    94.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
  Cohesion  Phi  UnitWeight  Ru
    0.00   35.0   130.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
  Cohesion  Phi  UnitWeight  Ru
    0.00   30.0   123.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress
  Cohesion  Phi  UnitWeight  Ru
    0.00   33.0   110.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Bedrock
  Cohesion  Phi  UnitWeight  Ru
    0.00   37.0   138.00    Auto
Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
  Cohesion  Phi  UnitWeight  Ru
    30.00   17.0   100.00    Auto
Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
  Cohesion  Phi  UnitWeight  Ru
    0.00   33.0   110.00    Auto

```

Water Properties

Unit weight of water: 62.400
0.000

Unit weight of water/medium above ground:

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 1 - Tailings
90.00 420.00 237.30 420.00
Profile: 2 (11 points) Material beneath: 6 - Tailings/Geomembrane Interface
90.10 410.90 155.00 404.40 168.00 411.80
175.20 411.70 181.80 405.60
215.00 406.00 240.00 420.10 244.00 420.10
244.10 417.00 246.90 417.00
247.00 420.00
Profile: 3 (4 points) Material beneath: 2 - Embankment (Proposed)
215.00 406.00 240.00 420.00 248.00 420.00
305.00 393.00
Profile: 4 (2 points) Material beneath: 1 - Tailings
182.00 406.00 249.10 406.00
Profile: 5 (4 points) Material beneath: 4 - Soil Buttress
155.00 405.00 168.00 412.00 175.00 412.00
190.00 400.00
Profile: 6 (4 points) Material beneath: 3 - Embankment (Existing)
230.80 396.60 251.00 407.00 262.00 407.00
305.00 393.00
Profile: 7 (2 points) Material beneath: 5 - Bedrock
90.00 411.00 305.00 390.00

Slope Surface (5 points)

179.50 408.00 219.00 407.90 240.00 420.00
248.00 420.00 305.00 393.00

Piezometric Surfaces (1 surface)

Failure Surface

Initial non-circular surface for critical search (4 points)
213.73 407.91 217.70 402.30 225.40 402.20
230.67 414.62

Tension Crack

Automatically-generated crack depth: 0.25

Variable Restraints

Horizontal range around X-Left: 14.97 Trial positions within range: 5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

Spencer-Wright Method of Analysis - Non-Circular Failure Surface

Solution did not converge for initial failure surface approximation

There were: 159 successful analyses from a total of 501 trial surfaces

1 analyses terminated due to unacceptable geometry

24 analyses rejected due to Theta out of valid range

317 analyses failed to produce a result

Final Angle of

Interslice Forces: 11.4 degrees

Results Summary - Lowest 99 Factor of Safety surfaces

Surface Theta	X-Left	Y-Left	X-Right	Y-Right	Y-Deflection	FoS
11.4	206.24	407.93	230.41	414.22	0.90	2.867
11.3	206.24	407.93	230.41	414.23	0.71	2.934
12.7	206.24	407.93	234.59	416.63	0.90	2.959
11.3	206.24	407.93	230.42	414.23	0.62	2.970
12.6	206.24	407.93	234.59	416.63	0.81	2.995
12.9	209.99	407.92	230.47	414.26	0.90	3.003
12.6	206.24	407.93	234.59	416.64	0.71	3.032
22.6	221.21	409.18	222.21	409.50	0.71	3.043
11.2	206.24	407.93	230.42	414.23	0.43	3.044
	209.99	407.92	230.47	414.26	0.81	3.051

12.9						
11	209.99	407.92	226.24	411.82	0.90	3.069
11.2						
12	206.24	407.93	234.60	416.64	0.62	3.071
12.5						
13	209.99	407.92	230.47	414.26	0.71	3.100
12.8						
14	209.99	407.92	226.25	411.83	0.81	3.102
11.1						
15	206.24	407.93	234.60	416.64	0.52	3.112
12.5						
16	206.24	407.93	230.43	414.23	0.24	3.122
11.1						
17	209.99	407.92	226.25	411.83	0.71	3.138
11.1						
18	221.21	409.18	222.16	409.47	0.81	3.141
19.3						
19	209.99	407.92	230.47	414.26	0.62	3.151
12.7						
20	206.24	407.93	234.60	416.64	0.43	3.154
12.5						
21	206.24	407.93	230.43	414.24	0.14	3.164
11.1						
22	209.99	407.92	226.26	411.83	0.62	3.175
11.0						
23	206.24	407.93	234.60	416.64	0.33	3.196
12.4						
24	209.99	407.92	230.47	414.26	0.52	3.203
12.7						
25	206.24	407.93	230.43	414.24	0.05	3.206
11.0						
26	209.99	407.92	226.26	411.84	0.52	3.216
10.9						
27	206.24	407.93	238.75	419.03	0.90	3.218
13.4						
28	206.24	407.93	234.60	416.64	0.24	3.240
12.4						
29	206.24	407.93	230.43	414.24	-0.05	3.250
11.0						
30	209.99	407.92	226.27	411.84	0.43	3.259
10.8						
31	209.99	407.92	230.48	414.26	0.43	3.259
12.6						
32	206.24	407.93	238.75	419.03	0.81	3.260
13.4						
33	221.21	409.18	222.24	409.52	0.62	3.272
22.2						
34	206.24	407.93	234.60	416.64	0.14	3.288
12.3						
35	206.24	407.93	230.44	414.24	-0.14	3.296

11.0						
36	206.24	407.93	238.75	419.03	0.71	3.302
13.4						
37	209.99	407.92	226.27	411.84	0.33	3.305
10.8						
38	209.99	407.92	230.48	414.26	0.33	3.315
12.6						
39	206.24	407.93	234.60	416.64	0.05	3.334
12.3						
40	206.24	407.93	230.44	414.24	-0.24	3.342
10.9						
41	209.99	407.92	234.63	416.65	0.90	3.367
13.9						
42	213.73	407.91	226.34	411.88	0.90	3.367
13.4						
43	209.99	407.92	230.48	414.27	0.24	3.374
12.5						
44	206.24	407.93	234.61	416.64	-0.05	3.382
12.2						
45	206.24	407.93	230.44	414.24	-0.33	3.389
10.9						
46	209.99	407.92	226.28	411.85	0.14	3.402
10.6						
47	209.99	407.92	234.63	416.66	0.81	3.423
13.8						
48	206.24	407.93	234.61	416.64	-0.14	3.431
12.2						
49	209.99	407.92	230.48	414.27	0.14	3.435
12.4						
50	206.24	407.93	230.44	414.24	-0.43	3.439
10.8						
51	213.73	407.91	226.35	411.88	0.81	3.439
13.3						
52	206.24	407.93	226.10	411.74	0.90	3.465
9.2						
53	206.24	407.93	234.61	416.64	-0.24	3.481
12.2						
54	206.24	407.93	226.11	411.75	0.81	3.485
9.2						
55	206.24	407.93	230.45	414.24	-0.52	3.490
10.8						
56	209.99	407.92	230.48	414.27	0.05	3.499
12.4						
57	206.24	407.93	226.12	411.75	0.71	3.506
9.2						
58	209.99	407.92	226.29	411.85	-0.05	3.513
10.5						
59	213.73	407.91	226.35	411.88	0.71	3.514
13.2						
60	206.24	407.93	226.13	411.76	0.62	3.530

9.1						
61	206.24	407.93	234.61	416.64	-0.33	3.533
12.1						
62	206.24	407.93	230.45	414.25	-0.62	3.543
10.7						
63	206.24	407.93	226.14	411.76	0.52	3.556
9.1						
64	209.99	407.92	230.49	414.27	-0.05	3.565
12.3						
65	209.99	407.92	226.30	411.85	-0.14	3.572
10.5						
66	206.24	407.93	226.15	411.77	0.43	3.584
9.0						
67	206.24	407.93	234.61	416.64	-0.43	3.587
12.1						
68	206.24	407.93	230.45	414.25	-0.71	3.600
10.7						
69	206.24	407.93	226.16	411.77	0.33	3.614
9.0						
70	209.99	407.92	226.30	411.86	-0.24	3.633
10.4						
71	209.99	407.92	230.49	414.27	-0.14	3.634
12.3						
72	206.24	407.93	234.61	416.65	-0.52	3.642
12.1						
73	206.24	407.93	226.16	411.78	0.24	3.645
9.0						
74	206.24	407.93	230.45	414.25	-0.81	3.657
10.7						
75	209.99	407.92	234.63	416.66	0.43	3.668
13.6						
76	206.24	407.93	238.75	419.03	0.43	3.680
13.4						
77	206.24	407.93	226.17	411.78	0.14	3.681
9.0						
78	213.73	407.91	226.36	411.89	0.52	3.682
13.0						
79	206.24	407.93	234.61	416.65	-0.62	3.698
12.0						
80	209.99	407.92	226.30	411.86	-0.33	3.698
10.3						
81	209.99	407.92	230.49	414.27	-0.24	3.706
12.2						
82	206.24	407.93	230.45	414.25	-0.90	3.715
10.7						
83	206.24	407.93	226.18	411.79	0.05	3.716
8.9						
84	209.99	407.92	234.64	416.66	0.33	3.735
13.6						
85	206.24	407.93	226.19	411.79	-0.05	3.755

8.9						
86	206.24	407.93	234.61	416.65	-0.71	3.756
12.0						
87	209.99	407.92	226.31	411.86	-0.43	3.766
10.3						
88	213.73	407.91	226.36	411.89	0.43	3.774
12.9						
89	209.99	407.92	230.49	414.27	-0.33	3.778
12.2						
90	206.24	407.93	226.19	411.79	-0.14	3.795
8.9						
91	209.99	407.92	234.64	416.66	0.24	3.804
13.5						
92	206.24	407.93	234.62	416.65	-0.81	3.816
11.9						
93	209.99	407.92	226.31	411.86	-0.52	3.838
10.2						
94	209.99	407.92	230.49	414.27	-0.43	3.855
12.1						
95	221.21	409.18	222.27	409.53	0.52	3.863
20.3						
96	213.73	407.91	226.36	411.89	0.33	3.874
12.8						
97	206.24	407.93	234.62	416.65	-0.90	3.878
11.9						
98	209.99	407.92	226.31	411.86	-0.62	3.913
10.2						
99	209.99	407.92	230.49	414.27	-0.52	3.935
12.1						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

206.24	407.93	211.97	403.11	223.07	403.02
230.41	414.22				

Slice Geometry and Properties - Critical Failure Surface (surface 1, 34 slices)

Slice	X-S	Base						
	PoreWater	--- Left Hand Side ---						
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Side Force	l/h	l'/h				
1	206.24	0.25	-40.1	0.76	1.00	1	40.00	20.0
23.08	0.00	0.00	0.00	0.00				
2	207.01	0.74	-40.1	0.76	1.00	1	40.00	20.0
69.24	0.00	59.41	0.62	0.62				
3	207.77	1.23	-40.1	0.76	1.00	1	40.00	20.0
115.40	0.00	184.30	0.51	0.51				
4	208.54	1.52	-40.1	0.69	0.90	6	30.00	17.0

143.68	0.00	374.66	0.48	0.48			
5	209.23	1.91 -40.1	0.69	0.90	6	30.00	17.0
183.25	0.00	585.71	0.47	0.47			
6	209.91	2.31 -40.1	0.69	0.90	6	30.00	17.0
222.80	0.00	850.09	0.46	0.46			
7	210.60	2.70 -40.1	0.69	0.90	6	30.00	17.0
262.36	0.00	1167.78	0.45	0.45			
8	211.28	3.10 -40.1	0.69	0.90	6	30.00	17.0
301.91	0.00	1538.79	0.44	0.44			
9	211.97	3.64 -0.5	0.76	0.76	6	30.00	17.0
355.51	0.00	1963.07	0.44	0.44			
10	212.73	3.65 -0.5	0.76	0.76	6	30.00	17.0
355.89	0.00	2014.00	0.46	0.46			
11	213.48	3.65 -0.5	0.76	0.76	6	30.00	17.0
356.25	0.00	2064.97	0.48	0.48			
12	214.24	3.65 -0.5	0.76	0.76	6	30.00	17.0
356.63	0.00	2115.98	0.50	0.50			
13	215.00	3.25 -0.5	0.67	0.67	1	40.00	20.0
310.47	0.00	2167.04	0.52	0.52			
14	215.67	3.26 -0.5	0.67	0.67	1	40.00	20.0
319.88	0.00	2220.94	0.54	0.54			
15	216.35	3.26 -0.5	0.67	0.67	1	40.00	20.0
329.31	0.00	2276.16	0.55	0.55			
16	217.02	3.26 -0.5	0.67	0.67	1	40.00	20.0
338.73	0.00	2332.73	0.57	0.57			
17	217.70	3.26 -0.5	0.67	0.67	1	40.00	20.0
348.14	0.00	2390.62	0.58	0.58			
18	218.37	3.04 -0.5	0.63	0.63	1	40.00	20.0
329.17	0.00	2449.86	0.60	0.60			
19	219.00	3.42 -0.5	0.68	0.68	1	40.00	20.0
372.97	0.00	2505.73	0.61	0.61			
20	219.68	3.69 -0.5	0.68	0.68	1	40.00	20.0
407.81	0.00	2568.55	0.58	0.58			
21	220.36	3.96 -0.5	0.68	0.68	1	40.00	20.0
442.65	0.00	2636.31	0.55	0.55			
22	221.04	4.23 -0.5	0.68	0.68	1	40.00	20.0
477.50	0.00	2709.01	0.52	0.52			
23	221.71	4.50 -0.5	0.68	0.68	1	40.00	20.0
512.34	0.00	2786.63	0.50	0.50			
24	222.39	4.77 -0.5	0.68	0.68	1	40.00	20.0
547.19	0.00	2869.21	0.48	0.48			
25	223.07	4.50 56.8	0.65	1.19	1	40.00	20.0
526.64	0.00	2956.74	0.46	0.46			
26	223.72	4.10 56.8	0.65	1.19	1	40.00	20.0
497.61	0.00	2468.22	0.45	0.45			
27	224.37	3.69 56.8	0.65	1.19	1	40.00	20.0
468.57	0.00	2007.80	0.46	0.46			
28	225.02	3.85 56.8	0.77	1.40	2	0.00	35.0
500.43	0.00	1575.45	0.47	0.47			
29	225.79	3.29 56.8	0.77	1.40	2	0.00	35.0

427.29	0.00	1174.12	0.47	0.47			
30	226.56	2.72	56.8	0.77	1.40	2	0.00 35.0
354.14	0.00	831.44	0.47	0.47			
31	227.33	2.16	56.8	0.77	1.40	2	0.00 35.0
281.01	0.00	547.43	0.47	0.47			
32	228.10	1.60	56.8	0.77	1.40	2	0.00 35.0
207.86	0.00	322.06	0.47	0.47			
33	228.87	1.04	56.8	0.77	1.40	2	0.00 35.0
134.71	0.00	155.37	0.48	0.48			
34	229.64	0.47	56.8	0.77	1.40	2	0.00 35.0
61.57	0.00	47.33	0.52	0.52			
RHS	230.41	-----			-----		
-----			-2.05	0.00	0.00		
X-S Area:	99.69	Path Length:	31.98				X-S Weight:
10941.98							

DATA: Analysis 8 - 2023 Embankment Stability - 10FT Below Embankment Top

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400
0.000

Unit weight of water/medium above ground:

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 1 - Tailings						
90.00	420.00	237.30	420.00			
Profile: 2 (11 points) Material beneath: 6 - Tailings/Geomembrane Interface						
90.10	410.90	155.00	404.40	168.00	411.80	
175.20	411.70	181.80	405.60			
215.00	406.00	240.00	420.10	244.00	420.10	
244.10	417.00	246.90	417.00			
247.00	420.00					
Profile: 3 (4 points) Material beneath: 2 - Embankment (Proposed)						
215.00	406.00	240.00	420.00	248.00	420.00	
305.00	393.00					
Profile: 4 (2 points) Material beneath: 1 - Tailings						
182.00	406.00	249.10	406.00			
Profile: 5 (4 points) Material beneath: 4 - Soil Buttress						
155.00	405.00	168.00	412.00	175.00	412.00	
190.00	400.00					
Profile: 6 (4 points) Material beneath: 3 - Embankment (Existing)						
230.80	396.60	251.00	407.00	262.00	407.00	
305.00	393.00					
Profile: 7 (2 points) Material beneath: 5 - Bedrock						
90.00	411.00	305.00	390.00			

Slope Surface (5 points)

179.50	408.00	219.00	407.90	240.00	420.00	
248.00	420.00	305.00	393.00			

Piezometric Surfaces (1 surface)

Failure Surface (Critical, from previous analysis)

Initial non-circular surface for critical search (4 points)						
206.24	407.93	211.97	403.11	223.07	403.02	
230.67	414.62					

Tension Crack

Automatically-generated crack depth: 0.25

Variable Restraints

Horizontal range around X-Left:	14.97	Trial positions within range:	5
Horizontal range around X-Right:	16.50	Trial positions within range:	5
Vertical range around Mid-Point:	1.80	Trial positions within range:	20

- - - - -
- - - - -

RESULTS: Analysis 8 - 2023 Embankment Stability - 10FT Below Embankment Top

Spencer-Wright Method of Analysis - Non-Circular Failure Surface

Critical Failure Surface Search using Multiple Surface Generation Techniques

Factor of Safety for initial failure surface approximation: 2.867

There were: 344 successful analyses from a total of 501 trial surfaces

19 analyses rejected due to Theta out of valid range

138 analyses failed to produce a result

Critical (minimum) Factor of Safety: 2.48

Final Angle of

Interslice Forces: 12.2 degrees

Results Summary - Lowest 99 Factor of Safety surfaces

Surface Theta	X-Left	Y-Left	X-Right	Y-Right	Y-Deflection	FoS
1	198.76	407.95	238.66	418.98	0.90	2.483
12.2	<-- Critical Surface					
2	198.76	407.95	238.66	418.98	0.81	2.501
12.1						
3	202.50	407.94	234.52	416.59	0.90	2.517
12.1						
4	198.76	407.95	238.66	418.98	0.71	2.520
12.1						
5	202.50	407.94	238.69	419.00	0.90	2.521
13.1						
6	202.50	407.94	234.52	416.59	0.81	2.539
12.0						
7	198.76	407.95	238.66	418.98	0.62	2.540
12.1						
8	202.50	407.94	238.70	419.00	0.81	2.544
13.1						
9	206.24	407.93	234.57	416.62	0.90	2.555
13.3						
10	198.76	407.95	238.66	418.98	0.52	2.559
12.0						
11	202.50	407.94	234.52	416.60	0.71	2.560
12.0						
12	202.50	407.94	238.70	419.00	0.71	2.566
13.0						
13	198.76	407.95	238.66	418.98	0.43	2.579
12.0						
14	202.50	407.94	234.53	416.60	0.62	2.583
12.0						

15	198.76	407.95	234.46	416.56	0.90	2.586
11.0						
16	202.50	407.94	238.70	419.00	0.62	2.589
13.0						
17	198.76	407.95	238.67	418.98	0.33	2.599
11.9						
18	206.24	407.93	230.37	414.20	0.90	2.604
11.9						
19	198.76	407.95	234.47	416.56	0.81	2.605
10.9						
20	202.50	407.94	234.53	416.60	0.52	2.606
11.9						
21	202.50	407.94	238.70	419.00	0.52	2.613
12.9						
22	198.76	407.95	238.67	418.98	0.24	2.620
11.9						
23	198.76	407.95	234.47	416.56	0.71	2.623
10.9						
24	206.24	407.93	230.38	414.21	0.81	2.628
11.9						
25	202.50	407.94	234.53	416.60	0.43	2.629
11.9						
26	209.99	407.92	230.44	414.24	0.90	2.632
13.6						
27	202.50	407.94	238.70	419.00	0.43	2.637
12.9						
28	198.76	407.95	238.67	418.98	0.14	2.640
11.9						
29	198.76	407.95	234.47	416.57	0.62	2.642
10.9						
30	202.50	407.94	234.53	416.60	0.33	2.652
11.8						
31	206.24	407.93	230.38	414.21	0.71	2.653
11.8						
32	202.50	407.94	238.70	419.00	0.33	2.661
12.9						
33	198.76	407.95	234.48	416.57	0.52	2.661
10.8						
34	198.76	407.95	238.67	418.98	0.05	2.662
11.8						
35	206.24	407.93	238.73	419.02	0.90	2.663
14.2						
36	209.99	407.92	230.45	414.25	0.81	2.665
13.6						
37	202.50	407.94	234.54	416.60	0.24	2.677
11.8						
38	206.24	407.93	230.39	414.21	0.62	2.678
11.8						
39	198.76	407.95	234.48	416.57	0.43	2.681
10.8						

40	198.76	407.95	238.67	418.99	-0.05	2.684
11.8						
41	202.50	407.94	238.70	419.00	0.24	2.686
12.8						
42	206.24	407.93	238.73	419.02	0.81	2.691
14.1						
43	209.99	407.92	230.45	414.25	0.71	2.699
13.5						
44	198.76	407.95	234.48	416.57	0.33	2.702
10.8						
45	202.50	407.94	234.54	416.60	0.14	2.702
11.7						
46	206.24	407.93	230.39	414.21	0.52	2.706
11.7						
47	198.76	407.95	238.67	418.99	-0.14	2.706
11.8						
48	202.50	407.94	238.71	419.00	0.14	2.711
12.8						
49	206.24	407.93	238.73	419.02	0.71	2.720
14.1						
50	198.76	407.95	234.48	416.57	0.24	2.722
10.8						
51	206.24	407.93	234.58	416.63	0.33	2.725
13.0						
52	202.50	407.94	234.54	416.60	0.05	2.728
11.7						
53	198.76	407.95	238.68	418.99	-0.24	2.729
11.8						
54	206.24	407.93	230.39	414.21	0.43	2.732
11.7						
55	202.50	407.94	238.71	419.00	0.05	2.737
12.8						
56	198.76	407.95	234.49	416.57	0.14	2.743
10.7						
57	206.24	407.93	238.73	419.02	0.62	2.749
14.0						
58	206.24	407.93	234.58	416.63	0.24	2.756
12.9						
59	206.24	407.93	230.40	414.22	0.33	2.761
11.6						
60	202.50	407.94	230.29	414.15	0.90	2.762
10.4						
61	202.50	407.94	238.71	419.01	-0.05	2.763
12.7						
62	198.76	407.95	234.49	416.58	0.05	2.765
10.7						
63	198.76	407.95	238.68	418.99	-0.33	2.767
11.7						
64	209.99	407.92	234.61	416.65	0.90	2.777
14.7						

65	206.24	407.93	238.73	419.02	0.52	2.780
14.0						
66	202.50	407.94	234.54	416.61	-0.14	2.781
11.6						
67	202.50	407.94	230.29	414.16	0.81	2.781
10.4						
68	198.76	407.95	234.49	416.58	-0.05	2.787
10.7						
69	206.24	407.93	234.58	416.63	0.14	2.788
12.9						
70	206.24	407.93	230.40	414.22	0.24	2.789
11.6						
71	202.50	407.94	238.71	419.01	-0.14	2.790
12.7						
72	202.50	407.94	230.30	414.16	0.71	2.800
10.4						
73	202.50	407.94	234.55	416.61	-0.24	2.808
11.6						
74	198.76	407.95	234.50	416.58	-0.14	2.810
10.7						
75	206.24	407.93	238.73	419.02	0.43	2.811
13.9						
76	209.99	407.92	234.61	416.65	0.81	2.815
14.6						
77	202.50	407.94	238.71	419.01	-0.24	2.818
12.6						
78	206.24	407.93	230.40	414.22	0.14	2.819
11.5						
79	206.24	407.93	234.58	416.63	0.05	2.821
12.8						
80	202.50	407.94	230.30	414.16	0.62	2.821
10.4						
81	198.76	407.95	234.50	416.58	-0.24	2.833
10.6						
82	202.50	407.94	234.55	416.61	-0.33	2.836
11.5						
83	198.76	407.95	238.68	418.99	-0.43	2.842
11.8						
84	202.50	407.94	230.31	414.17	0.52	2.843
10.3						
85	206.24	407.93	238.73	419.02	0.33	2.843
13.9						
86	202.50	407.94	238.71	419.01	-0.33	2.846
12.6						
87	206.24	407.93	230.41	414.22	0.05	2.851
11.5						
88	209.99	407.92	230.46	414.25	0.33	2.852
13.2						
89	209.99	407.92	234.61	416.65	0.71	2.854
14.6						

90	206.24	407.93	234.59	416.63	-0.05	2.856
12.8						
91	198.76	407.95	234.50	416.58	-0.33	2.857
10.6						
92	202.50	407.94	230.31	414.17	0.43	2.864
10.3						
93	206.24	407.93	230.41	414.22	0.00	2.867
11.4						
94	202.50	407.94	238.71	419.01	-0.43	2.875
12.6						
95	206.24	407.93	238.74	419.02	0.24	2.876
13.8						
96	198.76	407.95	234.50	416.58	-0.43	2.881
10.6						
97	206.24	407.93	230.41	414.22	-0.05	2.883
11.4						
98	202.50	407.94	230.32	414.17	0.33	2.887
10.3						
99	206.24	407.93	234.59	416.63	-0.14	2.891
12.8						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

198.76 407.95 208.17 400.49 226.43 400.35
238.66 418.98

Slice Geometry and Properties - Critical Failure Surface (surface 1, 35 slices)

Slice		X-S	Base -----					
	PoreWater	--- Left Hand Side ---						
Weight	X-Left Force	Area	Angle	Width	Length	Matl	Cohesion	Phi
		Side	Force	l/h	l'/h			
1	198.76	0.60	-38.4	1.23	1.57	1	40.00	20.0
56.28	0.00	0.00	0.00	0.00	0.00			
2	199.99	1.80	-38.4	1.23	1.57	1	40.00	20.0
168.84	0.00	127.77	0.64	0.64				
3	201.22	0.42	-38.4	0.21	0.26	1	40.00	20.0
39.31	0.00	414.13	0.52	0.52				
4	201.43	2.87	-38.4	1.12	1.43	6	30.00	17.0
272.60	0.00	477.64	0.50	0.50				
5	202.55	3.87	-38.4	1.12	1.43	6	30.00	17.0
372.47	0.00	871.61	0.49	0.49				
6	203.68	4.86	-38.4	1.12	1.43	6	30.00	17.0
472.32	0.00	1398.17	0.47	0.47				
7	204.80	5.86	-38.4	1.12	1.43	6	30.00	17.0
572.18	0.00	2057.28	0.46	0.46				
8	205.92	6.86	-38.4	1.12	1.43	6	30.00	17.0
672.04	0.00	2848.98	0.45	0.45				

9	207.05	7.85	-38.4	1.12	1.43	6	30.00	17.0
771.89	0.00	3773.25	0.45	0.45				
10	208.17	8.46	-0.5	1.14	1.14	6	30.00	17.0
832.65	0.00	4830.05	0.44	0.44				
11	209.31	8.47	-0.5	1.14	1.14	6	30.00	17.0
833.44	0.00	4959.55	0.47	0.47				
12	210.45	8.48	-0.5	1.14	1.14	6	30.00	17.0
834.24	0.00	5089.17	0.49	0.49				
13	211.59	8.48	-0.5	1.14	1.14	6	30.00	17.0
835.06	0.00	5218.89	0.51	0.51				
14	212.72	8.49	-0.5	1.14	1.14	6	30.00	17.0
835.85	0.00	5348.72	0.53	0.53				
15	213.86	8.50	-0.5	1.14	1.14	6	30.00	17.0
836.65	0.00	5478.67	0.55	0.55				
16	215.00	8.40	-0.5	1.12	1.12	1	40.00	20.0
802.22	0.00	5608.73	0.57	0.57				
17	216.12	8.41	-0.4	1.12	1.12	1	40.00	20.0
828.32	0.00	5759.29	0.59	0.59				
18	217.25	8.41	-0.5	1.12	1.12	1	40.00	20.0
854.45	0.00	5914.10	0.60	0.60				
19	218.37	4.71	-0.5	0.63	0.63	1	40.00	20.0
485.40	0.00	6073.21	0.62	0.62				
20	219.00	9.72	-0.4	1.24	1.24	1	40.00	20.0
1014.17	0.00	6163.43	0.63	0.63				
21	220.24	10.61	-0.5	1.24	1.24	1	40.00	20.0
1130.04	0.00	6350.61	0.59	0.59				
22	221.48	11.51	-0.5	1.24	1.24	1	40.00	20.0
1245.92	0.00	6556.78	0.56	0.56				
23	222.71	12.40	-0.5	1.24	1.24	1	40.00	20.0
1361.81	0.00	6781.93	0.53	0.53				
24	223.95	13.30	-0.4	1.24	1.24	1	40.00	20.0
1477.69	0.00	7026.06	0.50	0.50				
25	225.19	14.19	-0.5	1.24	1.24	1	40.00	20.0
1593.57	0.00	7289.12	0.47	0.47				
26	226.43	13.90	56.7	1.24	2.25	1	40.00	20.0
1597.77	0.00	7571.20	0.45	0.45				
27	227.66	12.45	56.7	1.24	2.25	1	40.00	20.0
1493.39	0.00	6135.48	0.45	0.45				
28	228.90	11.01	56.7	1.24	2.25	1	40.00	20.0
1389.05	0.00	4796.45	0.45	0.45				
29	230.14	9.42	56.7	1.22	2.22	2	0.00	35.0
1224.73	0.00	3554.10	0.47	0.47				
30	231.35	8.02	56.7	1.22	2.22	2	0.00	35.0
1042.39	0.00	2638.03	0.47	0.47				
31	232.57	6.62	56.7	1.22	2.22	2	0.00	35.0
860.06	0.00	1858.35	0.47	0.47				
32	233.79	5.21	56.7	1.22	2.22	2	0.00	35.0
677.72	0.00	1215.05	0.47	0.47				
33	235.00	3.81	56.7	1.22	2.22	2	0.00	35.0
495.39	0.00	708.13	0.48	0.48				

34	236.22	2.41	56.7	1.22	2.22	2	0.00	35.0
313.05	0.00		337.59	0.50	0.50			
35	237.44	1.01	56.7	1.22	2.22	2	0.00	35.0
130.73	0.00		103.43	0.57	0.57			
RHS	238.66	-----						
-----			5.65	0.00	0.00			
X-S Area:	261.38		Path Length:	52.54			X-S Weight:	
28423.70								

DATA: Analysis 9 - 2023 Embankment Stability - 10FT Below Embankment Top

Material Properties (7 materials)

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Material: 1 (Mohr-Coulomb Isotropic) - Tailings
  Cohesion  Phi  UnitWeight  Ru
    40.00   20.0    94.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
  Cohesion  Phi  UnitWeight  Ru
    0.00   35.0   130.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
  Cohesion  Phi  UnitWeight  Ru
    0.00   30.0   123.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress
  Cohesion  Phi  UnitWeight  Ru
    0.00   33.0   110.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Bedrock
  Cohesion  Phi  UnitWeight  Ru
    0.00   37.0   138.00    Auto
Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
  Cohesion  Phi  UnitWeight  Ru
    30.00   17.0   100.00    Auto
Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
  Cohesion  Phi  UnitWeight  Ru
    0.00   33.0   110.00    Auto

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Water Properties

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Unit weight of water: 62.400          Unit weight of water/medium above ground:
0.000

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Material Profiles (7 profiles)

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-----
Profile: 1 (2 points)   Material beneath: 1 - Tailings
    90.00    420.00        237.30    420.00
Profile: 2 (11 points)  Material beneath: 6 - Tailings/Geomembrane Interface
    90.10    410.90        155.00    404.40        168.00    411.80
    175.20    411.70        181.80    405.60

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215.00	406.00	240.00	420.10	244.00	420.10
244.10	417.00	246.90	417.00		
247.00	420.00				
Profile: 3 (4 points)	Material beneath:	2 - Embankment (Proposed)			
215.00	406.00	240.00	420.00	248.00	420.00
305.00	393.00				
Profile: 4 (2 points)	Material beneath:	1 - Tailings			
182.00	406.00	249.10	406.00		
Profile: 5 (4 points)	Material beneath:	4 - Soil Buttress			
155.00	405.00	168.00	412.00	175.00	412.00
190.00	400.00				
Profile: 6 (4 points)	Material beneath:	3 - Embankment (Existing)			
230.80	396.60	251.00	407.00	262.00	407.00
305.00	393.00				
Profile: 7 (2 points)	Material beneath:	5 - Bedrock			
90.00	411.00	305.00	390.00		

Slope Surface (5 points)

179.50	408.00	219.00	407.90	240.00	420.00
248.00	420.00	305.00	393.00		

Piezometric Surfaces (1 surface)

Failure Surface (Critical, from previous analysis)

Initial non-circular surface for critical search (4 points)

198.76	407.95	208.17	400.49	226.43	400.35
238.92	419.38				

Tension Crack

Automatically-generated crack depth: 0.25

Variable Restraints

Horizontal range around X-Left:	14.97	Trial positions within range:	5
Horizontal range around X-Right:	16.50	Trial positions within range:	5
Vertical range around Mid-Point:	1.80	Trial positions within range:	20

RESULTS: Analysis 9 - 2023 Embankment Stability - 10FT Below Embankment Top

Spencer-Wright Method of Analysis - Non-Circular Failure Surface

Critical Failure Surface Search using Multiple Surface Generation Techniques

Factor of Safety for initial failure surface approximation: 2.483

There were: 489 successful analyses from a total of 501 trial surfaces
9 analyses rejected due to Theta out of valid range
3 analyses failed to produce a result

Critical (minimum) Factor of Safety: 1.87
Interslice Forces: 13.2 degrees

Final Angle of

Negative interslice forces exist on one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety surfaces

Surface	X-Left	Y-Left	X-Right	Y-Right	Y-Deflection	FoS
Theta						
1	198.76	407.95	246.97	419.75	0.90	1.872
13.2	<-- Critical Surface					
2	195.02	407.96	246.96	419.75	0.90	1.877
12.4						
3	198.76	407.95	246.98	419.75	0.81	1.879
13.2						
4	195.02	407.96	246.96	419.75	0.81	1.883
12.4						
5	198.76	407.95	246.98	419.75	0.71	1.887
13.2						
6	195.02	407.96	246.96	419.75	0.71	1.890
12.4						
7	202.50	407.94	246.99	419.75	0.90	1.891
14.2						
8	198.76	407.95	246.98	419.75	0.62	1.894
13.2						
9	195.02	407.96	246.96	419.75	0.62	1.897
12.3						
10	202.50	407.94	246.99	419.75	0.81	1.900
14.1						
11	198.76	407.95	246.98	419.75	0.52	1.902
13.1						
12	191.27	407.97	246.94	419.75	0.90	1.903
11.6						
13	195.02	407.96	246.96	419.75	0.52	1.904
12.3						
14	202.50	407.94	246.99	419.75	0.71	1.908
14.1						
15	191.27	407.97	246.95	419.75	0.81	1.909
11.6						
16	198.76	407.95	246.98	419.75	0.43	1.910
13.1						
17	195.02	407.96	246.96	419.75	0.43	1.911

12.3						
18	191.27	407.97	246.95	419.75	0.71	1.915
11.6						
19	202.50	407.94	246.99	419.75	0.62	1.917
14.0						
20	198.76	407.95	246.98	419.75	0.33	1.918
13.1						
21	195.02	407.96	246.96	419.75	0.33	1.918
12.3						
22	191.27	407.97	246.95	419.75	0.62	1.922
11.6						
23	195.02	407.96	246.97	419.75	0.24	1.925
12.2						
24	202.50	407.94	246.99	419.75	0.52	1.926
14.0						
25	198.76	407.95	246.98	419.75	0.24	1.926
13.0						
26	191.27	407.97	246.95	419.75	0.52	1.928
11.6						
27	195.02	407.96	246.97	419.75	0.14	1.933
12.2						
28	198.76	407.95	246.98	419.75	0.14	1.934
13.0						
29	191.27	407.97	246.95	419.75	0.43	1.934
11.5						
30	202.50	407.94	246.99	419.75	0.43	1.935
13.9						
31	195.02	407.96	246.97	419.75	0.05	1.940
12.2						
32	191.27	407.97	246.95	419.75	0.33	1.941
11.5						
33	198.76	407.95	246.98	419.75	0.05	1.943
13.0						
34	202.50	407.94	246.99	419.75	0.33	1.944
13.9						
35	191.27	407.97	246.95	419.75	0.24	1.947
11.5						
36	206.24	407.93	247.01	419.75	0.90	1.948
15.1						
37	195.02	407.96	246.97	419.75	-0.05	1.948
12.1						
38	198.76	407.95	246.98	419.75	-0.05	1.951
12.9						
39	202.50	407.94	247.00	419.75	0.24	1.953
13.9						
40	191.27	407.97	246.95	419.75	0.14	1.954
11.5						
41	195.02	407.96	246.97	419.75	-0.14	1.956
12.1						
42	206.24	407.93	247.01	419.75	0.81	1.958

15.0						
43	198.76	407.95	246.98	419.75	-0.14	1.960
12.9						
44	191.27	407.97	246.95	419.75	0.05	1.961
11.5						
45	202.50	407.94	247.00	419.75	0.14	1.963
13.8						
46	195.02	407.96	246.97	419.75	-0.24	1.964
12.1						
47	191.27	407.97	246.95	419.75	-0.05	1.968
11.4						
48	206.24	407.93	247.01	419.75	0.71	1.968
15.0						
49	198.76	407.95	246.98	419.75	-0.24	1.969
12.9						
50	195.02	407.96	246.97	419.75	-0.33	1.972
12.1						
51	202.50	407.94	247.00	419.75	0.05	1.972
13.7						
52	191.27	407.97	246.95	419.75	-0.14	1.975
11.4						
53	206.24	407.93	247.01	419.75	0.62	1.978
14.9						
54	198.76	407.95	246.99	419.75	-0.33	1.978
12.8						
55	195.02	407.96	246.97	419.75	-0.43	1.980
12.1						
56	191.27	407.97	246.96	419.75	-0.24	1.983
11.4						
57	198.76	407.95	246.99	419.75	-0.43	1.987
12.8						
58	195.02	407.96	246.97	419.75	-0.52	1.989
12.0						
59	206.24	407.93	247.01	419.75	0.52	1.989
14.8						
60	191.27	407.97	246.96	419.75	-0.33	1.990
11.4						
61	202.50	407.94	247.00	419.75	-0.14	1.993
13.7						
62	198.76	407.95	246.99	419.75	-0.52	1.997
12.8						
63	195.02	407.96	246.97	419.75	-0.62	1.997
12.0						
64	206.24	407.93	247.01	419.75	0.43	2.000
14.7						
65	202.50	407.94	247.00	419.75	-0.24	2.003
13.7						
66	198.76	407.95	246.99	419.75	-0.62	2.006
12.7						
67	206.24	407.93	247.01	419.75	0.33	2.011

14.7						
68	202.50	407.94	247.00	419.75	-0.33	2.014
13.6						
69	198.76	407.95	246.99	419.75	-0.71	2.016
12.7						
70	206.24	407.93	247.01	419.75	0.24	2.022
14.7						
71	202.50	407.94	247.00	419.75	-0.43	2.024
13.6						
72	191.27	407.97	246.96	419.75	-0.43	2.025
11.4						
73	195.02	407.96	246.97	419.75	-0.71	2.026
12.0						
74	198.76	407.95	246.99	419.75	-0.81	2.026
12.7						
75	206.24	407.93	247.01	419.75	0.14	2.034
14.6						
76	202.50	407.94	247.00	419.75	-0.52	2.035
13.5						
77	198.76	407.95	242.87	419.75	0.90	2.035
13.5						
78	198.76	407.95	246.99	419.75	-0.90	2.036
12.6						
79	206.24	407.93	247.01	419.75	0.05	2.045
14.6						
80	202.50	407.94	247.00	419.75	-0.62	2.046
13.5						
81	198.76	407.95	242.87	419.75	0.81	2.047
13.5						
82	195.02	407.96	242.85	419.75	0.90	2.047
12.6						
83	206.24	407.93	247.01	419.75	-0.05	2.057
14.5						
84	202.50	407.94	247.00	419.75	-0.71	2.057
13.5						
85	195.02	407.96	242.85	419.75	0.81	2.057
12.6						
86	198.76	407.95	242.87	419.75	0.71	2.059
13.5						
87	202.50	407.94	242.88	419.75	0.90	2.060
14.5						
88	195.02	407.96	242.85	419.75	0.71	2.067
12.5						
89	202.50	407.94	247.00	419.75	-0.81	2.068
13.4						
90	206.24	407.93	247.01	419.75	-0.14	2.069
14.5						
91	198.76	407.95	242.87	419.75	0.62	2.070
13.4						
92	202.50	407.94	242.88	419.75	0.81	2.073

14.4						
93	195.02	407.96	242.85	419.75	0.62	2.078
12.5						
94	202.50	407.94	247.00	419.75	-0.90	2.080
13.3						
95	191.27	407.97	246.96	419.75	-0.52	2.081
11.4						
96	198.76	407.95	242.87	419.75	0.52	2.081
13.3						
97	206.24	407.93	247.01	419.75	-0.24	2.082
14.4						
98	195.02	407.96	246.97	419.75	-0.81	2.084
12.0						
99	202.50	407.94	242.88	419.75	0.71	2.087
14.4						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

198.76 407.95 210.11 400.86 232.11 400.73
246.97 419.75

Slice Geometry and Properties - Critical Failure Surface (surface 1, 37 slices)

Slice		X-S	Base -----						
	PoreWater	---	Left Hand Side			----			
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	
Weight	Force	Side	Force	l/h	l'/h				
1	198.76	0.76	-32.0	1.56	1.84	1	40.00	20.0	
71.28	0.00	0.00	0.00	0.00	0.00				
2	200.32	2.27	-32.0	1.56	1.84	1	40.00	20.0	
213.84	0.00	157.00	0.69	0.69					
3	201.88	0.50	-32.0	0.25	0.29	1	40.00	20.0	
47.11	0.00	489.03	0.57	0.57					
4	202.13	4.14	-32.0	1.60	1.88	6	30.00	17.0	
393.85	0.00	557.92	0.56	0.56					
5	203.72	5.72	-32.0	1.60	1.88	6	30.00	17.0	
552.47	0.00	1056.92	0.54	0.54					
6	205.32	7.31	-32.0	1.60	1.88	6	30.00	17.0	
711.08	0.00	1736.25	0.52	0.52					
7	206.91	8.89	-32.0	1.60	1.88	6	30.00	17.0	
869.70	0.00	2595.88	0.50	0.50					
8	208.51	10.47	-32.0	1.60	1.88	6	30.00	17.0	
1028.32	0.00	3635.87	0.49	0.49					
9	210.11	8.65	-0.3	1.22	1.22	6	30.00	17.0	
850.05	0.00	4856.14	0.49	0.49					
10	211.33	8.65	-0.3	1.22	1.22	6	30.00	17.0	
850.71	0.00	5031.27	0.51	0.51					
11	212.55	8.66	-0.3	1.22	1.22	6	30.00	17.0	

851.35	0.00	5206.51	0.54	0.54			
12	213.78	8.66	-0.3	1.22	1.22	6	30.00 17.0
852.01	0.00	5381.88	0.56	0.56			
13	215.00	7.96	-0.3	1.12	1.12	1	40.00 20.0
760.91	0.00	5557.36	0.58	0.58			
14	216.12	7.96	-0.3	1.12	1.12	1	40.00 20.0
786.79	0.00	5747.87	0.60	0.60			
15	217.25	7.97	-0.3	1.12	1.12	1	40.00 20.0
812.70	0.00	5943.98	0.62	0.62			
16	218.37	4.46	-0.3	0.63	0.63	1	40.00 20.0
461.96	0.00	6145.71	0.63	0.63			
17	219.00	10.95	-0.3	1.46	1.46	1	40.00 20.0
1151.00	0.00	6260.15	0.64	0.64			
18	220.46	12.19	-0.3	1.46	1.46	1	40.00 20.0
1311.13	0.00	6542.70	0.59	0.59			
19	221.91	13.42	-0.3	1.46	1.46	1	40.00 20.0
1471.28	0.00	6859.92	0.55	0.55			
20	223.37	14.66	-0.3	1.46	1.46	1	40.00 20.0
1631.39	0.00	7211.79	0.51	0.51			
21	224.83	15.89	-0.3	1.46	1.46	1	40.00 20.0
1791.52	0.00	7598.29	0.48	0.48			
22	226.28	17.13	-0.3	1.46	1.46	1	40.00 20.0
1951.66	0.00	8019.43	0.45	0.45			
23	227.74	18.36	-0.3	1.46	1.46	1	40.00 20.0
2111.81	0.00	8475.21	0.43	0.43			
24	229.20	19.60	-0.3	1.46	1.46	1	40.00 20.0
2271.92	0.00	8965.58	0.40	0.40			
25	230.65	20.83	-0.3	1.46	1.46	1	40.00 20.0
2432.05	0.00	9490.65	0.38	0.38			
26	232.11	19.56	52.0	1.37	2.23	1	40.00 20.0
2325.73	0.00	10050.35	0.36	0.36			
27	233.48	18.23	52.0	1.37	2.23	1	40.00 20.0
2240.15	0.00	8379.26	0.35	0.35			
28	234.86	16.91	52.0	1.37	2.23	1	40.00 20.0
2154.52	0.00	6771.61	0.34	0.34			
29	236.23	14.31	52.0	1.26	2.04	2	0.00 35.0
1860.09	0.00	5227.43	0.34	0.34			
30	237.49	13.20	52.0	1.26	2.04	2	0.00 35.0
1715.65	0.00	4204.33	0.32	0.32			
31	238.74	12.09	52.0	1.26	2.04	2	0.00 35.0
1571.21	0.00	3260.66	0.30	0.30			
32	240.00	11.10	52.0	1.33	2.17	2	0.00 35.0
1443.58	0.00	2396.45	0.28	0.28			
33	241.33	8.83	52.0	1.33	2.17	2	0.00 35.0
1147.33	0.00	1602.44	0.28	0.28			
34	242.67	6.55	52.0	1.33	2.17	2	0.00 35.0
851.12	0.00	971.37	0.28	0.28			
35	244.00	2.90	52.0	0.82	1.34	6	30.00 17.0
364.05	0.00	503.23	0.26	0.26			
36	244.83	2.48	52.0	1.07	1.75	2	0.00 35.0

323.01	0.00	243.78	0.29	0.29			
37	245.90	1.01	52.0	1.07	1.75	2	0.00 35.0
130.95	0.00	66.12	0.35	0.35			
RHS	246.97	-----			-----		
-----			-5.91	0.00	0.00		
X-S Area:	373.22	Path Length:	59.53			X-S Weight:	
42365.32							

DATA: Analysis 10 - 2023 Embankment Stability - 10FT Below Embankment Top

Material Properties (7 materials)

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-----
Material: 1 (Mohr-Coulomb Isotropic) - Tailings
  Cohesion  Phi  UnitWeight  Ru
    40.00   20.0    94.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
  Cohesion  Phi  UnitWeight  Ru
    0.00   35.0   130.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
  Cohesion  Phi  UnitWeight  Ru
    0.00   30.0   123.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress
  Cohesion  Phi  UnitWeight  Ru
    0.00   33.0   110.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Bedrock
  Cohesion  Phi  UnitWeight  Ru
    0.00   37.0   138.00    Auto
Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
  Cohesion  Phi  UnitWeight  Ru
    30.00   17.0   100.00    Auto
Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
  Cohesion  Phi  UnitWeight  Ru
    0.00   33.0   110.00    Auto

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Water Properties

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-----
Unit weight of water: 62.400          Unit weight of water/medium above ground:
0.000

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Material Profiles (7 profiles)

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-----
Profile: 1 (2 points)   Material beneath: 1 - Tailings
    90.00    420.00        237.30    420.00
Profile: 2 (11 points)  Material beneath: 6 - Tailings/Geomembrane Interface
    90.10    410.90        155.00    404.40    168.00    411.80
    175.20    411.70        181.80    405.60
    215.00    406.00        240.00    420.10    244.00    420.10

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244.10	417.00	246.90	417.00		
247.00	420.00				
Profile: 3 (4 points)		Material beneath: 2 - Embankment (Proposed)			
215.00	406.00	240.00	420.00	248.00	420.00
305.00	393.00				
Profile: 4 (2 points)		Material beneath: 1 - Tailings			
182.00	406.00	249.10	406.00		
Profile: 5 (4 points)		Material beneath: 4 - Soil Buttress			
155.00	405.00	168.00	412.00	175.00	412.00
190.00	400.00				
Profile: 6 (4 points)		Material beneath: 3 - Embankment (Existing)			
230.80	396.60	251.00	407.00	262.00	407.00
305.00	393.00				
Profile: 7 (2 points)		Material beneath: 5 - Bedrock			
90.00	411.00	305.00	390.00		

Slope Surface (5 points)

179.50	408.00	219.00	407.90	240.00	420.00
248.00	420.00	305.00	393.00		

Piezometric Surfaces (1 surface)

Failure Surface (Critical, from previous analysis)

Initial non-circular surface for critical search (4 points)

198.76	407.95	210.11	400.86	232.11	400.73
247.17	420.00				

Tension Crack

Automatically-generated crack depth: 0.25

Variable Restraints

Horizontal range around X-Left:	14.97	Trial positions within range:	5
Horizontal range around X-Right:	16.50	Trial positions within range:	5
Vertical range around Mid-Point:	1.80	Trial positions within range:	20

RESULTS: Analysis 10 - 2023 Embankment Stability - 10FT Below Embankment Top

Spencer-Wright Method of Analysis - Non-Circular Failure Surface

Critical Failure Surface Search using Multiple Surface Generation Techniques

Factor of Safety for initial failure surface approximation: 1.872

There were: 480 successful analyses from a total of 501 trial surfaces
 1 analyses rejected due to Theta out of valid range
 20 analyses failed to produce a result

Critical (minimum) Factor of Safety: 1.76
 Interslice Forces: 12.7 degrees

Final Angle of

Negative interslice forces exist on one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety surfaces

Surface Theta	X-Left	Y-Left	X-Right	Y-Right	Y-Deflection	FoS
1	198.76	407.95	251.12	418.27	0.90	1.755
12.7	<-- Critical Surface					
2	198.76	407.95	251.12	418.27	0.81	1.757
12.7						
3	198.76	407.95	251.12	418.27	0.71	1.759
12.6						
4	202.50	407.94	251.13	418.27	0.90	1.759
13.5						
5	198.76	407.95	251.12	418.27	0.62	1.761
12.6						
6	202.50	407.94	251.13	418.27	0.81	1.761
13.5						
7	198.76	407.95	251.13	418.27	0.52	1.763
12.6						
8	202.50	407.94	251.13	418.27	0.71	1.764
13.4						
9	198.76	407.95	251.13	418.27	0.43	1.765
12.5						
10	202.50	407.94	251.13	418.27	0.62	1.766
13.4						
11	195.02	407.96	251.11	418.27	0.90	1.767
11.9						
12	198.76	407.95	251.13	418.27	0.33	1.768
12.5						
13	202.50	407.94	251.13	418.27	0.52	1.769
13.4						
14	195.02	407.96	251.12	418.27	0.81	1.769
11.9						
15	198.76	407.95	251.13	418.27	0.24	1.770
12.5						
16	195.02	407.96	251.12	418.27	0.71	1.770
11.8						
17	202.50	407.94	251.13	418.27	0.43	1.771
13.3						

18	195.02	407.96	251.12	418.27	0.62	1.772
11.8						
19	198.76	407.95	251.13	418.27	0.14	1.773
12.4						
20	195.02	407.96	251.12	418.27	0.52	1.774
11.8						
21	202.50	407.94	251.13	418.27	0.33	1.774
13.3						
22	198.76	407.95	251.13	418.27	0.05	1.776
12.4						
23	195.02	407.96	251.12	418.27	0.43	1.776
11.8						
24	202.50	407.94	251.14	418.26	0.24	1.777
13.2						
25	195.02	407.96	251.12	418.27	0.33	1.778
11.7						
26	198.76	407.95	251.13	418.27	-0.05	1.779
12.4						
27	195.02	407.96	251.12	418.27	0.24	1.780
11.7						
28	202.50	407.94	251.14	418.26	0.14	1.780
13.2						
29	198.76	407.95	251.13	418.27	-0.14	1.782
12.3						
30	195.02	407.96	251.12	418.27	0.14	1.782
11.7						
31	195.02	407.96	251.12	418.27	0.05	1.784
11.6						
32	202.50	407.94	251.14	418.26	0.05	1.784
13.2						
33	198.76	407.95	251.13	418.27	-0.24	1.785
12.3						
34	195.02	407.96	251.12	418.27	-0.05	1.787
11.6						
35	206.24	407.93	251.14	418.26	0.90	1.787
14.3						
36	198.76	407.95	251.13	418.27	-0.33	1.788
12.3						
37	195.02	407.96	251.12	418.27	-0.14	1.790
11.6						
38	202.50	407.94	251.14	418.26	-0.05	1.790
13.2						
39	206.24	407.93	251.14	418.26	0.81	1.790
14.3						
40	198.76	407.95	251.13	418.27	-0.43	1.791
12.3						
41	195.02	407.96	251.12	418.27	-0.24	1.792
11.6						
42	206.24	407.93	251.14	418.26	0.71	1.793
14.3						

43	191.27	407.97	251.11	418.28	0.90	1.793
11.2						
44	191.27	407.97	251.11	418.28	0.81	1.794
11.1						
45	198.76	407.95	251.13	418.27	-0.52	1.795
12.2						
46	195.02	407.96	251.12	418.27	-0.33	1.795
11.5						
47	191.27	407.97	251.11	418.28	0.71	1.796
11.1						
48	202.50	407.94	251.14	418.26	-0.14	1.796
13.1						
49	206.24	407.93	251.14	418.26	0.62	1.796
14.2						
50	191.27	407.97	251.11	418.28	0.62	1.797
11.1						
51	202.50	407.94	251.14	418.26	-0.33	1.798
13.1						
52	195.02	407.96	251.12	418.27	-0.43	1.798
11.5						
53	198.76	407.95	251.13	418.27	-0.62	1.798
12.2						
54	191.27	407.97	251.11	418.28	0.52	1.798
11.1						
55	206.24	407.93	251.14	418.26	0.52	1.800
14.2						
56	191.27	407.97	251.11	418.28	0.43	1.800
11.0						
57	195.02	407.96	251.12	418.27	-0.52	1.801
11.5						
58	202.50	407.94	251.14	418.26	-0.24	1.802
13.1						
59	202.50	407.94	251.14	418.26	-0.43	1.802
13.0						
60	191.27	407.97	251.11	418.28	0.33	1.802
11.0						
61	198.76	407.95	251.13	418.27	-0.71	1.802
12.1						
62	206.24	407.93	251.14	418.26	0.43	1.803
14.1						
63	191.27	407.97	251.11	418.28	0.24	1.804
11.0						
64	195.02	407.96	251.12	418.27	-0.62	1.804
11.5						
65	191.27	407.97	251.11	418.28	0.14	1.806
11.0						
66	202.50	407.94	251.14	418.26	-0.52	1.806
13.0						
67	198.76	407.95	251.13	418.27	-0.81	1.806
12.1						

68	206.24	407.93	251.14	418.26	0.33	1.807
14.1						
69	195.02	407.96	251.12	418.27	-0.71	1.808
11.4						
70	191.27	407.97	251.11	418.28	0.05	1.808
11.0						
71	191.27	407.97	251.11	418.28	-0.05	1.810
10.9						
72	198.76	407.95	251.13	418.27	-0.90	1.810
12.1						
73	198.76	407.95	246.97	419.75	0.90	1.810
13.6						
74	202.50	407.94	251.14	418.26	-0.62	1.810
13.0						
75	206.24	407.93	251.14	418.26	0.24	1.811
14.1						
76	195.02	407.96	251.13	418.27	-0.81	1.811
11.4						
77	191.27	407.97	251.11	418.28	-0.14	1.812
10.9						
78	195.02	407.96	251.13	418.27	-0.90	1.814
11.4						
79	191.27	407.97	251.11	418.27	-0.24	1.814
10.9						
80	202.50	407.94	251.14	418.26	-0.71	1.815
12.9						
81	206.24	407.93	251.14	418.26	0.14	1.815
14.0						
82	198.76	407.95	246.97	419.75	0.81	1.816
13.5						
83	191.27	407.97	251.11	418.27	-0.33	1.817
10.9						
84	202.50	407.94	251.14	418.26	-0.81	1.819
12.9						
85	206.24	407.93	251.15	418.26	0.05	1.819
14.0						
86	191.27	407.97	251.12	418.27	-0.43	1.820
10.8						
87	202.50	407.94	246.98	419.75	0.90	1.821
14.5						
88	195.02	407.96	246.95	419.75	0.90	1.822
12.7						
89	198.76	407.95	246.97	419.75	0.71	1.822
13.5						
90	191.27	407.97	251.12	418.27	-0.52	1.822
10.8						
91	206.24	407.93	251.15	418.26	-0.05	1.824
13.9						
92	202.50	407.94	251.14	418.26	-0.90	1.824
12.8						

93	191.27	407.97	251.12	418.27	-0.62	1.825
10.8						
94	195.02	407.96	246.95	419.75	0.81	1.827
12.6						
95	202.50	407.94	246.98	419.75	0.81	1.827
14.5						
96	191.27	407.97	251.12	418.27	-0.71	1.828
10.8						
97	198.76	407.95	246.97	419.75	0.62	1.828
13.5						
98	206.24	407.93	251.15	418.26	-0.14	1.828
13.9						
99	191.27	407.97	251.12	418.27	-0.81	1.831
10.8						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

198.76 407.95 211.07 402.55 234.95 402.46
251.12 418.27

Slice Geometry and Properties - Critical Failure Surface (surface 1, 37 slices)

Slice	X-S	Base						
	PoreWater	--- Left Hand Side ---						
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Side	Force	l/h	l'/h			
1	198.76	0.48	-23.7	1.48	1.62	1	40.00	20.0
45.05	0.00		0.00	0.00	0.00			
2	200.24	1.44	-23.7	1.48	1.62	1	40.00	20.0
135.15	0.00		93.14	0.76	0.76			
3	201.72	2.40	-23.7	1.48	1.62	1	40.00	20.0
225.24	0.00		264.43	0.65	0.65			
4	203.21	0.63	-23.7	0.32	0.34	1	40.00	20.0
59.50	0.00		513.89	0.61	0.61			
5	203.52	3.63	-23.7	1.51	1.65	6	30.00	17.0
344.72	0.00		577.01	0.60	0.60			
6	205.03	4.63	-23.7	1.51	1.65	6	30.00	17.0
444.42	0.00		892.90	0.60	0.60			
7	206.54	5.62	-23.7	1.51	1.65	6	30.00	17.0
544.09	0.00		1288.53	0.58	0.58			
8	208.05	6.62	-23.7	1.51	1.65	6	30.00	17.0
643.78	0.00		1763.90	0.57	0.57			
9	209.56	7.61	-23.7	1.51	1.65	6	30.00	17.0
743.46	0.00		2319.02	0.56	0.56			
10	211.07	7.03	-0.2	1.31	1.31	6	30.00	17.0
688.06	0.00		2953.86	0.55	0.55			
11	212.38	7.04	-0.2	1.31	1.31	6	30.00	17.0
688.44	0.00		3108.63	0.58	0.58			

12	213.69	7.04	-0.2	1.31	1.31	6	30.00	17.0
688.83	0.00	3263.45		0.61	0.61			
13	215.00	9.07	-0.2	1.69	1.69	1	40.00	20.0
880.90	0.00	3418.35		0.63	0.63			
14	216.69	9.07	-0.2	1.69	1.69	1	40.00	20.0
938.63	0.00	3660.06		0.66	0.66			
15	218.37	3.38	-0.2	0.63	0.63	1	40.00	20.0
360.91	0.00	3914.89		0.69	0.69			
16	219.00	9.32	-0.2	1.60	1.60	1	40.00	20.0
1011.92	0.00	4012.38		0.70	0.70			
17	220.60	10.80	-0.2	1.60	1.60	1	40.00	20.0
1203.43	0.00	4281.65		0.61	0.61			
18	222.19	12.28	-0.2	1.60	1.60	1	40.00	20.0
1394.95	0.00	4594.46		0.55	0.55			
19	223.79	13.75	-0.2	1.60	1.60	1	40.00	20.0
1586.49	0.00	4950.83		0.49	0.49			
20	225.38	15.23	-0.2	1.60	1.60	1	40.00	20.0
1778.02	0.00	5350.77		0.45	0.45			
21	226.98	16.70	-0.2	1.60	1.60	1	40.00	20.0
1969.52	0.00	5794.26		0.41	0.41			
22	228.57	18.18	-0.2	1.60	1.60	1	40.00	20.0
2161.05	0.00	6281.30		0.38	0.38			
23	230.17	19.66	-0.2	1.60	1.60	1	40.00	20.0
2352.59	0.00	6811.95		0.35	0.35			
24	231.76	21.13	-0.2	1.60	1.60	1	40.00	20.0
2544.12	0.00	7386.11		0.33	0.33			
25	233.36	22.61	-0.2	1.60	1.60	1	40.00	20.0
2735.61	0.00	8003.83		0.31	0.31			
26	234.95	17.39	44.4	1.21	1.69	1	40.00	20.0
2131.85	0.00	8665.09		0.29	0.29			
27	236.16	16.80	44.4	1.21	1.69	1	40.00	20.0
2107.00	0.00	7481.47		0.28	0.28			
28	237.37	16.21	44.4	1.21	1.69	1	40.00	20.0
2082.16	0.00	6312.12		0.27	0.27			
29	238.58	18.37	44.4	1.42	1.99	2	0.00	35.0
2387.49	0.00	5157.02		0.27	0.27			
30	240.00	15.95	44.4	1.33	1.87	2	0.00	35.0
2073.78	0.00	4224.57		0.24	0.24			
31	241.33	14.21	44.4	1.33	1.87	2	0.00	35.0
1847.38	0.00	3414.63		0.24	0.24			
32	242.67	12.47	44.4	1.33	1.87	2	0.00	35.0
1621.01	0.00	2693.12		0.23	0.23			
33	244.00	11.56	44.4	1.45	2.03	6	30.00	17.0
1286.70	0.00	2060.02		0.21	0.21			
34	245.45	9.51	44.4	1.45	2.03	6	30.00	17.0
1081.55	0.00	1312.15		0.20	0.20			
35	246.90	5.85	44.4	1.10	1.54	2	0.00	35.0
760.92	0.00	689.39		0.20	0.20			
36	248.00	5.70	44.4	1.56	2.18	2	0.00	35.0
740.83	0.00	392.20		0.19	0.19			

37	249.56	2.16	44.4	1.56	2.18	2	0.00	35.0
280.78	0.00	102.86	0.23	0.23				
RHS	251.12	-----			-----			
-----			-6.80	0.00	0.00			
X-S Area:	381.54		Path Length:	59.94			X-S Weight:	
44570.32								

DATA: Analysis 11 - 2023 Embankment Stability - 10FT Below Embankment Top

Material Properties (7 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Tailings
  Cohesion  Phi  UnitWeight  Ru
    40.00   20.0    94.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
  Cohesion  Phi  UnitWeight  Ru
    0.00   35.0   130.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
  Cohesion  Phi  UnitWeight  Ru
    0.00   30.0   123.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress
  Cohesion  Phi  UnitWeight  Ru
    0.00   33.0   110.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Bedrock
  Cohesion  Phi  UnitWeight  Ru
    0.00   37.0   138.00    Auto
Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
  Cohesion  Phi  UnitWeight  Ru
    30.00   17.0   100.00    Auto
Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
  Cohesion  Phi  UnitWeight  Ru
    0.00   33.0   110.00    Auto

```

Water Properties

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-----
Unit weight of water: 62.400          Unit weight of water/medium above ground:
0.000

```

Material Profiles (7 profiles)

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-----
Profile: 1 (2 points)   Material beneath: 1 - Tailings
    90.00    420.00        237.30    420.00
Profile: 2 (11 points)  Material beneath: 6 - Tailings/Geomembrane Interface
    90.10    410.90        155.00    404.40        168.00    411.80
    175.20    411.70        181.80    405.60
    215.00    406.00        240.00    420.10        244.00    420.10
    244.10    417.00        246.90    417.00

```

247.00	420.00				
Profile: 3 (4 points)		Material beneath:	2 - Embankment (Proposed)		
215.00	406.00	240.00	420.00	248.00	420.00
305.00	393.00				
Profile: 4 (2 points)		Material beneath:	1 - Tailings		
182.00	406.00	249.10	406.00		
Profile: 5 (4 points)		Material beneath:	4 - Soil Buttress		
155.00	405.00	168.00	412.00	175.00	412.00
190.00	400.00				
Profile: 6 (4 points)		Material beneath:	3 - Embankment (Existing)		
230.80	396.60	251.00	407.00	262.00	407.00
305.00	393.00				
Profile: 7 (2 points)		Material beneath:	5 - Bedrock		
90.00	411.00	305.00	390.00		

Slope Surface (5 points)

179.50	408.00	219.00	407.90	240.00	420.00
248.00	420.00	305.00	393.00		

Piezometric Surfaces (1 surface)

Failure Surface (Critical, from previous analysis)

Initial non-circular surface for critical search (4 points)

198.76	407.95	211.07	402.55	234.95	402.46
251.29	418.44				

Tension Crack

Automatically-generated crack depth: 0.25

Variable Restraints

Horizontal range around X-Left:	14.97	Trial positions within range:	5
Horizontal range around X-Right:	16.50	Trial positions within range:	5
Vertical range around Mid-Point:	1.80	Trial positions within range:	20

RESULTS: Analysis 11 - 2023 Embankment Stability - 10FT Below Embankment Top

Spencer-Wright Method of Analysis - Non-Circular Failure Surface

Critical Failure Surface Search using Multiple Surface Generation Techniques

Factor of Safety for initial failure surface approximation: 1.755

There were: 441 successful analyses from a total of 501 trial surfaces
60 analyses failed to produce a result

Critical (minimum) Factor of Safety: 1.75
Interslice Forces: 13.0 degrees

Final Angle of

Negative interslice forces exist on one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety surfaces

Surface Theta	X-Left	Y-Left	X-Right	Y-Right	Y-Deflection	FoS
1	198.76	407.95	251.12	418.27	0.90	1.746
13.0	<-- Critical Surface					
2	202.50	407.94	251.13	418.27	0.90	1.746
13.9						
3	198.76	407.95	251.12	418.27	0.81	1.746
13.0						
4	202.50	407.94	251.13	418.27	0.81	1.747
13.9						
5	198.76	407.95	251.12	418.27	0.71	1.747
12.9						
6	198.76	407.95	251.12	418.27	0.62	1.748
12.9						
7	202.50	407.94	251.13	418.27	0.71	1.748
13.8						
8	198.76	407.95	251.12	418.27	0.52	1.748
12.9						
9	202.50	407.94	251.13	418.27	0.62	1.749
13.8						
10	198.76	407.95	251.12	418.27	0.43	1.749
12.8						
11	202.50	407.94	251.13	418.27	0.52	1.750
13.7						
12	198.76	407.95	251.12	418.27	0.33	1.751
12.8						
13	202.50	407.94	251.13	418.27	0.43	1.751
13.7						
14	198.76	407.95	251.12	418.27	0.24	1.752
12.8						
15	202.50	407.94	251.13	418.27	0.33	1.753
13.7						
16	198.76	407.95	251.12	418.27	0.14	1.753
12.7						
17	198.76	407.95	246.96	419.75	0.90	1.754
14.0						
18	202.50	407.94	251.13	418.27	0.24	1.754
13.6						

19	198.76	407.95	251.12	418.27	0.05	1.755
12.7						
20	198.76	407.95	251.12	418.27	0.00	1.755
12.7						
21	202.50	407.94	251.13	418.27	0.14	1.756
13.6						
22	198.76	407.95	251.12	418.27	-0.05	1.756
12.7						
23	202.50	407.94	246.97	419.75	0.90	1.757
15.1						
24	198.76	407.95	251.12	418.27	-0.14	1.758
12.6						
25	202.50	407.94	251.13	418.27	0.05	1.758
13.5						
26	198.76	407.95	246.96	419.75	0.81	1.759
14.0						
27	198.76	407.95	251.12	418.27	-0.24	1.760
12.6						
28	202.50	407.94	251.13	418.27	-0.05	1.760
13.5						
29	195.02	407.96	251.11	418.28	0.90	1.761
12.2						
30	195.02	407.96	251.11	418.28	0.81	1.761
12.2						
31	195.02	407.96	251.11	418.28	0.71	1.761
12.1						
32	195.02	407.96	251.11	418.28	0.62	1.762
12.1						
33	198.76	407.95	251.12	418.27	-0.33	1.762
12.6						
34	195.02	407.96	251.11	418.28	0.52	1.762
12.1						
35	202.50	407.94	251.13	418.27	-0.14	1.762
13.5						
36	202.50	407.94	246.97	419.75	0.81	1.762
15.0						
37	195.02	407.96	251.11	418.28	0.43	1.763
12.0						
38	198.76	407.95	246.96	419.75	0.71	1.763
13.9						
39	195.02	407.96	251.11	418.28	0.33	1.764
12.0						
40	198.76	407.95	251.13	418.27	-0.43	1.764
12.5						
41	195.02	407.96	251.11	418.28	0.24	1.765
12.0						
42	202.50	407.94	251.13	418.27	-0.24	1.765
13.4						
43	195.02	407.96	251.11	418.28	0.14	1.766
11.9						

44	198.76	407.95	251.13	418.27	-0.52	1.767
12.5						
45	195.02	407.96	251.11	418.27	0.05	1.767
11.9						
46	202.50	407.94	251.13	418.27	-0.33	1.767
13.4						
47	202.50	407.94	246.97	419.75	0.71	1.768
14.9						
48	198.76	407.95	246.96	419.75	0.62	1.768
13.9						
49	206.24	407.93	251.13	418.27	0.90	1.768
14.8						
50	195.02	407.96	251.11	418.27	-0.05	1.768
11.9						
51	198.76	407.95	251.13	418.27	-0.62	1.769
12.5						
52	206.24	407.93	251.14	418.26	0.81	1.769
14.7						
53	195.02	407.96	251.12	418.27	-0.14	1.770
11.9						
54	202.50	407.94	251.13	418.27	-0.43	1.770
13.3						
55	206.24	407.93	251.14	418.26	0.71	1.771
14.7						
56	195.02	407.96	251.12	418.27	-0.24	1.771
11.8						
57	195.02	407.96	246.94	419.75	0.90	1.771
13.1						
58	198.76	407.95	251.13	418.27	-0.71	1.772
12.4						
59	202.50	407.94	246.98	419.75	0.62	1.773
14.9						
60	202.50	407.94	251.13	418.27	-0.52	1.773
13.3						
61	195.02	407.96	251.12	418.27	-0.33	1.773
11.8						
62	198.76	407.95	246.96	419.75	0.52	1.773
13.8						
63	206.24	407.93	251.14	418.26	0.62	1.774
14.6						
64	198.76	407.95	251.13	418.27	-0.81	1.774
12.4						
65	195.02	407.96	251.12	418.27	-0.43	1.775
11.8						
66	195.02	407.96	246.94	419.75	0.81	1.775
13.0						
67	202.50	407.94	251.14	418.26	-0.62	1.776
13.3						
68	195.02	407.96	251.12	418.27	-0.52	1.777
11.7						

69	198.76	407.95	251.13	418.27	-0.90	1.777
12.4						
70	198.76	407.95	246.96	419.75	0.43	1.778
13.8						
71	202.50	407.94	246.98	419.75	0.52	1.778
14.9						
72	206.24	407.93	251.14	418.26	0.52	1.778
14.6						
73	206.24	407.93	251.14	418.26	0.33	1.778
14.5						
74	195.02	407.96	251.12	418.27	-0.62	1.779
11.7						
75	202.50	407.94	251.14	418.26	-0.71	1.779
13.2						
76	195.02	407.96	246.94	419.75	0.71	1.780
13.0						
77	206.24	407.93	251.14	418.26	0.24	1.781
14.4						
78	195.02	407.96	251.12	418.27	-0.71	1.781
11.7						
79	202.50	407.94	251.14	418.26	-0.81	1.782
13.2						
80	198.76	407.95	246.96	419.75	0.33	1.783
13.8						
81	206.24	407.93	251.14	418.26	0.43	1.783
14.6						
82	206.24	407.93	251.14	418.26	0.14	1.783
14.4						
83	195.02	407.96	251.12	418.27	-0.81	1.783
11.7						
84	195.02	407.96	246.94	419.75	0.62	1.784
12.9						
85	202.50	407.94	246.98	419.75	0.43	1.784
14.8						
86	195.02	407.96	251.12	418.27	-0.90	1.786
11.6						
87	206.24	407.93	251.14	418.26	0.05	1.786
14.4						
88	206.24	407.93	246.99	419.75	0.90	1.787
16.2						
89	202.50	407.94	251.14	418.26	-0.90	1.787
13.2						
90	195.02	407.96	246.94	419.75	0.52	1.788
12.9						
91	198.76	407.95	246.96	419.75	0.24	1.788
13.7						
92	191.27	407.97	251.10	418.28	0.81	1.788
11.4						
93	191.27	407.97	251.10	418.28	0.90	1.788
11.4						

94	191.27	407.97	251.10	418.28	0.71	1.788
11.3						
95	191.27	407.97	251.10	418.28	0.62	1.789
11.3						
96	206.24	407.93	251.14	418.26	-0.05	1.789
14.3						
97	191.27	407.97	251.10	418.28	0.52	1.789
11.3						
98	191.27	407.97	251.10	418.28	0.43	1.789
11.3						
99	202.50	407.94	246.98	419.75	0.33	1.790
14.8						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

198.76	407.95	211.07	403.32	234.95	403.25	
251.12	418.27					

Slice Geometry and Properties - Critical Failure Surface (surface 1, 36 slices)

Slice	X-S	-----	Base	-----				
	PoreWater	---	Left Hand Side	----				
Weight	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
	Force	Side	Force	l/h	l'/h			
1	198.76	0.56	-20.6	1.73	1.85	1	40.00	20.0
52.47	0.00	0.00	0.00	0.00	0.00			
2	200.49	1.67	-20.6	1.73	1.85	1	40.00	20.0
157.43	0.00	99.06	0.81	0.81				
3	202.22	2.79	-20.6	1.73	1.85	1	40.00	20.0
262.39	0.00	278.23	0.70	0.70				
4	203.94	0.69	-20.6	0.34	0.37	1	40.00	20.0
64.54	0.00	537.54	0.65	0.65				
5	204.29	4.04	-20.6	1.70	1.81	6	30.00	17.0
383.30	0.00	598.52	0.64	0.64				
6	205.98	5.12	-20.6	1.70	1.81	6	30.00	17.0
491.07	0.00	909.83	0.64	0.64				
7	207.68	6.19	-20.6	1.70	1.81	6	30.00	17.0
598.85	0.00	1296.77	0.63	0.63				
8	209.38	7.27	-20.6	1.70	1.81	6	30.00	17.0
706.62	0.00	1759.36	0.61	0.61				
9	211.07	6.03	-0.2	1.31	1.31	6	30.00	17.0
587.24	0.00	2297.56	0.60	0.60				
10	212.38	6.03	-0.2	1.31	1.31	6	30.00	17.0
587.45	0.00	2433.59	0.63	0.63				
11	213.69	6.03	-0.2	1.31	1.31	6	30.00	17.0
587.67	0.00	2569.66	0.67	0.67				
12	215.00	7.76	-0.2	1.69	1.69	1	40.00	20.0
758.24	0.00	2705.77	0.70	0.70				

13	216.69	7.76	-0.2	1.69	1.69	1	40.00	20.0
815.71	0.00	2920.50	0.73	0.73				
14	218.37	2.89	-0.2	0.63	0.63	1	40.00	20.0
315.02	0.00	3148.36	0.76	0.76				
15	219.00	8.08	-0.2	1.60	1.60	1	40.00	20.0
895.28	0.00	3235.79	0.77	0.77				
16	220.60	9.56	-0.2	1.60	1.60	1	40.00	20.0
1086.56	0.00	3479.55	0.66	0.66				
17	222.19	11.03	-0.2	1.60	1.60	1	40.00	20.0
1277.85	0.00	3766.97	0.58	0.58				
18	223.79	12.50	-0.2	1.60	1.60	1	40.00	20.0
1469.16	0.00	4098.03	0.51	0.51				
19	225.38	13.98	-0.2	1.60	1.60	1	40.00	20.0
1660.45	0.00	4472.73	0.46	0.46				
20	226.98	15.45	-0.2	1.60	1.60	1	40.00	20.0
1851.73	0.00	4891.13	0.42	0.42				
21	228.57	16.92	-0.2	1.60	1.60	1	40.00	20.0
2043.01	0.00	5353.14	0.38	0.38				
22	230.17	18.40	-0.2	1.60	1.60	1	40.00	20.0
2234.33	0.00	5858.85	0.35	0.35				
23	231.76	19.87	-0.2	1.60	1.60	1	40.00	20.0
2425.62	0.00	6408.17	0.33	0.33				
24	233.36	21.34	-0.2	1.60	1.60	1	40.00	20.0
2616.89	0.00	7001.19	0.31	0.31				
25	234.95	20.10	42.9	1.48	2.02	1	40.00	20.0
2503.50	0.00	7637.81	0.29	0.29				
26	236.43	19.33	42.9	1.48	2.02	1	40.00	20.0
2476.20	0.00	6323.63	0.28	0.28				
27	237.91	13.17	42.9	1.04	1.43	2	0.00	35.0
1711.80	0.00	5024.32	0.27	0.27				
28	238.96	12.78	42.9	1.04	1.43	2	0.00	35.0
1661.74	0.00	4403.11	0.25	0.25				
29	240.00	15.26	42.9	1.33	1.82	2	0.00	35.0
1984.37	0.00	3800.06	0.24	0.24				
30	241.33	13.61	42.9	1.33	1.82	2	0.00	35.0
1769.19	0.00	3079.94	0.23	0.23				
31	242.67	11.95	42.9	1.33	1.82	2	0.00	35.0
1554.06	0.00	2437.90	0.22	0.22				
32	244.00	11.10	42.9	1.45	1.98	6	30.00	17.0
1240.56	0.00	1873.94	0.20	0.20				
33	245.45	9.15	42.9	1.45	1.98	6	30.00	17.0
1045.59	0.00	1191.19	0.19	0.19				
34	246.90	5.65	42.9	1.10	1.50	2	0.00	35.0
734.25	0.00	621.35	0.19	0.19				
35	248.00	5.50	42.9	1.56	2.13	2	0.00	35.0
715.17	0.00	354.89	0.18	0.18				
36	249.56	2.09	42.9	1.56	2.13	2	0.00	35.0
272.15	0.00	95.36	0.22	0.22				
RHS	251.12	-----			-----			
-----			-3.40	0.00	0.00			

X-S Area: 351.67 Path Length: 59.10 X-S Weight:
41597.48

DATA: Analysis 12 - 2023 Embankment Stability - 10FT Below Embankment Top - Seismic

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400	Unit weight of water/medium above ground:
0.000	

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 1 - Tailings

90.00	420.00	237.30	420.00
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Profile: 2 (11 points) Material beneath: 6 - Tailings/Geomembrane Interface

90.10	410.90	155.00	404.40	168.00	411.80
175.20	411.70	181.80	405.60		
215.00	406.00	240.00	420.10	244.00	420.10
244.10	417.00	246.90	417.00		
247.00	420.00				

Profile: 3 (4 points) Material beneath: 2 - Embankment (Proposed)

215.00	406.00	240.00	420.00	248.00	420.00
305.00	393.00				

Profile: 4 (2 points)	Material beneath: 1 - Tailings
182.00 406.00	249.10 406.00
Profile: 5 (4 points)	Material beneath: 4 - Soil Buttress
155.00 405.00	168.00 412.00 175.00 412.00
190.00 400.00	
Profile: 6 (4 points)	Material beneath: 3 - Embankment (Existing)
230.80 396.60	251.00 407.00 262.00 407.00
305.00 393.00	
Profile: 7 (2 points)	Material beneath: 5 - Bedrock
90.00 411.00	305.00 390.00

Slope Surface (5 points)

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179.50 408.00 219.00 407.90 240.00 420.00
248.00 420.00 305.00 393.00

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Piezometric Surfaces (1 surface)

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Failure Surface (Critical, from previous analysis)

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Initial non-circular surface for critical search (4 points)

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198.76 407.95 211.07 403.32 234.95 403.25
251.29 418.44

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Earthquake Force

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Pseudo-static earthquake (seismic) coefficient: 0.050

Tension Crack

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Automatically-generated crack depth: 0.25

Variable Restraints

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Horizontal range around X-Left:	14.97	Trial positions within range:	5
Horizontal range around X-Right:	16.50	Trial positions within range:	5
Vertical range around Mid-Point:	1.80	Trial positions within range:	20

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RESULTS: Analysis 12 - 2023 Embankment Stability - 10FT Below Embankment Top - Seismic

Spencer-Wright Method of Analysis - Non-Circular Failure Surface

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Critical Failure Surface Search using Multiple Surface Generation Techniques

Factor of Safety for initial failure surface approximation: 1.478

There were: 441 successful analyses from a total of 501 trial surfaces
60 analyses failed to produce a result

Critical (minimum) Factor of Safety: 1.47
Interslice Forces: 15.2 degrees

Final Angle of

Negative interslice forces exist on one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety surfaces

Surface Theta	X-Left	Y-Left	X-Right	Y-Right	Y-Deflection	FoS
1	202.50	407.94	246.96	419.75	0.90	1.465
15.2	<-- Critical Surface					
2	198.76	407.95	246.94	419.75	0.90	1.466
14.1						
3	202.50	407.94	246.96	419.75	0.81	1.468
15.2						
4	198.76	407.95	246.95	419.75	0.81	1.468
14.1						
5	202.50	407.94	246.96	419.75	0.71	1.470
15.1						
6	198.76	407.95	246.95	419.75	0.71	1.471
14.0						
7	198.76	407.95	246.95	419.75	0.62	1.473
14.0						
8	202.50	407.94	246.96	419.75	0.62	1.473
15.1						
9	198.76	407.95	246.95	419.75	0.52	1.475
13.9						
10	202.50	407.94	246.97	419.75	0.52	1.476
15.0						
11	202.50	407.94	251.12	418.27	0.24	1.477
13.7						
12	202.50	407.94	251.12	418.27	0.33	1.478
13.7						
13	202.50	407.94	251.12	418.27	0.14	1.478
13.6						
14	202.50	407.94	251.12	418.27	0.43	1.478
13.8						
15	198.76	407.95	246.95	419.75	0.43	1.478
13.9						
16	202.50	407.94	251.13	418.27	0.05	1.478
13.6						
17	198.76	407.95	251.12	418.27	0.05	1.478
12.7						
18	198.76	407.95	251.12	418.27	0.00	1.478

12.7						
19	202.50	407.94	251.12	418.27	0.52	1.478
13.8						
20	198.76	407.95	251.12	418.27	-0.05	1.478
12.7						
21	198.76	407.95	251.12	418.27	0.14	1.478
12.8						
22	198.76	407.95	251.12	418.27	-0.14	1.478
12.6						
23	198.76	407.95	251.12	418.27	0.24	1.478
12.8						
24	202.50	407.94	251.13	418.27	-0.05	1.478
13.5						
25	202.50	407.94	251.12	418.27	0.62	1.478
13.9						
26	198.76	407.95	251.12	418.27	-0.24	1.478
12.6						
27	198.76	407.95	251.11	418.27	0.33	1.479
12.9						
28	202.50	407.94	251.13	418.27	-0.14	1.479
13.5						
29	202.50	407.94	246.97	419.75	0.43	1.479
15.0						
30	202.50	407.94	251.12	418.27	0.71	1.479
13.9						
31	198.76	407.95	251.12	418.27	-0.33	1.479
12.6						
32	198.76	407.95	251.11	418.28	0.43	1.479
12.9						
33	202.50	407.94	251.13	418.27	-0.24	1.479
13.5						
34	198.76	407.95	251.12	418.27	-0.43	1.479
12.6						
35	198.76	407.95	251.11	418.28	0.52	1.480
12.9						
36	202.50	407.94	251.12	418.27	0.81	1.480
13.9						
37	198.76	407.95	251.12	418.27	-0.52	1.480
12.5						
38	202.50	407.94	251.13	418.27	-0.33	1.480
13.4						
39	198.76	407.95	251.11	418.28	0.62	1.480
13.0						
40	198.76	407.95	246.95	419.75	0.33	1.480
13.9						
41	202.50	407.94	251.12	418.27	0.90	1.480
14.0						
42	198.76	407.95	251.12	418.27	-0.62	1.481
12.5						
43	202.50	407.94	251.13	418.27	-0.43	1.481

13.4						
44	198.76	407.95	251.11	418.28	0.71	1.481
13.0						
45	195.02	407.96	246.93	419.75	0.90	1.481
13.1						
46	198.76	407.95	251.12	418.27	-0.71	1.482
12.4						
47	202.50	407.94	246.97	419.75	0.33	1.482
14.9						
48	206.24	407.93	246.98	419.75	0.90	1.482
16.4						
49	198.76	407.95	251.11	418.28	0.81	1.482
13.1						
50	202.50	407.94	251.13	418.27	-0.52	1.482
13.3						
51	198.76	407.95	251.12	418.27	-0.81	1.483
12.4						
52	195.02	407.96	246.93	419.75	0.81	1.483
13.0						
53	198.76	407.95	246.95	419.75	0.24	1.483
13.8						
54	198.76	407.95	251.11	418.28	0.90	1.483
13.1						
55	202.50	407.94	251.13	418.27	-0.62	1.483
13.3						
56	198.76	407.95	251.12	418.27	-0.90	1.484
12.4						
57	202.50	407.94	251.13	418.27	-0.71	1.484
13.3						
58	195.02	407.96	246.93	419.75	0.71	1.485
13.0						
59	206.24	407.93	246.98	419.75	0.81	1.485
16.3						
60	202.50	407.94	246.97	419.75	0.24	1.485
14.8						
61	202.50	407.94	251.13	418.27	-0.81	1.486
13.2						
62	198.76	407.95	246.95	419.75	0.14	1.486
13.8						
63	195.02	407.96	246.93	419.75	0.62	1.487
13.0						
64	202.50	407.94	251.13	418.27	-0.90	1.487
13.2						
65	206.24	407.93	246.98	419.75	0.71	1.488
16.2						
66	202.50	407.94	246.97	419.75	0.14	1.489
14.8						
67	195.02	407.96	251.11	418.28	-0.14	1.489
11.8						
68	195.02	407.96	251.11	418.28	-0.24	1.489

11.8						
69	195.02	407.96	251.11	418.28	-0.05	1.489
11.9						
70	195.02	407.96	251.11	418.28	-0.33	1.489
11.8						
71	195.02	407.96	246.93	419.75	0.52	1.489
12.9						
72	198.76	407.95	246.95	419.75	0.05	1.489
13.7						
73	195.02	407.96	251.11	418.28	0.05	1.489
11.9						
74	195.02	407.96	251.11	418.28	-0.43	1.489
11.7						
75	195.02	407.96	251.11	418.28	0.14	1.489
12.0						
76	195.02	407.96	251.11	418.28	-0.52	1.489
11.7						
77	195.02	407.96	251.11	418.28	0.24	1.490
12.0						
78	195.02	407.96	251.11	418.28	-0.62	1.490
11.7						
79	195.02	407.96	251.11	418.28	0.33	1.490
12.0						
80	195.02	407.96	251.11	418.28	-0.71	1.490
11.7						
81	195.02	407.96	251.11	418.28	0.43	1.491
12.1						
82	195.02	407.96	246.93	419.75	0.43	1.491
12.9						
83	195.02	407.96	251.11	418.27	-0.81	1.491
11.6						
84	206.24	407.93	246.98	419.75	0.62	1.492
16.2						
85	195.02	407.96	251.10	418.28	0.52	1.492
12.1						
86	195.02	407.96	251.11	418.27	-0.90	1.492
11.6						
87	198.76	407.95	246.95	419.75	-0.05	1.492
13.7						
88	202.50	407.94	246.97	419.75	0.05	1.492
14.7						
89	206.24	407.93	251.13	418.27	0.62	1.492
14.7						
90	206.24	407.93	251.13	418.27	0.52	1.492
14.6						
91	206.24	407.93	251.13	418.27	0.71	1.492
14.7						
92	206.24	407.93	251.13	418.27	0.43	1.492
14.6						
93	206.24	407.93	251.13	418.27	0.81	1.493

14.8						
94	206.24	407.93	251.13	418.27	0.33	1.493
14.5						
95	195.02	407.96	251.10	418.28	0.62	1.493
12.1						
96	206.24	407.93	251.13	418.27	0.90	1.493
14.8						
97	195.02	407.96	246.93	419.75	0.33	1.493
12.9						
98	206.24	407.93	251.13	418.27	0.24	1.493
14.5						
99	195.02	407.96	251.10	418.28	0.71	1.494
12.2						

Note: Y-Deflection values are failure surface mid-point vertical distances from the initial failure surface mid-point

Critical Failure Surface (surface 1, 4 points), adjusted for tension crack

202.50	407.94	212.97	403.38	233.27	403.33	
246.96	419.75					

Slice Geometry and Properties - Critical Failure Surface (surface 1, 37 slices)

Slice	X-S	Base						
	PoreWater	--- Left Hand Side ---						
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Side	Force	l/h	l'/h			
1	202.50	0.27	-23.5	1.11	1.22	1	40.00	20.0
25.29	0.00	0.00	0.00	0.00	0.00			
2	203.62	0.81	-23.5	1.11	1.22	1	40.00	20.0
75.87	0.00	76.94	0.82	0.82				
3	204.73	1.35	-23.5	1.11	1.22	1	40.00	20.0
126.45	0.00	201.38	0.72	0.72				
4	205.85	1.88	-23.5	1.11	1.22	1	40.00	20.0
177.04	0.00	373.33	0.68	0.68				
5	206.96	0.43	-23.5	0.22	0.24	1	40.00	20.0
40.23	0.00	592.80	0.65	0.65				
6	207.18	3.38	-23.5	1.45	1.58	6	30.00	17.0
320.98	0.00	640.91	0.65	0.65				
7	208.63	4.29	-23.5	1.45	1.58	6	30.00	17.0
411.91	0.00	962.20	0.65	0.65				
8	210.07	5.20	-23.5	1.45	1.58	6	30.00	17.0
502.83	0.00	1360.42	0.64	0.64				
9	211.52	6.11	-23.5	1.45	1.58	6	30.00	17.0
593.77	0.00	1835.53	0.63	0.63				
10	212.97	4.60	-0.2	1.01	1.01	6	30.00	17.0
448.02	0.00	2387.58	0.62	0.62				
11	213.99	4.60	-0.2	1.01	1.01	6	30.00	17.0
448.14	0.00	2490.01	0.65	0.65				
12	215.00	5.09	-0.2	1.12	1.12	1	40.00	20.0

491.52	0.00	2592.48	0.69	0.69			
13	216.12	5.09	-0.2	1.12	1.12	1	40.00 20.0
517.03	0.00	2736.71	0.72	0.72			
14	217.25	5.09	-0.2	1.12	1.12	1	40.00 20.0
542.55	0.00	2886.65	0.74	0.74			
15	218.37	2.85	-0.2	0.63	0.63	1	40.00 20.0
310.75	0.00	3042.31	0.77	0.77			
16	219.00	7.06	-0.2	1.43	1.43	1	40.00 20.0
782.40	0.00	3131.01	0.79	0.79			
17	220.43	8.24	-0.2	1.43	1.43	1	40.00 20.0
935.57	0.00	3349.61	0.69	0.69			
18	221.85	9.42	-0.2	1.43	1.43	1	40.00 20.0
1088.71	0.00	3602.55	0.62	0.62			
19	223.28	10.60	-0.2	1.43	1.43	1	40.00 20.0
1241.86	0.00	3889.75	0.56	0.56			
20	224.71	11.78	-0.2	1.43	1.43	1	40.00 20.0
1395.03	0.00	4211.25	0.51	0.51			
21	226.14	12.96	-0.2	1.43	1.43	1	40.00 20.0
1548.18	0.00	4567.06	0.47	0.47			
22	227.56	14.14	-0.2	1.43	1.43	1	40.00 20.0
1701.33	0.00	4957.17	0.44	0.44			
23	228.99	15.32	-0.2	1.43	1.43	1	40.00 20.0
1854.48	0.00	5381.58	0.41	0.41			
24	230.42	16.50	-0.2	1.43	1.43	1	40.00 20.0
2007.65	0.00	5840.33	0.38	0.38			
25	231.85	17.68	-0.2	1.43	1.43	1	40.00 20.0
2160.78	0.00	6333.35	0.36	0.36			
26	233.27	13.87	50.2	1.11	1.74	1	40.00 20.0
1722.39	0.00	6860.65	0.34	0.34			
27	234.39	13.09	50.2	1.11	1.74	1	40.00 20.0
1675.40	0.00	5744.88	0.33	0.33			
28	235.50	12.43	50.2	1.12	1.76	2	0.00 35.0
1616.54	0.00	4660.91	0.34	0.34			
29	236.63	11.65	50.2	1.12	1.76	2	0.00 35.0
1513.99	0.00	3902.79	0.32	0.32			
30	237.75	10.86	50.2	1.12	1.76	2	0.00 35.0
1411.48	0.00	3192.78	0.30	0.30			
31	238.88	10.07	50.2	1.12	1.76	2	0.00 35.0
1308.95	0.00	2530.84	0.28	0.28			
32	240.00	10.41	50.2	1.33	2.08	2	0.00 35.0
1353.49	0.00	1916.98	0.26	0.26			
33	241.33	8.27	50.2	1.33	2.08	2	0.00 35.0
1075.73	0.00	1282.23	0.26	0.26			
34	242.67	6.14	50.2	1.33	2.08	2	0.00 35.0
798.01	0.00	777.74	0.26	0.26			
35	244.00	2.27	50.2	0.67	1.04	6	30.00 17.0
286.56	0.00	403.50	0.24	0.24			
36	244.67	2.65	50.2	1.15	1.79	2	0.00 35.0
344.51	0.00	220.35	0.27	0.27			
37	245.82	1.07	50.2	1.15	1.79	2	0.00 35.0

139.67	0.00	58.78	0.33	0.33
RHS	246.96	-----		-----
-----			-6.72	0.00
				0.00
X-S Area:	277.51	Path Length:	53.10	
32995.09				

X-S Weight:
