Technical Memorandum

To: Troy Meyer

Cc:

From: Alyssa Kohlman, Ana Mohseni, Jiny Carrera

Project No: 320614

Subject: **Liquefaction and Stability Analyses- Rosemont Dry Tailings Facility**

Date: June 12, 2007

1.0   Introduction

This memo presents the results of liquefaction and slope stability analyses of the proposed dry tailings facility at the Rosemont Mine in Arizona. The attached sections show the generalized facility geometry used for this analysis and are based on the North Dry Stack maximum section and the Central Drain located between the North and South Dry Stack. The North Dry Stack generalized section assumes a natural ground slope of seven percent. The downstream side embankment of the dry stack tailings facility will consist of a 100 foot high starter buttress constructed from waste rock with ten 50 foot upstream waste rock raises. The upstream side of the facility will consist of a 25 foot starter buttress and 25 foot high upstream raises. Tailings directly beneath the waste rock raise footprints will be compacted to provide a suitable foundation and to preclude the possibility of liquefaction of the tailings in these areas.

The Central Drain will be constructed between the North and South Stack to convey surface water from the drainage above the process plant area. This drain will extend to the top of the south tailings stack and allow surface water from the top of the stack to be conveyed through the drain following closure. The rock drain will be approximately 450 feet high and will be constructed mainly from waste rock. The attached sections show a generalized version of the Central Drain with one strength function for all of the waste rock, though during construction different portions of the drain will have different specifications for the waste rock used for different portions of the drain. The sections also show the maximum overall slope of 1.6H:1V, not including benches or interbench slopes.

2.0   Design Criteria

Design of the tailings disposal facility is governed by the requirements of Arizona BADCT, adjusted for site-specific conditions. Based on these requirements, the minimum stability criteria adopted for the facility are presented in Table 1.

Table 1 - Minimum Stability Requirements

Analysis Condition	Required Minimum Factor of Safety
Static	1.50
Pseudostatic	1.10
Temporary, End-of Construction (Static)	1.30

The site seismicity was analyzed for two levels of ground motion: the maximum probable earthquake (MPE) and the maximum credible earthquake (MCE). These values are 0.036g for the MPE and 0.326g for the MCE. Applicable regulations require that the MCE ground motion is applied to analysis of the tailings disposal facility. A detailed seismicity study for the Rosemont site is provided in a separate technical memo.

Due the construction of a compliance dam below the tailings facility, the foundation of the tailings dam on the downstream side may occasionally be saturated to an elevation of 4597.5 feet. This saturation was incorporated into the analyses.

3.0   Methods

Susceptibility of the tailings to liquefaction was evaluated using an initial screening method proposed by Bray et. al (2004), which reviewed several published criteria for liquefaction potential of fine-grained soils. Based on the results of their study, a fine-grained soil is considered to be susceptible to liquefaction or cyclic mobility if the ratio of the water content (w_c) to the liquid limit (LL) is equal to or greater than 0.85 (w_c/LL ≥ 0.85), and the soil's plasticity index (PI) is equal to or less than 12 (PI ≤ 12). Soils with 12 < PI ≤ 20 and w_c/LL ≥ 0.80 may be moderately susceptible to liquefaction or cyclic mobility.

To evaluate the effect of liquefaction on the proposed facility post-liquefaction analyses were conducted using residual strength values to check against the possibility of a catastrophic flow slide failure. These analyses incorporated no additional earthquake loading beyond that required to trigger liquefaction as a check against development of excessive deformations or flow slide failures. This approach is consistent with FEMA (2005) and current California Department of Water Resources recommendations.

The stability analyses were performed using the SLOPE/W component of GeoStudio 2004 (Version 6.20) by GEO-SLOPE International, Ltd. SLOPE/W was used to conduct limiting equilibrium analyses using the general limit equilibrium (GLE) method, which satisfies both force and moment equilibrium. This program incorporates search routines to determine the critical, lowest factor-of-safety failure surface. SLOPE/W was used to conduct analyses of the facility's stability considering global stability of the waste rock berms, tailings, and foundation materials.

To evaluate the performance of the facility under seismic loading a pseudo-static analysis was performed. The pseudo-static analyses subject the two-dimensional sliding mass to a horizontal acceleration equal to an earthquake coefficient multiplied by the acceleration of gravity. To allow for damping and attenuation of the bedrock acceleration within a slope or embankment, and to account for the rigid body pseudo-static model, the pseudo-static coefficient used in the model

was a conservatively assumed to be equal to 2/3 of the peak ground acceleration of the design earthquake (the MCE in this case), or 0.217g.

Geomechanical properties for the waste rock materials were determined from field and laboratory testing, experience with similar materials, and professional judgment. The material properties used in the analyses are presented in Table 2.

Table 2 - Material Properties

Material #	Description	Strength Model	Phi	Cohesion	Unit Weight
			degrees	psf	pcf
1	Dry Tailings	Mohr-Coulomb	26	400	120
2	Compacted Tailings	Mohr-Coulomb	29.9	0	132
3	Waste Rock	Mohr-Coulomb	43	0	120
4	Alluvium	Mohr-Coulomb	39	2000	127
5	Weathered Bedrock	Mohr-Coulomb	40	3500	160
6	Liquefied Tailings	Strength = F(overburden)	Tau/Sigma Ratio (S_u/P)		120
			0.1		

4.0   Dry Tailings Liquefaction Potential

Based on laboratory test results, the liquid limit of the tailings is 23.5 and the PI is 7.3. Therefore, the soil is potentially susceptible to liquefaction per the PI criteria proposed by Bray (PI ≤ 12). However, liquefaction may occur only at moisture contents ≥ 18.8% (0.80 LL). Since the tailings are proposed to be "dry-stacked" at a moisture content generally below 16% (for acceptable handleability and trafficability during conveyor transport and placement), the tailings will not normally be susceptible to liquefaction.

Limited higher moisture zones within the tailings mass created by meteoric water may potentially occur. These layers could form discrete liquefaction-susceptible layers in the tailings mass. Following liquefaction, these tailings will exhibit nominal undrained shear strength. Ishihara (1993 and 1996) indicates an average S_u/s'_{vc} ratio of 0.10 for non-plastic silty sand and tailings materials.

Post-liquefaction analyses of the tailings facility were performed to evaluate the effect of small (up to 5 foot thick), saturated, liquefiable layers in the tailings mass. The liquefied layers were modeled at selected stages of dry stack development to verify stability throughout the life of the facility and at closure. The selection of the liquefiable tailings depth (5 feet) is considered conservative since it is unlikely that rainfall will penetrate deeply into the surface of the tailings prior to being evaporated or dispersed by capillary tension in the tailings mass.

5.0 Results

5.1 North Dry Stack Maximum Section

Based on the results of the analyses, the presence of small liquefied tailings layers encapsulated in the facility reduces the factor of safety against global slope stability by 0.70 to 1.0 but does not result in slope failure. Both the upstream and downstream embankments can tolerate five-foot thick liquefied layers of tailings at the top of each stage analyzed and maintain a safety factor greater than unity. The stability of the inside (upstream) face the buttress founded on tailings was also analyzed with the uppermost tailings assumed to be liquefied. This did not result in a critical failure mode, as the safety factor for this scenario did not change.

The stability analyses indicate a minimum post-liquefaction safety factor of 1.13 for the maximum embankment section in the raised configuration considering a 5 foot thick liquefied tailings layer at the Stage 2 level in the tailings. With a safety factor greater than unity using conservative post-liquefaction residual strengths the analyses indicate that a flow slide failure would not be triggered in the event of liquefaction of the 5 foot thick layer in the tailings. As an added measure against potential deformation of the outer waste rock buttress constructed on tailings using the upstream method, compaction of the tailings below the waste rock buttress is recommended. This measure will result in a higher density material, thereby reducing the liquefaction susceptibility of the tailings that form the foundation for subsequent waste rock buttress.

Both the static and pseudostatic factors of safety against a global failure were found to be adequate for the upstream and downstream embankments of the facility, as well as the upstream face of each side. Failure through the foundation materials does not represent a critical failure mode for the facility based on the material properties used in the analysis.

Table 3 shows the results of the static and pseudostatic stability analyses and Table 4 presents the post-liquefaction analyses results. Graphic representations of the stability results are attached.

Table 3 - Results of North Dry Stack Slope Stability Analyses

Scenario	Safety Factor	
	Static	Pseudostatic (MCE)
Downstream Side of Impoundment, Global Failure	2.05	1.11
Upstream Face of Downstream Side (End-of-construction of last lift)	1.40	1. 11
Upstream Side of Impoundment, Global Failure	2.13	1.15
Upstream Face of Upstream Side (End-of-construction of last lift)	1.42	1.11

Table 4 - Results of North Dry Stack Post-Liquefaction Analyses

Scenario	Safety Factor
Upstream Face of Downstream Side (End-of-construction of last lift)	1.53
Downstream Side, Block Failure of Liquefied Stage 1 Surface	1.27
Downstream Side, Block Failure of Liquefied Stage 2 Surface	1.13
Downstream Side, Block Failure of Liquefied Stage 3 Surface	1.20
Downstream Side, Block Failure of Liquefied Stage 4 Surface	1.27
Upstream Face of Upstream Side (End-of-construction of last lift)	1.42
Upstream Side, Block Failure of Liquefied Stage 1 Surface	1.19
Upstream Side, Block Failure of Liquefied Stage 2 Surface	1.26
Upstream Side, Block Failure of Liquefied Stage 3 Surface	1.32
Upstream Side, Block Failure of Liquefied Stage 4 Surface	1.48

5.2   Central Drain Section

Based on the results of the analyses, the presence of small liquefied tailings layers encapsulated in the tailings does not affect the stability of the Central Drain. The stability analyses indicate a minimum post-liquefaction safety factor of 1.98. With a safety factor greater than unity using conservative post-liquefaction residual strengths the analyses indicate that a flow slide failure would not be triggered in the event of liquefaction of any of the layers analyzed.

Both the static and pseudostatic factors of safety against a global failure were found to be adequate for south side of the central drain. Failure through the foundation materials does not represent a critical failure mode for the facility based on the material properties used in the analysis.

Table 5 shows the results of the static and pseudostatic stability analyses of the Central Drain. Graphic representations of the stability results are attached to this memo.

Table 5 – Results of Slope Stability for the Central Drain

Scenario	Safety Factor	
	Static	Pseudostatic (MCE)
South Side of Drain - Global Failure	2.03	1.25
South Side of Drain – Upper Liquefied layer	1.98	N/A
South Side of Drain – Lower Liquefied layer	1.98	N/A

6.0   References

Bray, J.D., Sancio, R.B., Riemer, M.F., and Durgunoglu, T., 2004; "Liquefaction Susceptibility of Fine-Grained Soil, "Proc. 11th Inter. Conf. on Soil Dynamics and Earthquake Engineering and 3rd Inter. Conf. on Earthquake Geotech. Engrg., Doolin, Kammerer, Mogami, Seed and Towhata, Eds., Berkeley, CA Jan. 7-9, V.1, pp. 655-662.

Federal Emergency Management Agency (FEMA), 2005; "Federal Guidelines for Dam Safety – Earthquake Analysis and Design of Dams", U.S. Department of Homeland Security, dated May 2005.

Ishihara, K.,1993; "Liquefaction and Flow Failure During Earthquakes. *Géotechnique*, 43(3):351-415.

Ishihara, K., S. Yasuda, and M. Kato, 1997, "Characteristics of lateral Spreading in Liquefied Deposits during the 1995 Hanshin-Awaji Earthquake, Journal of Earthquake Engineering, Vol. 1, No. 1, pp. 23-55.

ATTACHMENT

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Method: GLE
Slip Surface Option: EntryAndExit

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
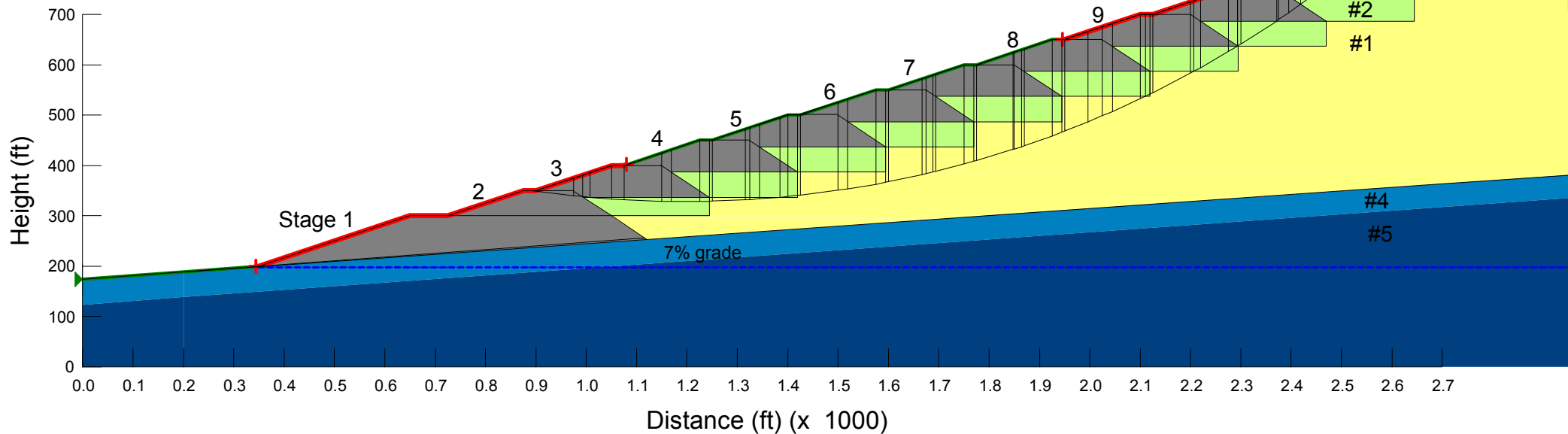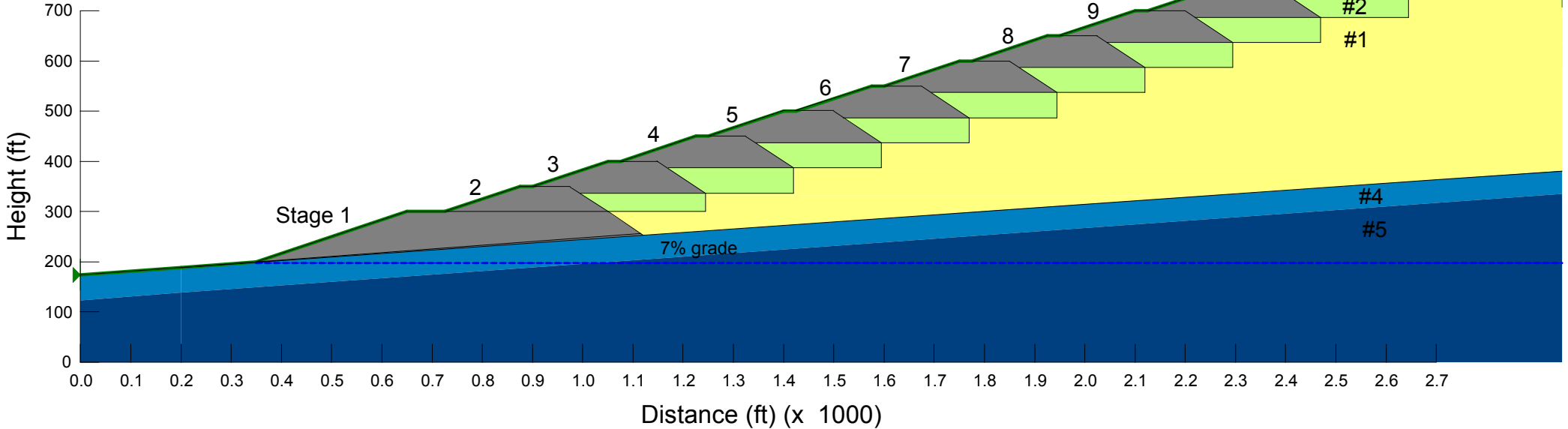Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquefied Tailings
Wt: 95
Tau/Sigma Ratio: 0.1

2.05

Stage 1 is 100' high and 400' wide crest.
All subsequent stages are 50' high and 100' wide crest.
25' offset between Stages. 13' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0.217
(Horizontal Component of the MCE)

Method: GLE
Slip Surface Option: EntryAndExit

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquefied Tailings
Wt: 95
Tau/Sigma Ratio: 0.1

1.11

Stage 1 is 100' high and 400' wide crest.
All subsequent stages are 50' high and 100' wide crest.
25' offset between Stages. 13' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

7% grade

Stage 1

#1
#2
#3
#4
#5

2 3 4 5 6 7 8 9 10 11

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Method: GLE
Slip Surface Option: EntryAndExit

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
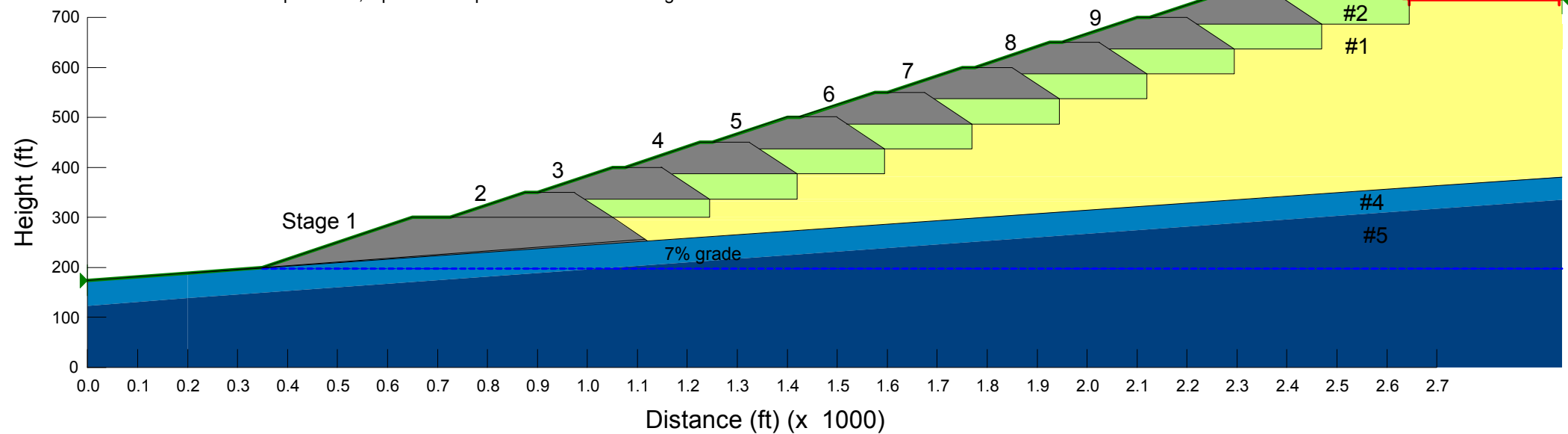Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquefied Tailings
Wt: 95
Tau/Sigma Ratio: 0.1

1.40

Stage 1 is 100' high and 400' wide crest.
All subsequent stages are 50' high and 100' wide crest.
25' offset between Stages. 13' freeborad.
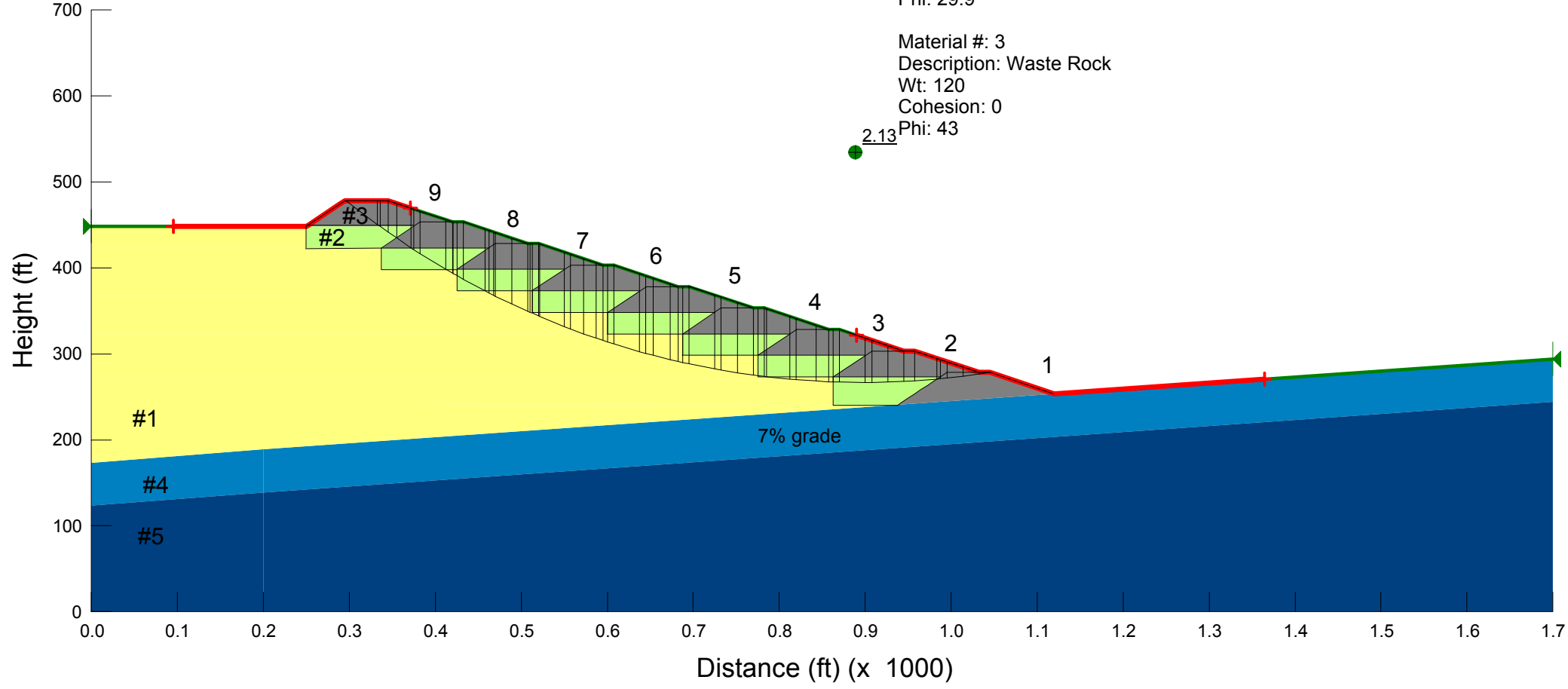Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Stage 1

7% grade

#1
#2
#3
#4
#5

2 3 4 5 6 7 8 9 10 11

Height (ft)

Distance (ft) (x 1000)

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0.217
(Horizontal Component of the MCE)

Method: GLE
Slip Surface Option: EntryAndExit

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

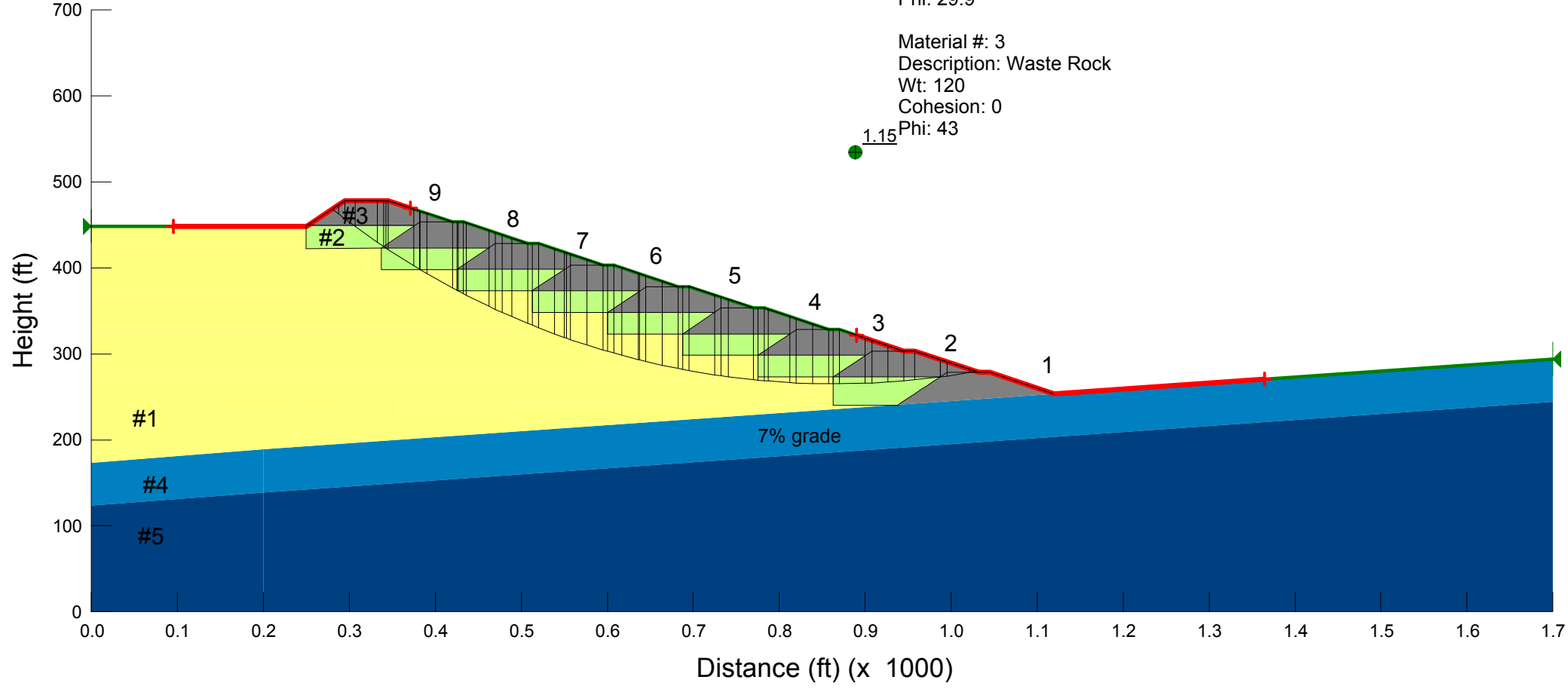Material #: 6
Description: Liquefied Tailings
Wt: 95
Tau/Sigma Ratio: 0.1

1.11

Stage 1 is 100' high and 400' wide crest.
All subsequent stages are 50' high and 100' wide crest.
25' offset between Stages. 13' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Stage 1

2
3
4
5
6
7
8
9
10
11

#3
#2
#1

#4
#5

7% grade

Height (ft) — 0, 100, 200, 300, 400, 500, 600, 700

Distance (ft) (x 1000) — 0.0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7
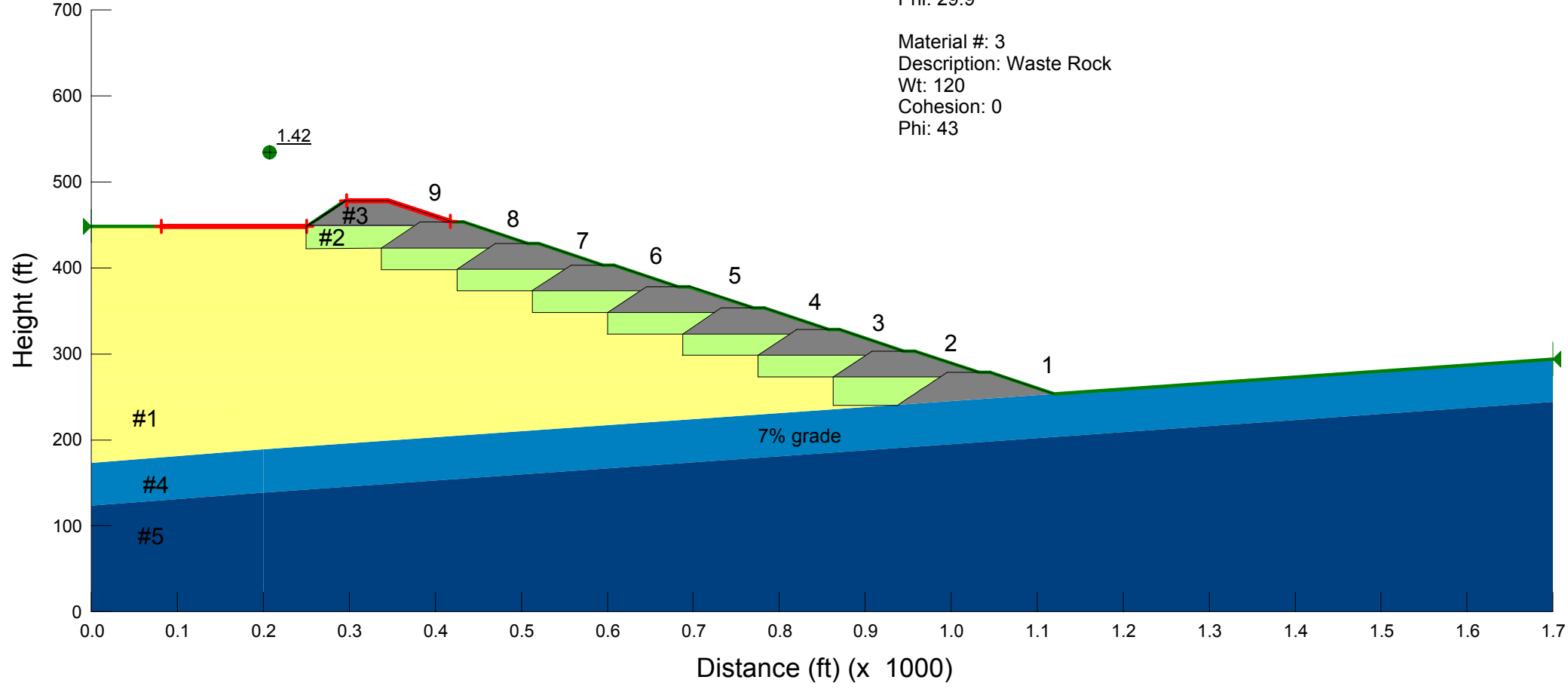
ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Stages are 25' high and 50' wide crest.
12.5' offset between Stages. 10' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
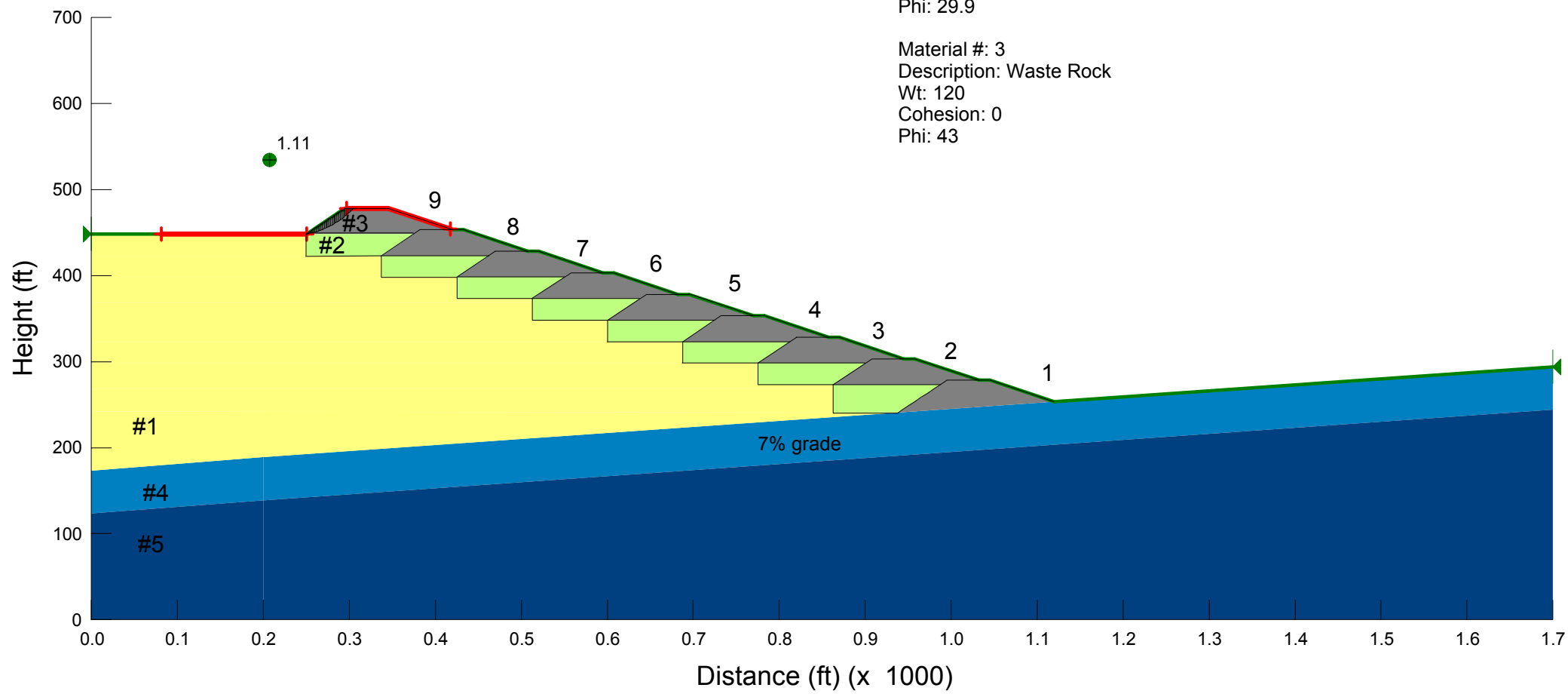Cohesion: 3500
Phi: 40

2.13

7% grade

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0.217
(Horizontal Component of the MCE)

Stages are 25' high and 50' wide crest.
12.5' offset between Stages. 10' freebord.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Stages are 25' high and 50' wide crest.
12.5' offset between Stages. 10' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
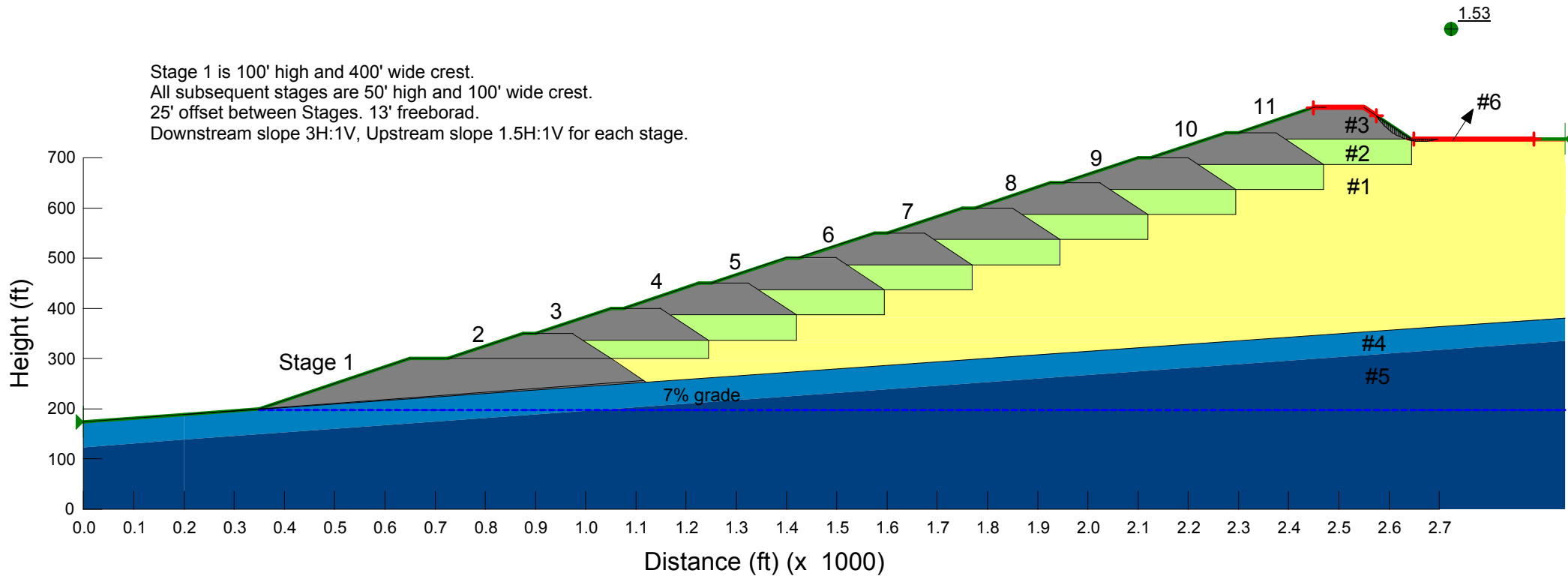Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0.217
(Horizontal Component of the MCE)

Stages are 25' high and 50' wide crest.
12.5' offset between Stages. 10' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

**ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY**

Horz Seismic Load: 0
(Static)

Method: GLE
Slip Surface Option: EntryAndExit

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
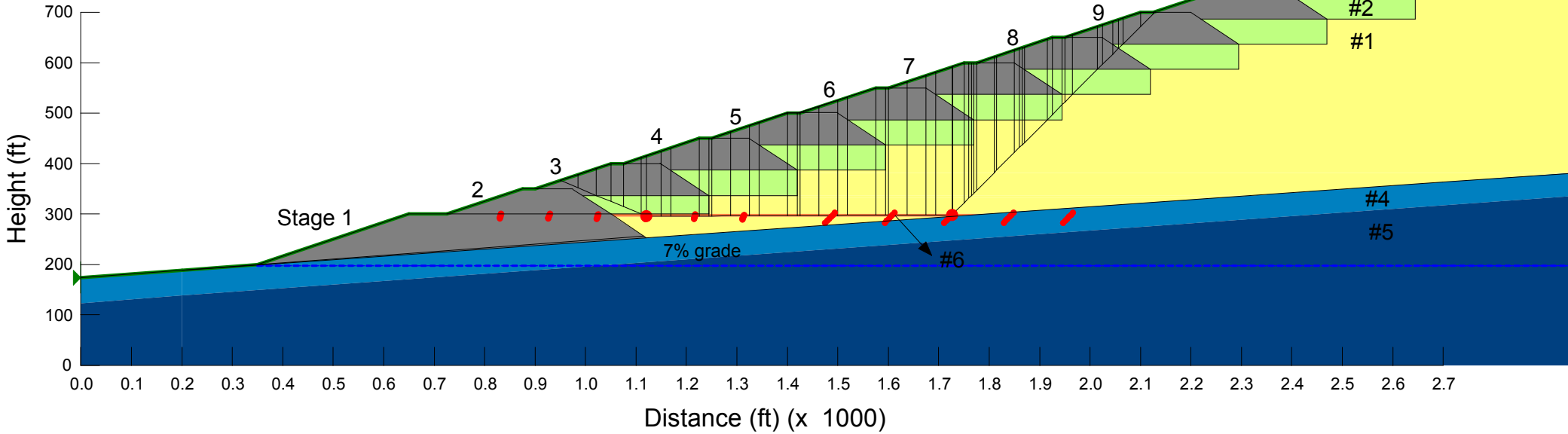Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquefied Tailings
Wt: 95
Tau/Sigma Ratio: 0.1

Stage 1 is 100' high and 400' wide crest.
All subsequent stages are 50' high and 100' wide crest.
25' offset between Stages. 13' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

1.53

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Method: GLE
Slip Surface Option: Block

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
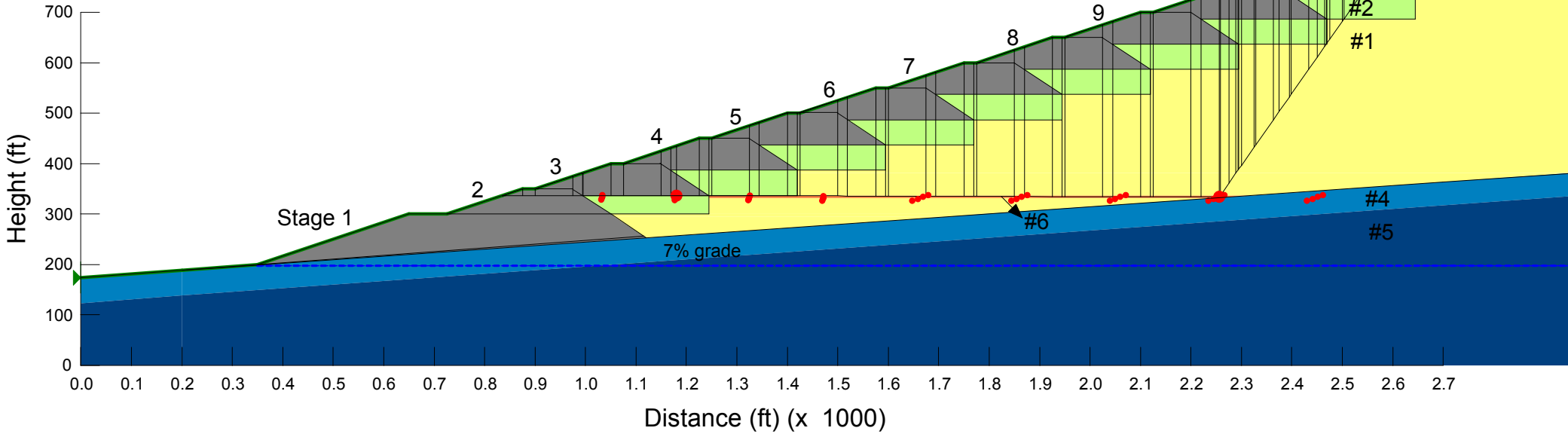Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquefied Tailings
Wt: 95
Tau/Sigma Ratio: 0.1

1.27

Stage 1 is 100' high and 400' wide crest.
All subsequent stages are 50' high and 100' wide crest.
25' offset between Stages. 13' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Stage 1

7% grade

#6

#3
#2
#1

#4
#5

2
3
4
5
6
7
8
9
10
11

Height (ft)

700
600
500
400
300
200
100
0

Distance (ft) (x 1000)

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7

**ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY**

Horz Seismic Load: 0
(Static)

Method: GLE
Slip Surface Option: Block

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
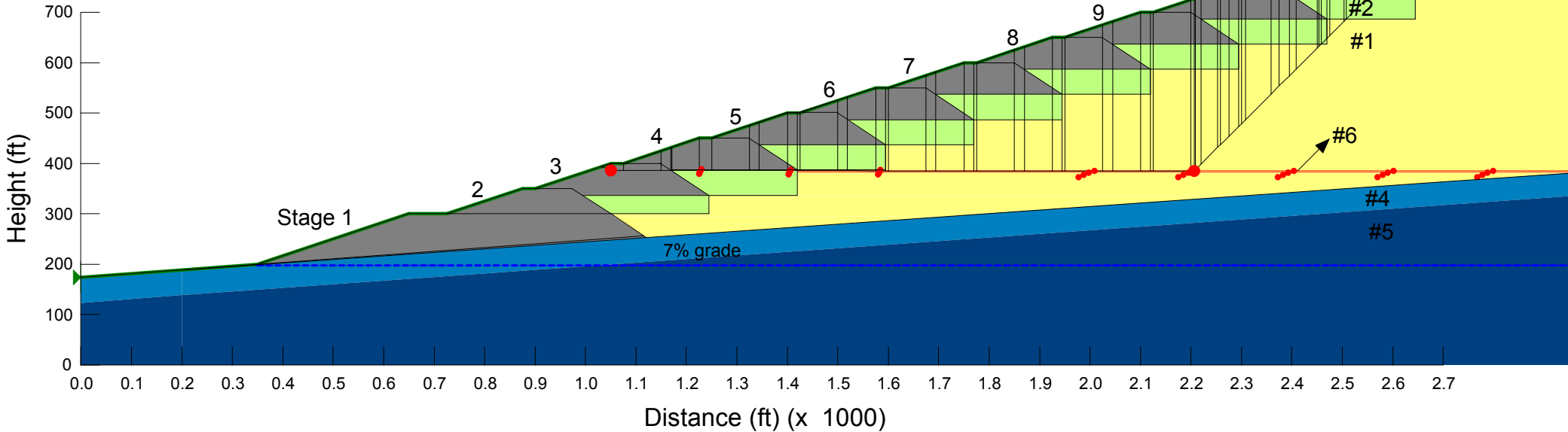Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquefied Tailings
Wt: 95
Tau/Sigma Ratio: 0.1

1.13

Stage 1 is 100' high and 400' wide crest.
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25' offset between Stages. 13' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Method: GLE
Slip Surface Option: Block

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
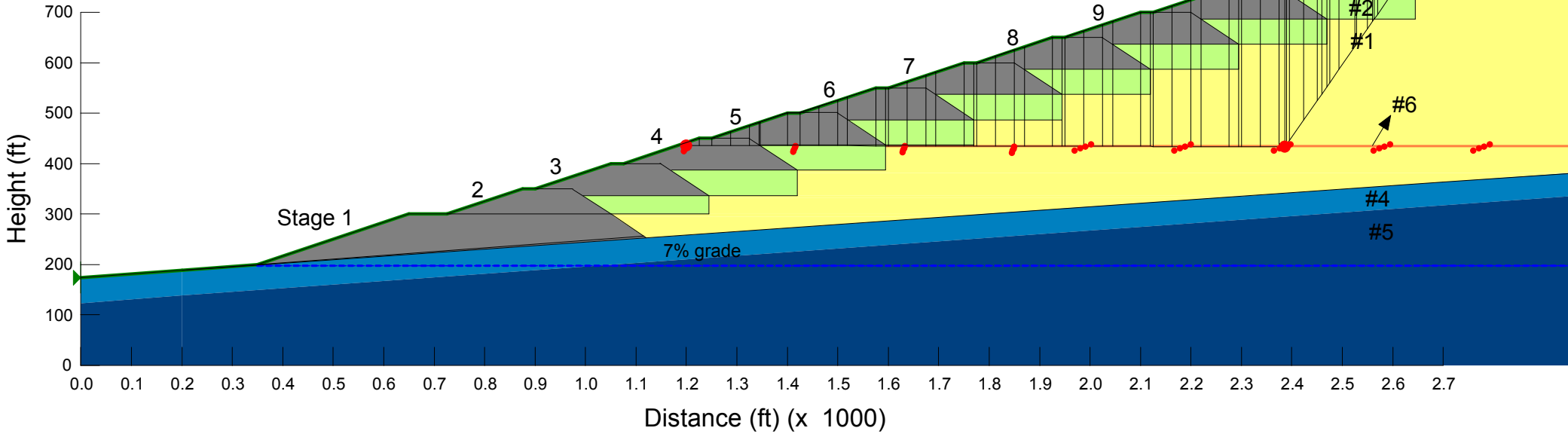Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquefied Tailings
Wt: 95
Tau/Sigma Ratio: 0.1

1.20

Stage 1 is 100' high and 400' wide crest.
All subsequent stages are 50' high and 100' wide crest.
25' offset between Stages. 13' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Stage 1

7% grade

2   3   4   5   6   7   8   9   10   11

#1   #2   #3

#6

#4

#5

Height (ft)
700
600
500
400
300
200
100
0

Distance (ft) (x 1000)
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
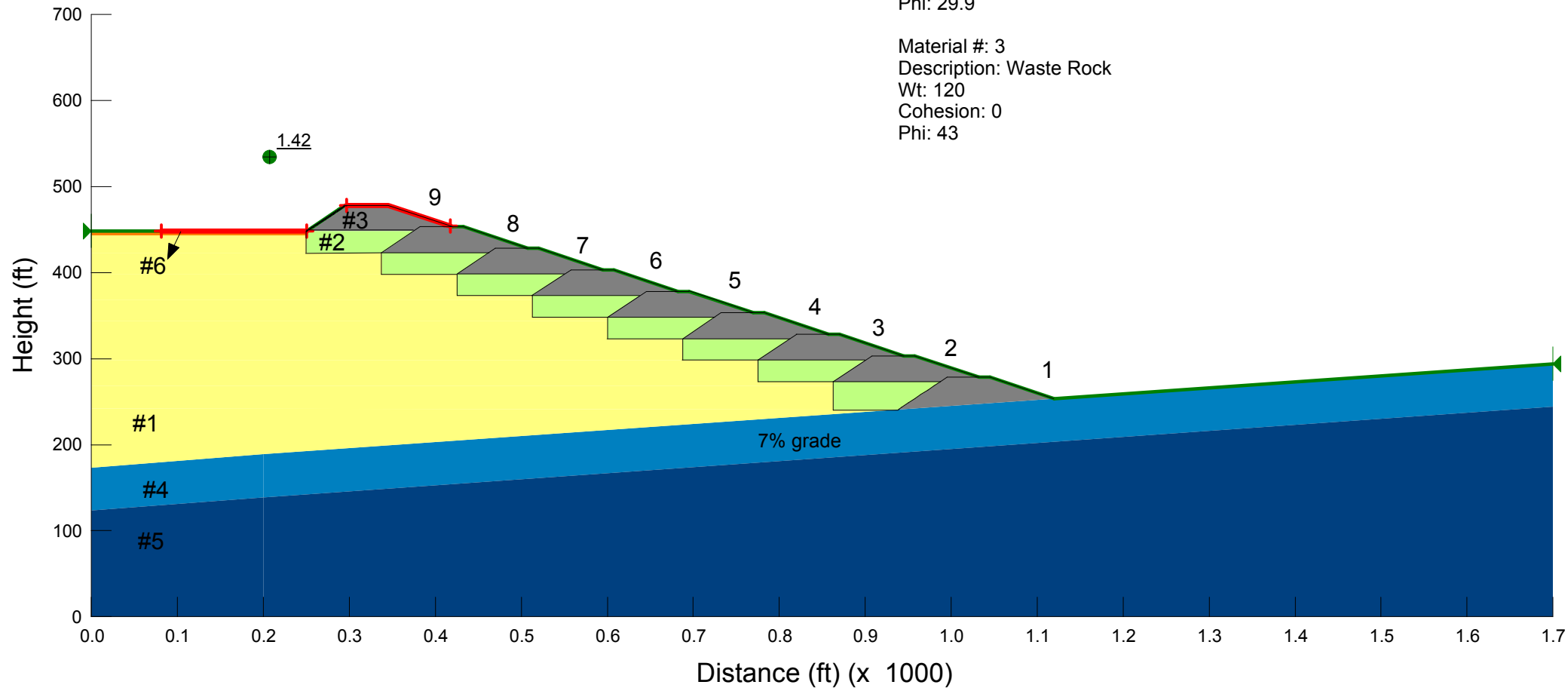(Static)

Method: GLE
Slip Surface Option: Block

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquefied Tailings
Wt: 95
Tau/Sigma Ratio: 0.1

1.27

Stage 1 is 100' high and 400' wide crest.
All subsequent stages are 50' high and 100' wide crest.
25' offset between Stages. 13' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

7% grade

Stage 1

#1 #2 #3 #4 #5 #6

Height (ft)

Distance (ft) (x 1000)

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Stages are 25' high and 50' wide crest.
12.5' offset between Stages. 10' freeborad.
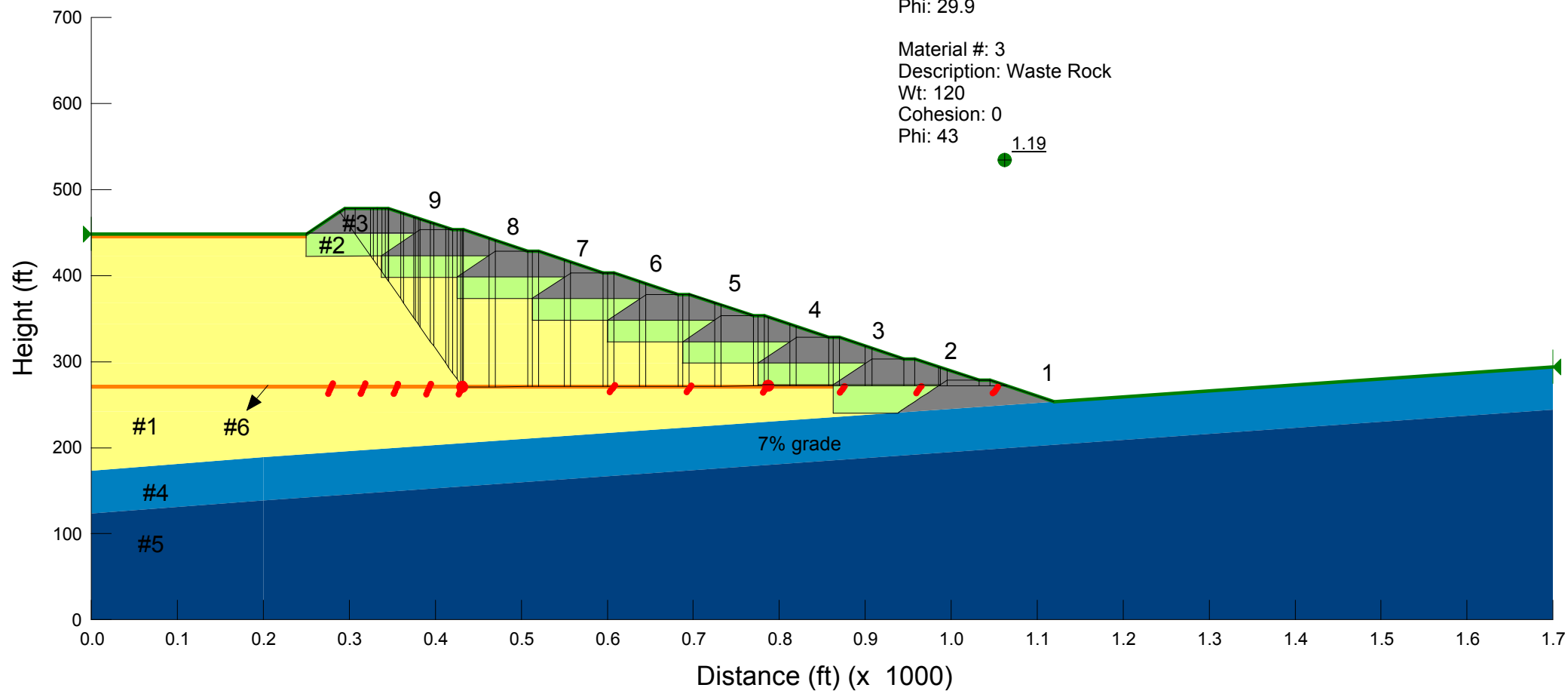Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
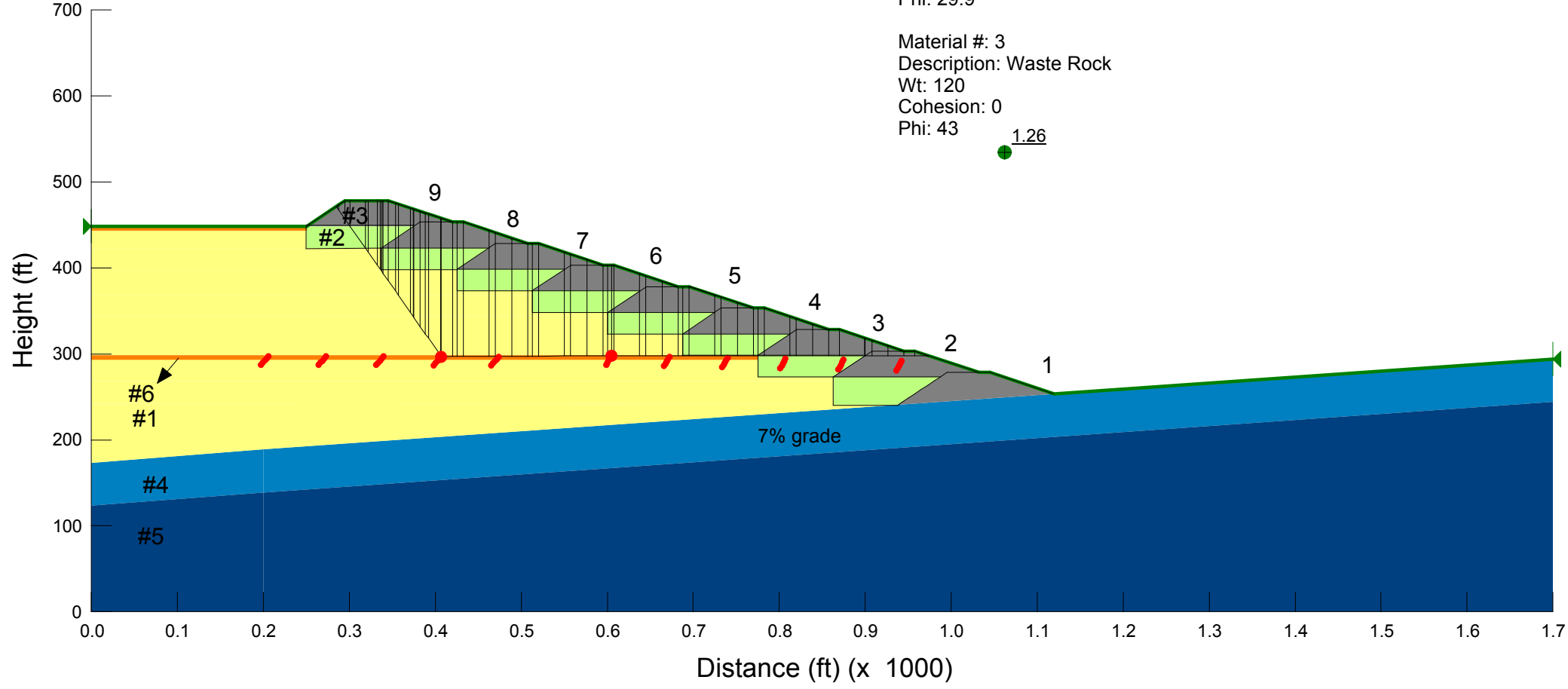Wt: 160
Cohesion: 3500
Phi: 40

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Stages are 25' high and 50' wide crest.
12.5' offset between Stages. 10' freeborad.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

1.19

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Stages are 25' high and 50' wide crest.
12.5' offset between Stages. 10' freeborad.
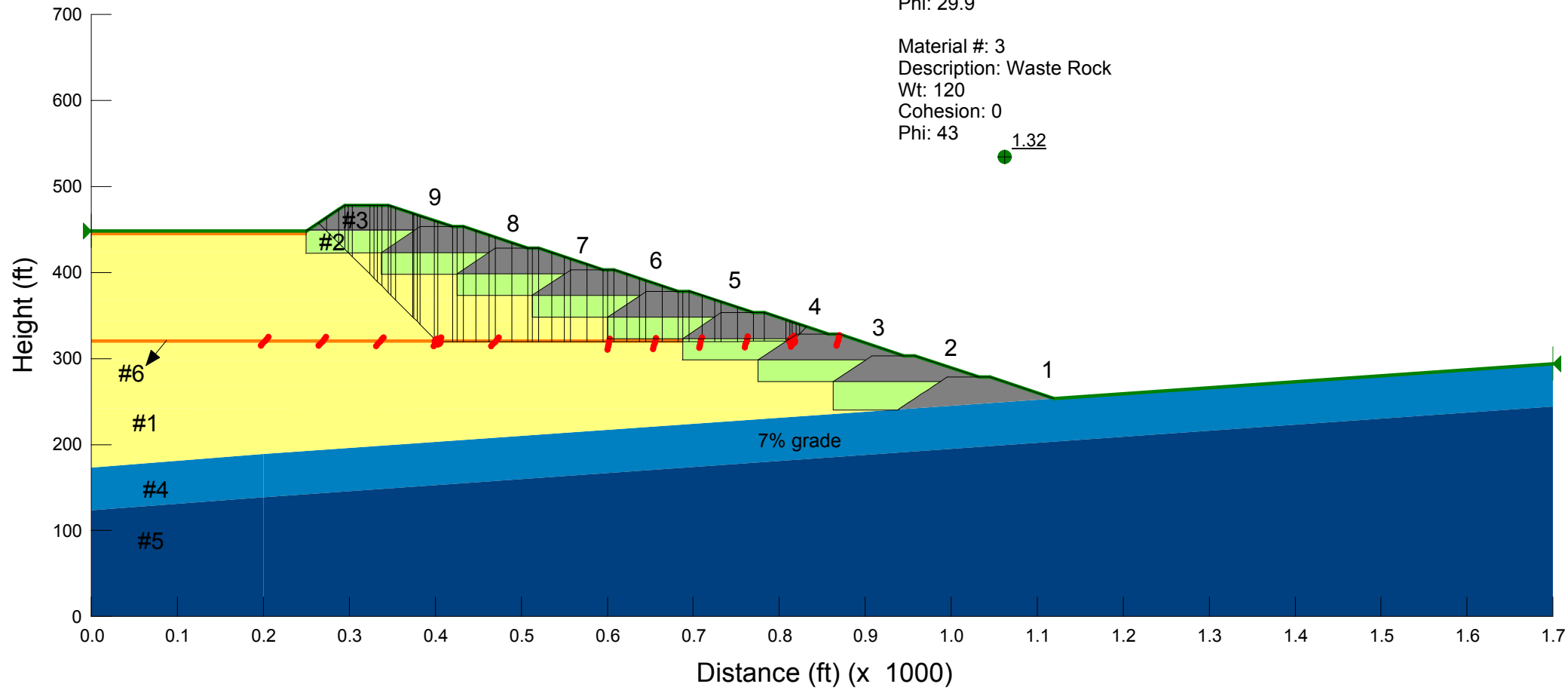Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Stages are 25' high and 50' wide crest.
12.5' offset between Stages. 10' freeborad.
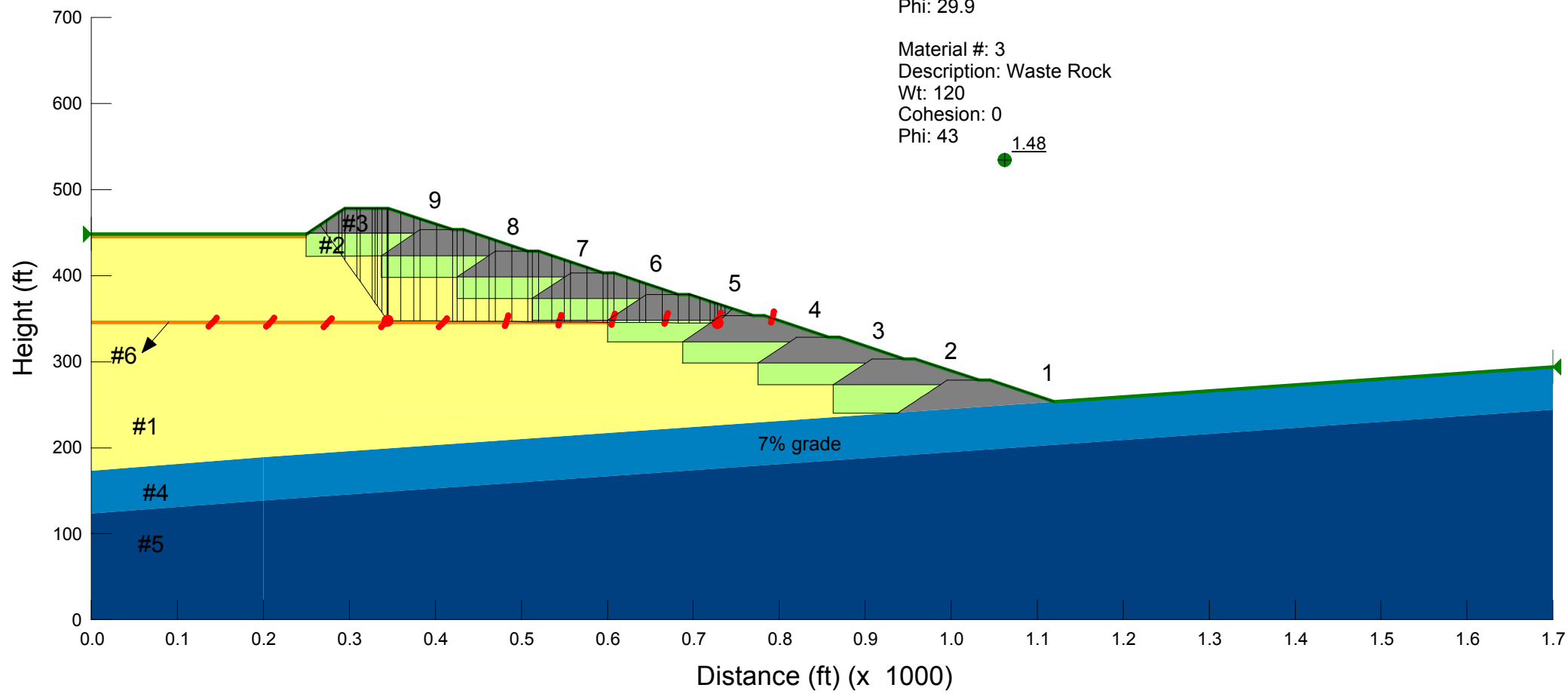Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

1.32

7% grade

ROSEMONT FEASIBILITY STUDY
DRY-STACK TAILINGS FACILITY

Horz Seismic Load: 0
(Static)

Stages are 25' high and 50' wide crest.
12.5' offset between Stages. 10' freebord.
Downstream slope 3H:1V, Upstream slope 1.5H:1V for each stage.

Material #: 1
Description: Dry Tailings
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted Tailings
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Wt: 160
Cohesion: 3500
Phi: 40

1.48

ROSEMONT FEASIBILITY STUDY
CENTRAL DRAIN SECTION

Horz Seismic Load: 0
(Static)

Method: GLE
Slip Surface Option: EntryAndExit

Material #: 1
Description: Dry-tailings
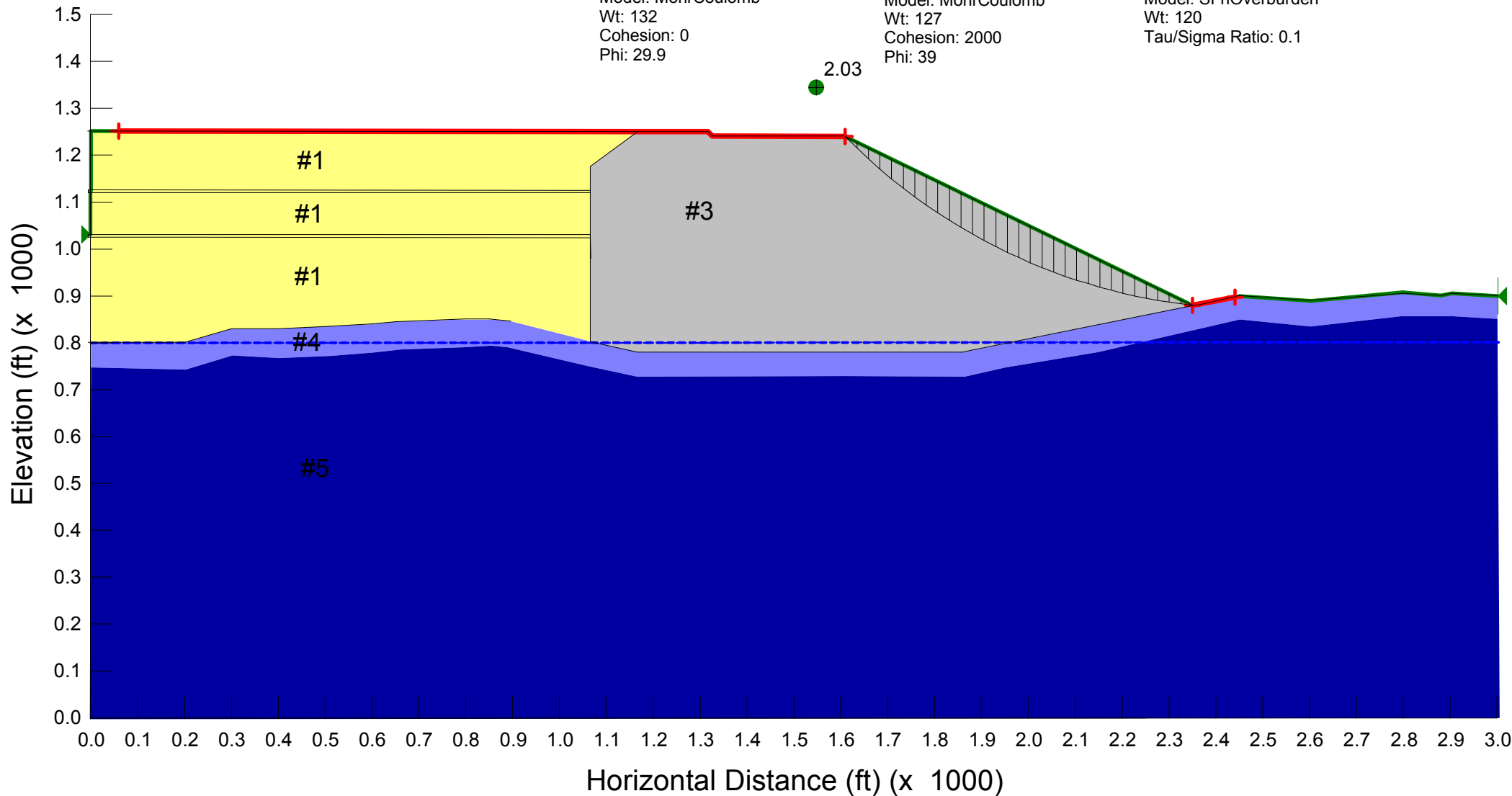Model: MohrCoulomb
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted tailings
Model: MohrCoulomb
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Model: MohrCoulomb
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Model: MohrCoulomb
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Model: MohrCoulomb
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquified tailings
Model: SFnOverburden
Wt: 120
Tau/Sigma Ratio: 0.1

2.03

#1
#1
#1
#3
#4
#5

Elevation (ft) (x 1000)

Horizontal Distance (ft) (x 1000)

ROSEMONT FEASIBILITY STUDY
CENTRAL DRAIN SECTION

Horz Seismic Load: 0.217
(Horizontal Component of the MCE)

Method: GLE
Slip Surface Option: EntryAndExit

Material #: 1
Description: Dry-tailings
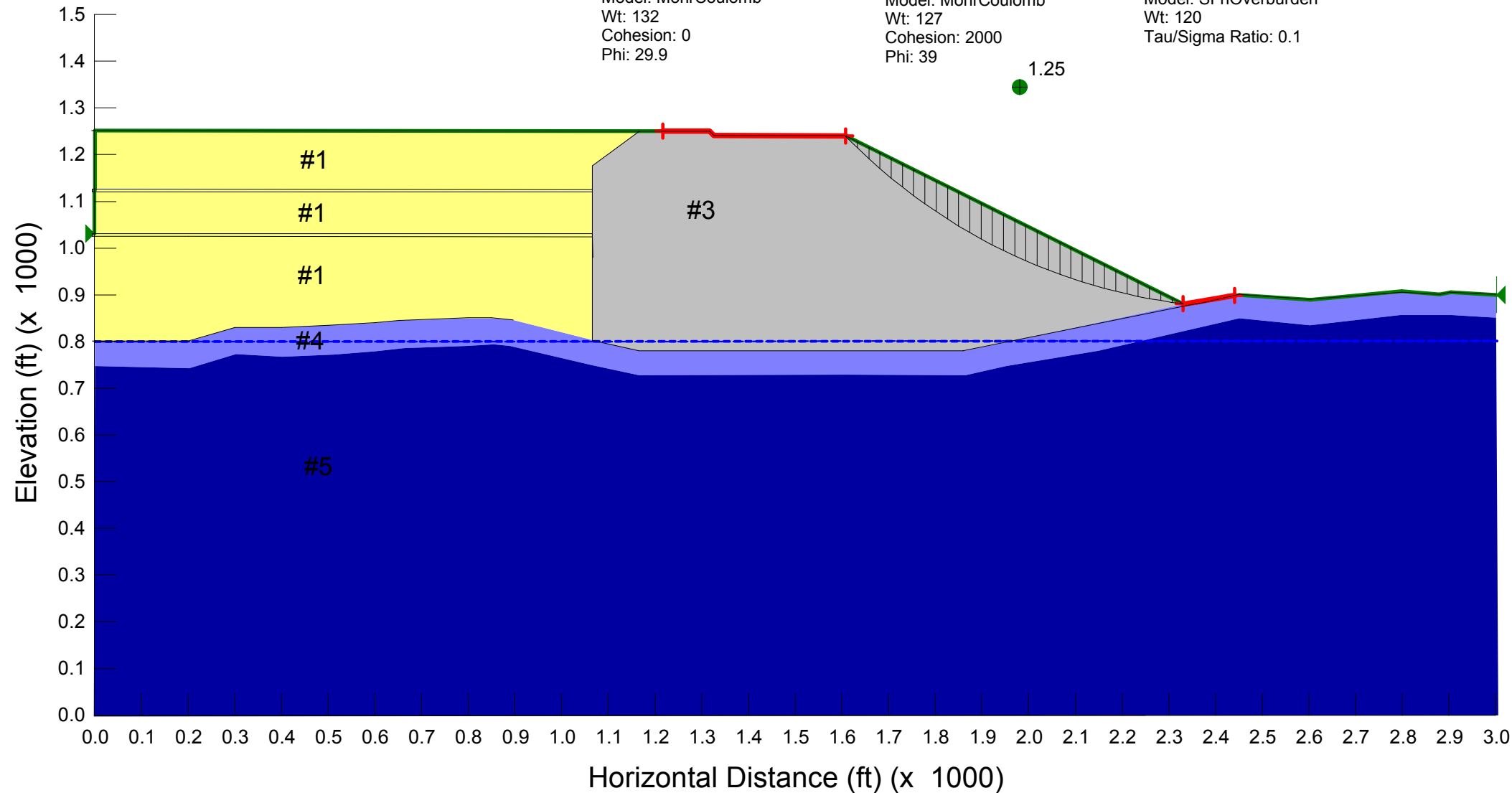Model: MohrCoulomb
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted tailings
Model: MohrCoulomb
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Model: MohrCoulomb
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Model: MohrCoulomb
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Model: MohrCoulomb
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquified tailings
Model: SFnOverburden
Wt: 120
Tau/Sigma Ratio: 0.1

1.25

#1

#1

#1

#4

#3

#5

ROSEMONT FEASIBILITY STUDY
CENTRAL DRAIN SECTION

Horz Seismic Load: 0
(Static)

Method: GLE
Slip Surface Option: EntryAndExit

Material #: 1
Description: Dry-tailings
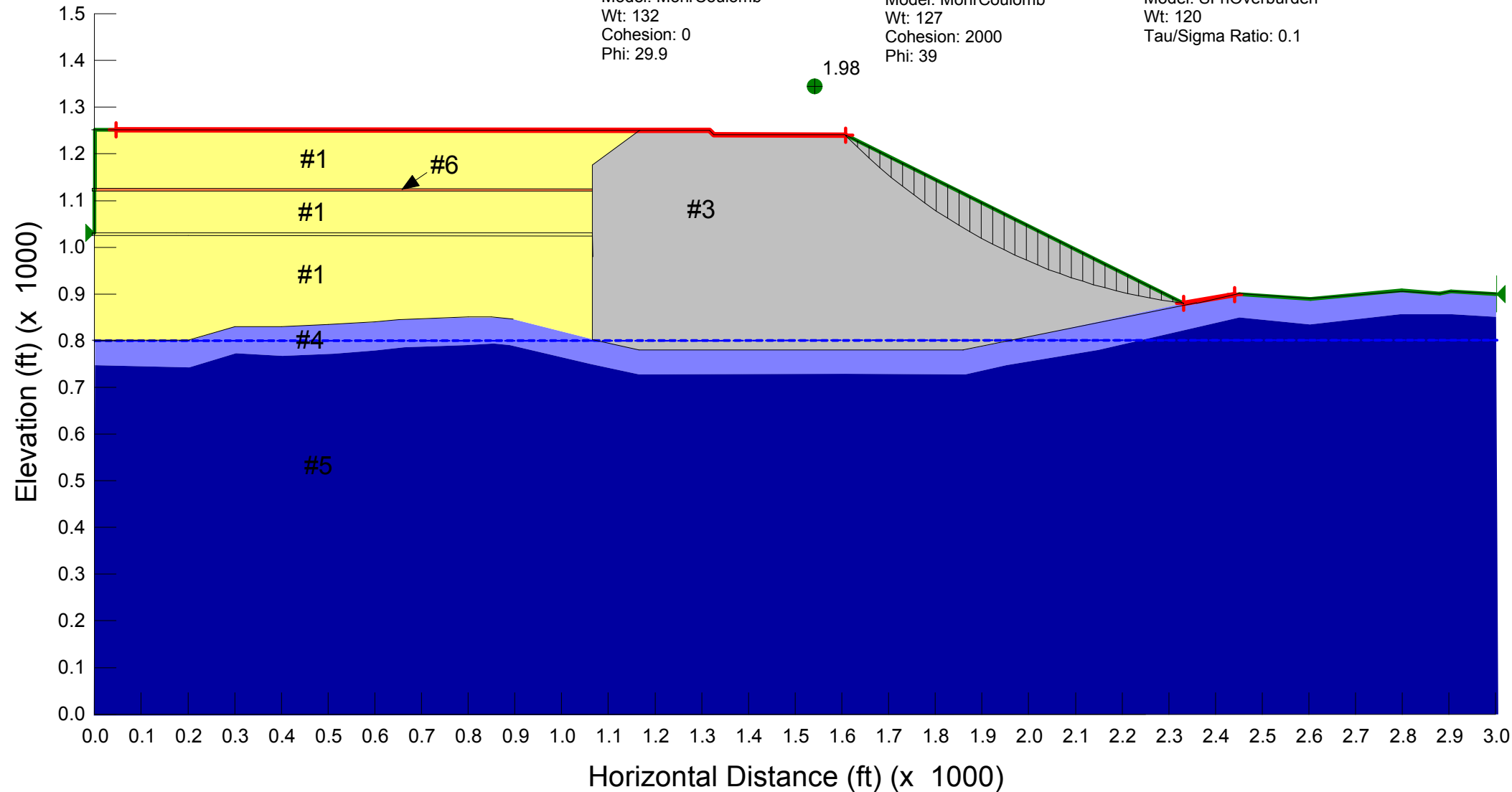Model: MohrCoulomb
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted tailings
Model: MohrCoulomb
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Model: MohrCoulomb
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Model: MohrCoulomb
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Model: MohrCoulomb
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquified tailings
Model: SFnOverburden
Wt: 120
Tau/Sigma Ratio: 0.1

1.98

#1
#6
#1
#1
#4
#5
#3

Elevation (ft) (x 1000)

Horizontal Distance (ft) (x 1000)

ROSEMONT FEASIBILITY STUDY
CENTRAL DRAIN SECTION

Horz Seismic Load: 0
(Static)

Method: GLE
Slip Surface Option: EntryAndExit

Material #: 1
Description: Dry-tailings
Model: MohrCoulomb
Wt: 120
Cohesion: 400
Phi: 26

Material #: 2
Description: Compacted tailings
Model: MohrCoulomb
Wt: 132
Cohesion: 0
Phi: 29.9

Material #: 3
Description: Waste Rock
Model: MohrCoulomb
Wt: 120
Cohesion: 0
Phi: 43

Material #: 4
Description: Alluvium
Model: MohrCoulomb
Wt: 127
Cohesion: 2000
Phi: 39

Material #: 5
Description: Weathered Bedrock
Model: MohrCoulomb
Wt: 160
Cohesion: 3500
Phi: 40

Material #: 6
Description: Liquified tailings
Model: SFnOverburden
Wt: 120
Tau/Sigma Ratio: 0.1

1.98