Macraes MP4 Consenting Project

Project Element 4.3.2: Open Pit Stability Assessment for Frasers TSF

PSM71-285R Rev 1   01 February 2024

Executive Summary

This report presents a geotechnical review undertaken by PSM to assess the foundation conditions and pit slope stability of the Frasers Tailings Storage Facility (FTSF) during the construction and throughout closure. The proposed development includes:

- The Frasers Back Fill (FRBF) will be constructed with waste rock to a final level of 480 mRL
- Slurried tails deposited in two stages beginning 2025 during and following construction of the FRBF embankment to 480 mRL. Stage 1 involves 8M tonnes of freshly milled wet tailings discharged via spigots up to approximately 345 mRL while the FRBF is constructed to 450 mRL. Stage 2 will commence in 2026 following the FRBF construction to 480 mRL with a further 28Mtonnes of wet tailings being discharged bringing the final FTSF height to 416.5 mRL.

Foundation conditions for the proposed FTSF embankment and impounded tailings will be influenced by past mining activity, existing slope performance and interactions with the Frasers underground (FRUG) mine workings. Several pit slope instabilities have occurred during mining, most notably:

- A 20 Mm^3 west wall slide along the Footwall Fault in April 2014
- A large unravelling planar failure within the eastern highwall in 2012
- A zone of highwall movement extended laterally along geological structures from the 2012 failure following an underground production blast in December 2022.

Limit equilibrium slope stability analyses have been completed using Rocscience's *Slide2D* software package. The stability assessment provides an understanding of the expected long-term stability for the proposed development and provides confidence to both OceanaGold and the consenting authority that:

- Operational safety can be maintained throughout the FTSF construction
- The existing pit walls will maintain sufficient stability during FTSF backfilling and under seismic loading scenarios throughout closure.

Four analytical sections were selected to represent the most adverse geometries and rock mass conditions based on the expected foundation conditions. The stability analysis accounts for both the elevated groundwater pressures and an increase in buttressing from tailings

The lowest Factor of Safety (FoS) of the four sections occurs at the end of mining, prior to tailings deposition. This result is consistent with the long-term west wall creep experienced within Frasers. The assessed FoS gradually increases as tailings' rise where additional buttress support is provided to the pit walls.

Slope movements are anticipated under the 1:10,000 annual exceedance probability Safety Evaluation Earthquake (very-low probability strong ground shaking) loading condition for closure. There is potential for a failure scarp to extend behind the design pit crest. It should be noted that many natural slopes in the surrounding area are likely to also deform at this level of shaking.

The FROP crest has a topographic low of approximately 505 mRL located along the eastern flank creating a significant offset (greater than 80 m vertically) between the final impoundment level and the adjacent landform. This negates the risk of potential external loss of FTSF contents. The estimated final Frasers-Innes Mills pit lake of 489 mRL creates approximately 15 m vertically offset at this location.

Some ongoing deformation (tension cracking, slumping, ground loss) could occur behind the pit crest post-closure. PSM recommends defining a strip of land/zone of influence around the crest of the FROP to isolate hazards associated with ground movement and falling from height. PSM understands a ring fence around the pit was included in the consent for MP3. Based on a FoS of 1.5, an exclusion zone at approximately 150 m from the pit crest is recommended. Further geotechnical assessment is recommended to better define the exclusion zone.

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1. Introduction

This report presents a geotechnical review undertaken by PSM to assess foundation conditions and pit slope stability for the proposed Frasers Tailings Storage Facility (FTSF) during construction, filling and closure. This work forms part of OceanaGold New Zealand Limited's (OG) proposed Macraes Phase 4 (MP4) development.

This assessment was undertaken in accordance with our proposal[1] and informs Project Element 4.3.2 of the wider MP4 consenting project. The project aims to extend the current mine life until approximately 2030 and requires a suite of technical studies to document the assessment of environmental effects (AEE) which will support Resource Consent, Building Consent and Wildlife Permit applications.

The report includes:

- Description of the proposed development associated with Project Element 4.3.2 and previous work undertaken by PSM applicable to the study
- A summary of the geological and geotechnical model with assessment on the expected foundation conditions for the in-pit backfill using waste rock and dry tailings
- A two-dimensional (2D) stability analysis was undertaken using limit equilibrium analysis to assess the stability of the final pit walls during backfilling and for FTSF closure
- Discussion of the analysis outcomes relative to the proposed consenting application.

2. Background

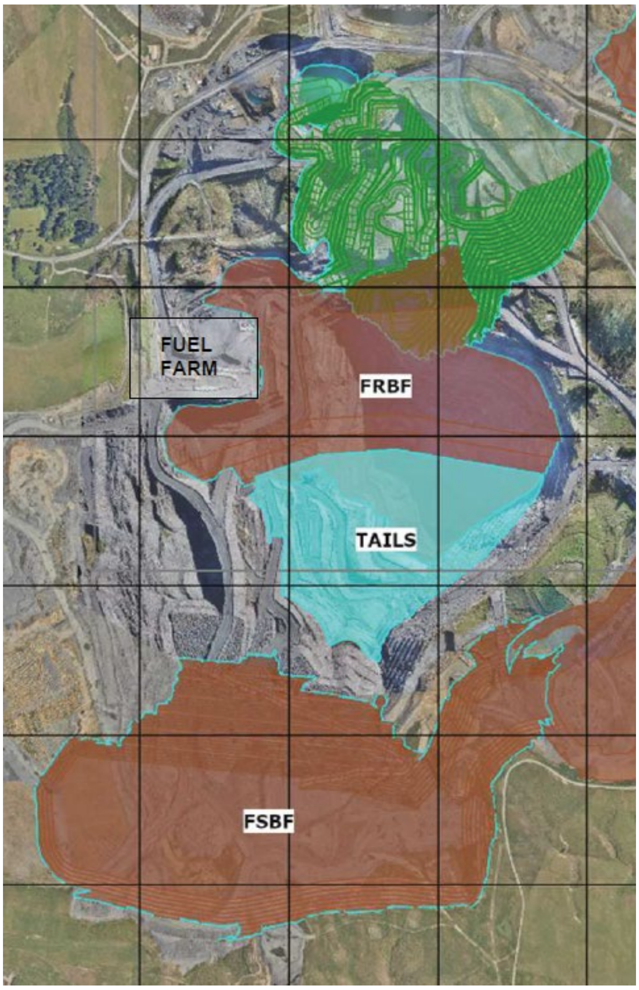
2.1 Proposed Development

The Frasers Open Pit (FROP) will be partially backfilled with both waste rock and tailings at the completion of mining within the remaining Gay Tan Pits. The proposed construction of FTSF within FROP is to comprise the following[2], Inset 1:

- The FRBF will be constructed with waste rock to a final level of 480 mRL
- Slurried tails - Disposal is scheduled to begin in 2025 during and following construction of the FTSF embankment where freshly milled tails will be discharged via spigots up to 416.5 mRL.

[1] PSM71-276L Rev1 "Macraes Phase 4 Consenting - Proposal To Undertake Life Of Mine Geotechnical Assessment" dated 9 April 2022

[2] "MP4 Open pit Extensions & FTSF – Project Scope Change" dated 17 August 2023



Inset 1: Plan view of proposed FRBF and FTSF impoundment. Illustrated tailings levels are representative only (Source: OceanaGold, August 2023).

2.2 Scope of Work

The scope of work for this study is outlined in our proposal and assesses the foundation conditions and pit slope stability for both construction and closure of the FTSF.

Specific details of our scope are summarised as follows:

- Review available data including proposed excavation stages
- Summary of the geotechnical model based on:
  - Available data, including borehole logs and geomechanical testing
  - The documented geological model
  - Previous experience including slope performance of the existing FROP and nearby underground excavations
  - Groundwater level, pore pressure estimates, and field observations provided by OG personnel
- Carry out geotechnical analyses of FROP slopes using 2D limit equilibrium methods, encompassing scenarios for both operation and mine closure
- Document assessment findings for inclusion in the AEE to support Resource Consent, Building Consent and Wildlife Permit applications for the wider MP4 Consenting Project.

The scope of this report does not include stability assessment of the FTSF embankment slopes, which is being undertaken by WSP-Golder[3].

[3] PS132071-023-RevA "Frasers Tailings Storage Facility (FTSF) Feasibility Design for Consent Application", WSP Golder, dated 24 January 2023

2.3 Available Data

The following points list the provided data by OG for this assessment:

- Topographic surfaces:
  - Pre-mining *(0_PCD_2018_ORIGINAL_-_DD-FR_-_ORIGINAL_TOPO_PART1.dxf)*
  - As-mined *(0_PCD_2018_180331_SITE_AS_MINED_SURFACE_PART1.dxf)*
  - As-built/current *(0_PCD_2018_180331_SITE_SURFACE_AS-BUILT_PART1.dxf)*
- Major Faults
  - Footwall Fault *(FWF_RH2105U_Modelled.dxf)*
- Tailing composition
  - Tailings Re-mining Pre-Feasibility Study for the RHOP Project – Golder Associates, 15 February 2021. Ref 20144962-013 Rev 0
- Pit Closure Lake levels
- Seismic Hazard Assessment
  - Probabilistic Seismic Hazard Analysis for Macraes, New Zealand. Bradley Seismic Limited, 23 May 2021.
  - Interim National Seismic Hazard Model (NSHM), GNS NZ, 2022.

2.4 Previous Studies

PSM has been providing geotechnical advice for the Macraes operation since mining began in 1991. Our involvement has ranged from operational support with regular site visits to detailed geotechnical analyses of open pit slopes and underground infrastructure from design to execution and final closure phases.

Throughout the development of Frasers Pit, Frasers-Innes Mills Pit (FRIM) and the subsequent slip pits (Frasers West and Gay Tan variants), PSM have completed a suite of assessments including slope design and back analysis that directly inform the expected foundation and stability conditions for the proposed FTSF and are referenced herein.

3. Foundation Conditions

Foundation conditions for the proposed FTSF development are influenced by the past mining activity, existing slope performance and interactions with the nearby Frasers Underground (FRUG) workings. The following sections present an overview of the key elements relevant to the development.

3.1 Geotechnical Model

On a deposit scale the geological model at Frasers follows the typical model seen throughout Macraes. A detailed review of this geotechnical model is presented in PSM71-287R[4] as part of the "open pit extensions" assessment and is not reproduced here. PSM71-287R documents the following aspects of the model in detail:

- Geotechnical setting, both regional and local
- Rock mass model
- Geomechanical laboratory testing
- Structural model
- Typical failure mechanisms.

3.1.1 Large Scale Geological Structures

Individual large scale geological structures have a demonstrated influence on rock mass condition and slope stability within FROP. The following sections outline specific elements of these and their potential impact on the FTSF development.

[4] PSM71-287R Rev 1 "Macraes Phase 4 Consenting – Project Element 4.3.1: Open Pit Extension" dated October 2023

3.1.1.1 Footwall Fault

The Footwall Fault (FF) is a north-south trending regional scale fault typically dipping between 10° and 20° that delineates the base of the mineralised zone at Macraes. Geological studies completed in the late 1990s highlight the Deepdell Creek landforms as an ancient landslide with the FF as its basal plane. This provided precedent for slope movement along the FF predating mining activity. A minimum offset of 25 m perpendicular to the structure has been established as a baseline recommendation for slope design by PSM[5] with localised variations adopted relative to the exposure length along strike. The condition of the sliding surface (Photo 1) results in a very low friction angle, creating a highly sensitive structure that responds to small changes in pore pressure and loading.


Photo 1: Example of the FF surface condition as exposed in the upper Frasers West headscarp. The sliding surface is described as slickensided and undulous, comprising high plasticity moist firm clay. Note: The exposed orientation does not reflect the regional geometry due to interactions with the Macraes Fault Zone.

3.1.1.2 Macraes Fault Zone

The Macraes Fault Zone (MFZ) is defined by a wide deformation zone of very poor quality, low strength rock mass dipping 50° to 60° towards 020° to 030°. The zone traverses obliquely through the northern extents of the existing FRIM pit shell and is expected to intersect the base of the FTSF embankment as illustrated in Figure 1.

The faulted and sheared rock mass of the MFZ will be located beneath the downstream toe of the proposed FTSF embankment but is not expected to have an adverse impact on embankment stability. The MFZ however has a higher permeability than that surrounding rock mass which may influence seepage through this highwall from the FROP lake or FTSF saturated tailings.

3.1.1.3 Murphys Gully Fault

The Murphy's Gully Fault (MGF) is a normal fault dipping 60° to 70° towards 004° to 010°[6] and is a zone approximately 100 m wide of crushed rock, clay gouge and rock blocks. This structure occurs in the south wall of Frasers and delineates the southern boundary of the pits' ore zone. The rock mass to the north of the MGF has been dragged up resulting in a steepening of foliation from 25° to 50° to subvertical over a length of approximately 200 m, Photo 2. Faulting occurs along this steepened foliation on the west wall typically resulting in planar slides. The location and presence of the MGF is not expected to have a discernible impact on development of the Frasers FTSF.

[5] PSM71-107R "Round Hill and Southern Pits" dated 26 November 2010

[6] PSM471.R36 "September 2006 Site Visit" dated 12 September 2006

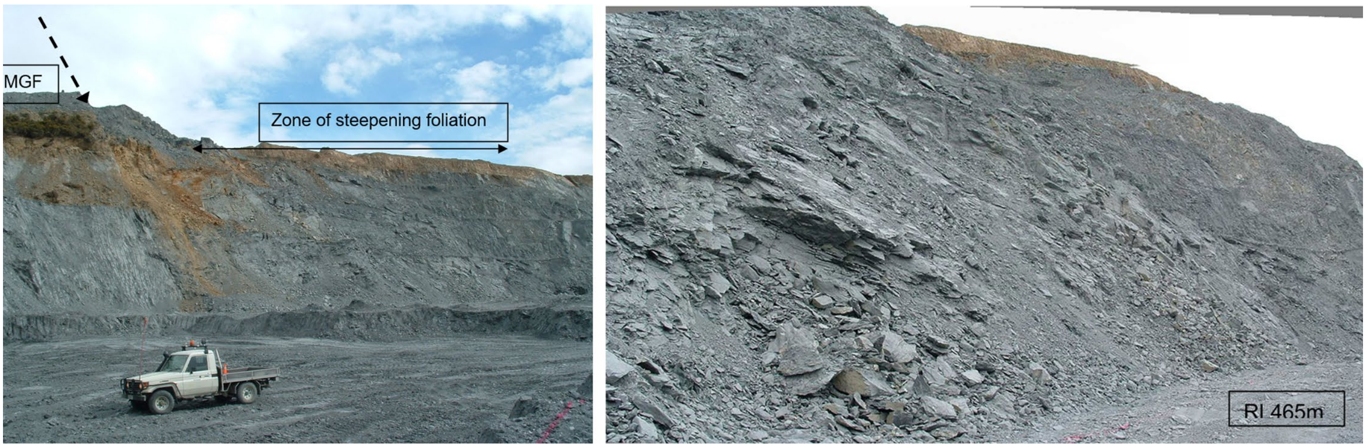


Photo 2: **MGF in west wall of Frasers South. Left: Hanging wall of MGF acting as a failure plane. Right: Close up of steepened foliation.**

3.2 Existing Slope Performance

A number of large-scale slope instabilities have occurred during mining at Frasers, and these provide valuable insight into the ground conditions and pit slope failure mechanisms relevant to this assessment.

3.2.1 East Wall

A section of the east wall failed in late 2012 during mining of Frasers Stage 5, Photo 3. The failure extended approximately 170 m laterally and 115 m vertically, from 405 mRL down to 290 mRL[7]. The failure was assessed to be structurally controlled, with sliding occurring along the following structures:

- A continuous rear shear/fault structure oriented sub-parallel to wall, dipping west at approximately 44°:
  - A series of conjugate structures were also observed to be associated with the main shear/fault structure
  - The failure plane appears to have come close to, or daylighted, at the toe of the slide
- Cross-cutting second order joints, observed at the flanks of the failure, Photo 4. These structures acted as side-release planes truncated against the basal surface.

Photo 3: **Frasers east wall failure during mining showing the interim base of failure at 330 mRL.**

[7] PSM71-138L "Macraes Mine – Frasers Pit East Wall Instability Assessment" dated 1 February 2013

Photo 4: Structural controls of east wall failure. Left: cross-cutting structures in rock mass near failure. Right: northern flank of failure showing side release structure and seepage.

A package of stopes within Frasers Underground (FRUG) known as the “3P’s” are located beneath the east wall of FROP. During December 2022 a localised production blast within these stopes initiated slope movement along a package of geological structures, extending laterally from 2013 failure and truncated by the Hanging Wall Shear at its base. The extent of movement is presented in plan relative to the proposed FTSF embankment geometry, Inset 2. To limit further strain in the rock mass all further development within the 3P’s stopes was halted following the observed movement.

Inset 2: East wall slope instability extents following 2022/2023 movement. Proposed FTSF embankment geometry overlain for context.

Buttress support will be provided to this area by the upstream shoulder of the FTSF embankment and deposition of tailings. Construction staging of the FTSF should be assessed during detailed design to manage highwall stability and associated risk of further slope movement. This is an example of potential long-term degradation of the highwalls and helps to define a zone of influence for closure around the pit crest.

3.2.2 West Wall – Pre April 2014

Prior to April 2014 the Frasers west wall experienced three large, rapid movement events in response to mining and rainfall.

1. The first occurred on 10 June 2012 when the wall moved approximately 10 m as a result of mining re-commencing in the area around 12000 mN – 12300 mN on the 285 mRL bench, below the previously mined Frasers 4C pit. Negligible rain fell in this period.
2. The second occurred on the 15 August 2012. Two 80 mm rain events occurred two weeks apart in July and August 2012. After the first 80 mm of rain, the movement rate of the west wall increased from 4 mm/day to 40 mm/day and remained roughly constant for two weeks until the second 80 mm of rain caused the wall to move 10 m on 15 August.
3. The third occurred on 5 January 2013 largely in response to a 50 mm rain event two days prior but also to mining activity at the bottom of the Frasers 5 pit in the preceding weeks. The wall moved approximately 65 m.

Between the 5 January 2013 and the 19 April 2014 failures, the upper sections of the west wall recorded displacements of approximately 2.5 m. In that same time, the lower sections of the west wall displaced approximately 0.1 m. This was in keeping with the expectation that slope movement responses to mining could be separated between mining the upper and lower sections of the west wall.

3.2.3 West Wall – April 2014 Failure

A 20 Mm^3 failure occurred within the west wall on 19 April 2014 following a heavy rainfall event and considered to be a reactivation of the January 2013 failure[8]. The failure extent is shown in Inset 3 and summarised below:

- The northern margin is well-defined at approximately 12500 mN. It is created by a series of discrete joints and cracks induced by previous movement including the 5 January 2013 failure, Photo 5
- The southern margin of the failure is indistinct, blending into the open pit excavation. It approximately coincides with 11800 mN, Photo 5
- The failure stopped against the east wall and pushed up tens of metres of toe heave
- The FF is the basal plane of the failure. The FF has been exposed in part of the failure's headscarp, Photo 6 and Photo 7
- Areas of the failure mass moved up to 200 m into the pit.

[8] PSM71-165R "Frasers West Wall Failure" dated 16 May 2014

Inset 3: Approximate extents of the April 2014 20 Mm^3 west wall failure.

Photo 5: Northern and southern extent of failure.

Photo 6: **Aerial view of the west wall taken from the south looking roughly along strike towards the north. The distance the west wall has moved can be gauged by the offset seen in the haul roads. The smooth plane in mid-photo is the FF.**

Photo 7: **Headscarp of FF exposed at the top of failure. Photo taken along strike towards the north.**

3.2.4 Slip Pits

Mining of Frasers west wall slip pits began in 2019. 3D stability assessments for Gay Tan 1 (GT1), Gay Tan 2 (GT2), Frasers West 3 (FW3) and Gay Tan 3 (GT3) have been completed by PSM[9] and include calibrated back analysis of recorded slope movements. The rock mass parameters derived from these analyses have been carried through to inform stability assessment for the proposed FTSF development.

3.2.5 Frasers Underground Interactions

The FRUG mine includes a series of drives and stopes located beneath the Frasers/FRIM highwall. Development of underground workings causes a redistribution of stresses within the rock mass. Yielding can occur where the induced stress exceeds the rock mass strength. Within FROP this is expressed as large-scale fracturing with increased dilation along geological structures. Dilated geological structure is visible throughout the pit wall with localised zones of caving in the pit floor where existing "Panel 1" workings have been mined out, Photo 8.

The FRUG Panel 1 workings with the least rock cover are located beneath the proposed FTSF embankment. Additional surcharge load associated with construction of the FTSF embankment has the potential to cause further subsidence. This is expected to choke rapidly underground and ongoing subsidence is expected to be negligible. During embankment construction the highwall rock mass will be progressively supported with additional buttressing from the placed fill.

The rock mass is expected to maintain elevated secondary permeabilities as water migrates along dilated geological structures and open or caved stopes.

Photo 8: Fraser 6/FRIM north wall - Surface caving expression of near surface stopes highlighted in orange. Dilated structures associated with rock mass relation visible through the zone in blue.

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[9] PSM71-242M "3D Stability Assessment of Frasers Slip Pits design" dated 25 November 2019

4. Limit Equilibrium Stability Analyses

4.1 Introduction

The stability assessment presented herein documents the expected long-term stability for the proposed FTSF development. These analyses are not considered to be at the level of a detailed design study but rather to provide confidence to both OG and the consenting authority that:

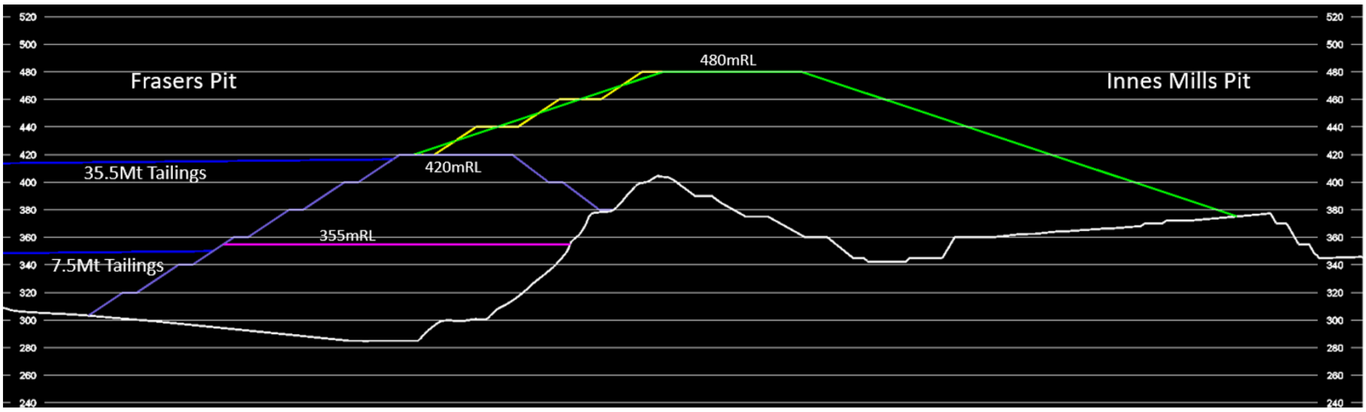
- Operational safety can be maintained throughout the FTSF construction
- The existing pit walls will maintain sufficient stability during FTSF backfilling and under long-term seismic loading scenarios throughout closure.

Limit equilibrium (LE) slope stability analyses have been completed using Rocscience's S*lide2D* software package adopting the GLE Morgenstern Price method for non-circular analyses.

4.1.1 Construction Staging

The proposed FTSF embankment construction and tailings deposition schedule[10] nominates the use of multi-point spigots to discharge tailings from the upstream crest of the FTSF embankment. The effect of the tailings decant pond on stability is considered by a conservative assumption that the pond level will be horizontal and at the same elevation as the wet tailings surface.

Construction will occur in two stages to ensure continual tailings deposal through operations. Stage 1 includes construction of FRBF to 450 mRL and 8Mtonnes of freshly milled wet tailings discharged via spigots up to approximately 345 mRL. Stage 2 will commence in 2026 following the FRBF construction to 480 mRL with a further 28Mtonnes of wet tailings being discharged bringing the final FTSF height 416.5 mRL, Inset 4.

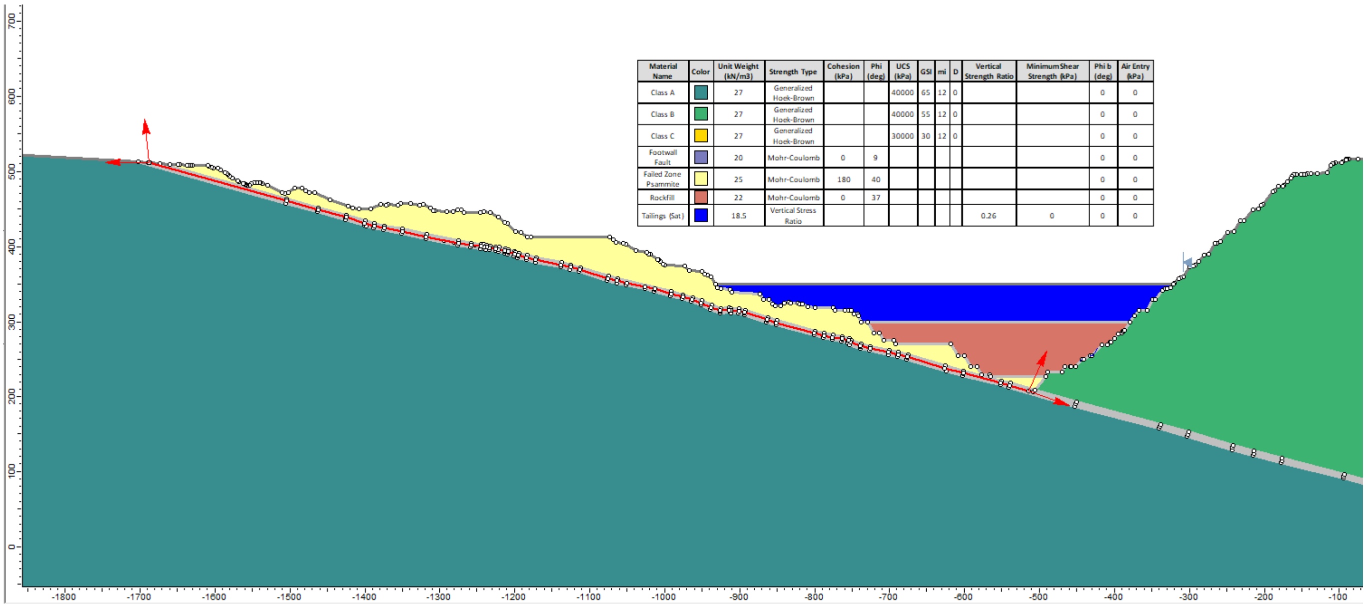


Inset 4: Cross-section looking west of Stage 1 (FRBF – 420 mRL, FTSF – 345 mRL) and Stage 2 (FRBF – 450 mRL, FTSF – 416.5 mRL) construction heights. (Source OG).

[10] PS132071-023-RevA "Frasers Tailings Storage Facility (FTSF) Feasibility Design for Consent Application", WSP Golder, dated 24 January 2023

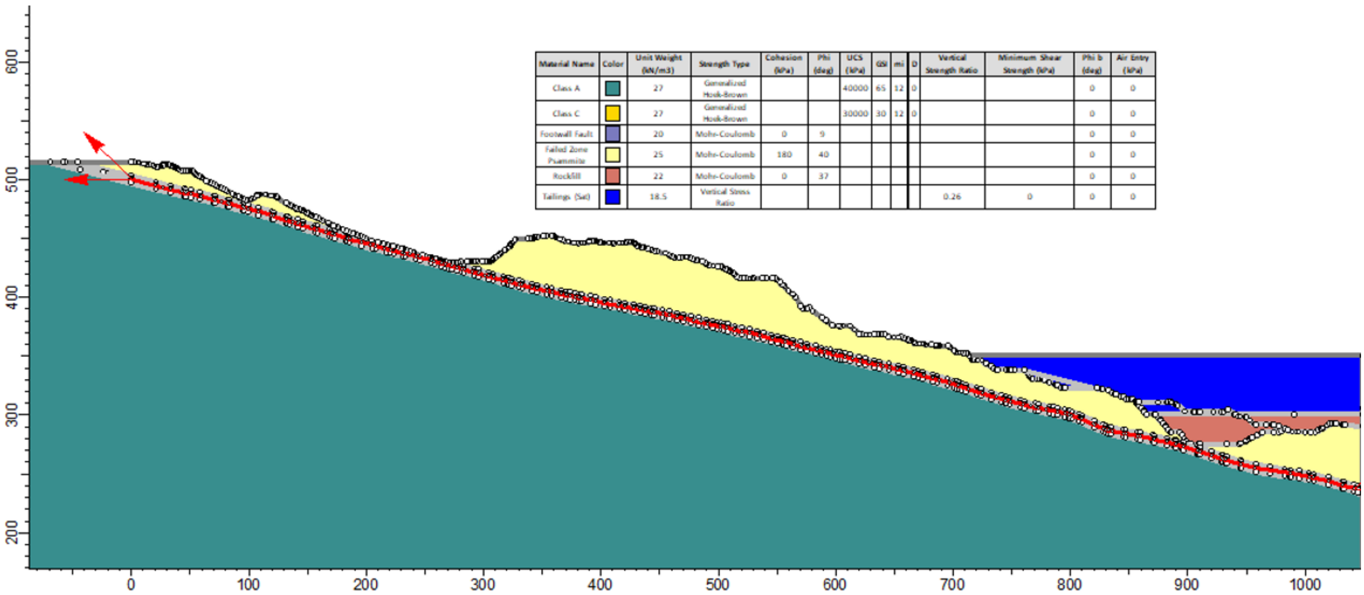
4.2 Section Locations and Geometry

Four sections were selected to represent the most adverse slope geometries and rock mass conditions based on the expected foundation conditions outlined in Section 3. The respective section locations are shown in plan on Figure 1. Inset 5 to Inset 8 presents the modelled geometry for the selected analysis sections.



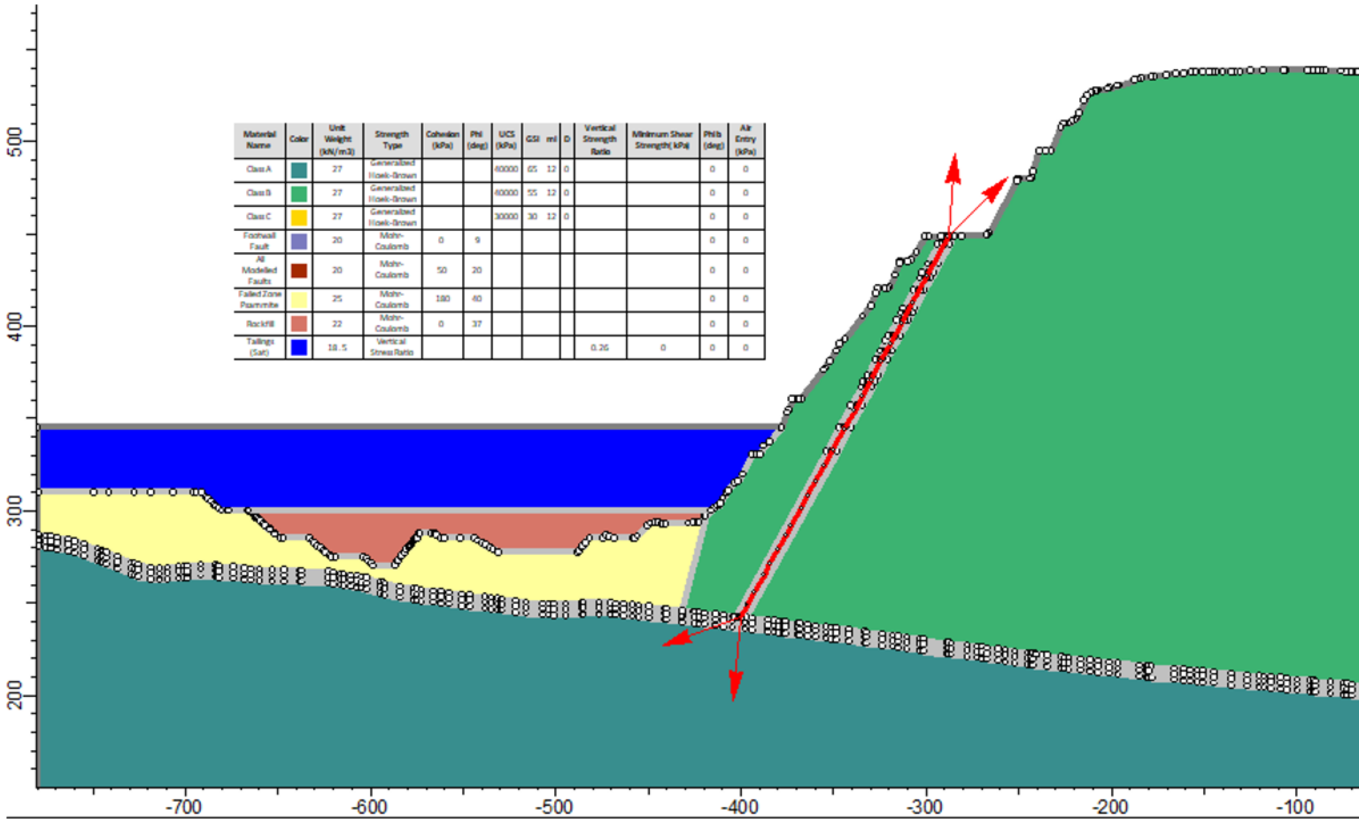
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0			0	0
Class B		27	Generalized Hoek-Brown			40000	55	12	0			0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0			0	0
Footwall Fault		20	Mohr-Coulomb	0	9							0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40							0	0
Rockfill		22	Mohr-Coulomb	0	37							0	0
Tailings (Sat)		18.5	Vertical Stress Ratio							0.26	0	0	0

Inset 5: Section 1 geometry for tailings deposited to 345 mRL.



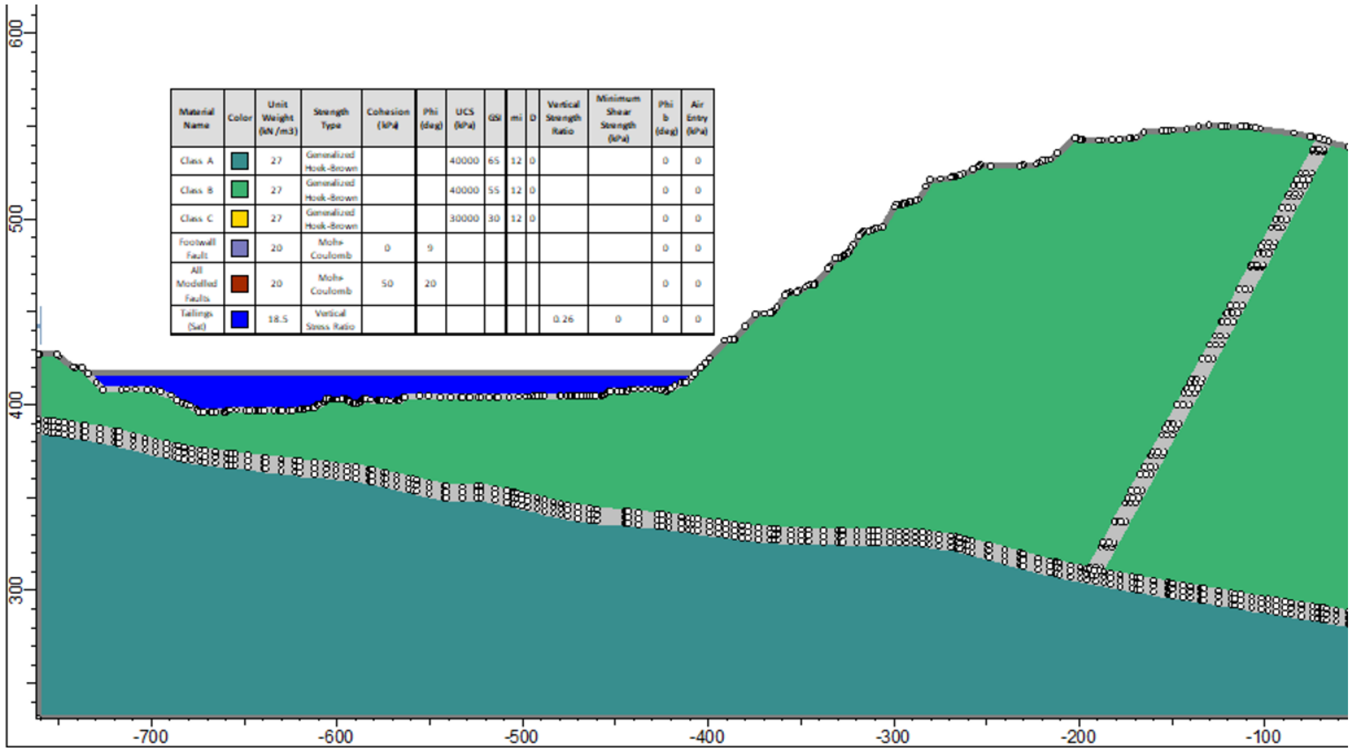
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0			0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0			0	0
Footwall Fault		20	Mohr-Coulomb	0	9							0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40							0	0
Rockfill		22	Mohr-Coulomb	0	37							0	0
Tailings (Sat)		18.5	Vertical Stress Ratio							0.26	0	0	0

Inset 6: Section 2 geometry for tailings deposited to 345 mRL.



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Vertical Strength Ratio	Minimum Shear Strength(kPa)	Phib (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0			0	0
Class B		27	Generalized Hoek-Brown			40000	55	12	0			0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0			0	0
Footwall Fault		20	Mohr-Coulomb	0	9							0	0
All Modelled Faults		20	Mohr-Coulomb	50	20							0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40							0	0
Rockfill		22	Mohr-Coulomb	0	37							0	0
Tailings (Sat)		18.5	Vertical Stress Ratio							0.26	0	0	0

Inset 7: Section 3 geometry for tailings deposited to 345 mRL.



Material Name	Color	Unit Weight (kN /m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0			0	0
Class B		27	Generalized Hoek-Brown			40000	55	12	0			0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0			0	0
Footwall Fault		20	Mohr-Coulomb	0	9							0	0
All Modelled Faults		20	Mohr-Coulomb	50	20							0	0
Tailings (Sat)		18.5	Vertical Stress Ratio							0.26	0	0	0

Inset 8: Section 4 geometry for tailings deposited to 416.5 mRL.

4.3 Material Parameters

Rock mass strength parameters adopted for this analysis are based on extensive review of geotechnical logging, geomechanical lab testing, and experience with similar rock masses at Macraes as discussed in Section 3.

Furthermore, the parameters are calibrated against numerous back-analyses of both footwall (west wall) movements and slope failures from previous studies and demonstrate reliable predictions of rock mass behaviour and movement trends. In addition to the established classification in situ rock classes and discrete geological structures, a specific classification is included for the failed zone psammite[11].

Rock fill and tailings parameters are adopted from the following sources:

- Rockfill properties are based on the information provided on behalf of OceanaGold[(12)]
- Tailings properties are adopted in line with the Golder's 2021 tailings remining prefeasibility study[13].

Table 1 - FTSF Stability Model Parameters

Unit	Unit Weight (kN/m^3)	UCS (MPa)	GSI	mi	Mohr – Coulomb cohesion' (kPa)	Mohr – Coulomb friction angle' (°)	Undrained strength ratio (Su/σ_v')	Permeability (m/s)
Class A	27	40	65	12	NA		NA	1×10^{-5}
Class B	27	40	55	12	NA		NA	1×10^{-5}
Class C	27	30	30	12	NA		NA	5×10^{-7}
Foot Wall Fault	20	NA			0	9	NA	1×10^{-7}
Other Faults	20	NA			50	20	NA	5×10^{-8}
Failed Zone Psammite	25	NA			180	40	NA	1×10^{-4}
Rockfill	22	NA			0	37	NA	1×10^{-3}
Tailings Unsaturated	18.5	NA			0	25	NA	1×10^{-7}
Tailings Saturated	18.5	NA			NA		0.26	1×10^{-7}

4.4 Groundwater

The following groundwater assumptions are included in the stability assessment:

- The adopted groundwater table for in-situ rock units is based on a far field water table at RL 510 m[14]
- Due to stress relief and unloading (relaxation) the rock mass has a zone of increased secondary permeability proximal to the pit face
- Ongoing site observations and available monitoring data indicate groundwater is present at mid-slope elevations with gradual drawdown to the pit floor due to open pit operations
- Previous slope experience has shown groundwater seeping from the face following periods of heavy rainfall.

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[11] PSM71-242M "3D Stability assessment of Frasers Slip Pits Design" dated 12 November 2019

[12] Email from EGL to PSM "Re: Design Parameters for Initial Assessment" dated 7 April 2022.

[13] Golder Associates "Tailings Re-mining Pre-feasibility Study for the RHOP Project, 20144962-013 Rev0" dated 15 February 2021.

[14] PSM. PSM71-242M – 3D Stability Assessment of Frasers Slip Pits Design. 25 November 2019.

4.4.1 Climate Change and Extreme Rain Events

The potential for extreme rain events due to climate change has been considered through the adverse groundwater assumed (e.g. high far field water table and neglecting beneficial seepage boundary at the bottom of the pit when wet tailings deposition starts). It is understood a specific assessment regarding magnitude and frequency of extreme rainfall events is being carried out by others as part of the consenting application process. Based on the current assessment the inclusion of a specific rainfall transient analysis is not deemed to be necessary.

4.5 Seismic Stability

A site-specific seismic hazard analysis was completed for Macraes Mine in 2021 by Bradley Seismic Ltd[15] which referenced the Vs30 measured at Macraes by Southern Geophysical Ltd in 2021[16]. GNS subsequently released an update to the National Seismic Hazard Model (NSHM) during 2022. For completeness, the interim NSHM values are adopted for this assessment in lieu of updated site-specific values being confirmed by Bradleys Seismic Ltd.

Table 2 summarises the seismic design loading scenarios. These values represent the horizontal seismic coefficient (K_h =0.5 PGA) based on the maximum component Peak Ground Acceleration (PGA) spectra values for Vs30 = 1500m/s.

Table 2 - Earthquake Loading Scenarios

Project Stage	Design Life	Annual Exceedance Probability (AEP)	Equivalence	Interim NSHM 2022 Max Component Vs 1500 m/s	Horizontal Seismic Coefficient (k_{han})
Operational	< 5 years	1:150	Operating Basis Earthquake (OBE)	0.077g	0.0385
Closure	~ 1000 years	1:10,000	Safety Evaluation Earthquake (SEE)	0.68g	0.34

4.6 Design Cases

Design cases included in the numerical analyses to replicate the proposed project stages are summarised in Table 3.

Table 3 - Summary of 2D LE Stability Analysis Scenarios

Project Stage	Analysis Scenario	Geometry	Load Case
Operational	Mining Completion	Final open pit geometry	Static
	FTSF Construction	FTSF embankment crest at 360 mRL	Static
	FTSF Filling	Tailings deposition modelled at 20m vertical increments	Static
			Seismic – Pseudo Static Analysis (OBE)
Closure	Final Landform	FTSF level at 416.5 mRL, pit lake at 489 mRL	Static
			Seismic – Pseudo Static Analysis (SEE)

[15] Bradley Seismic Limited. Probabilistic Seismic Hazard Analysis for Macraes, New Zealand. 23 May 2021.

[16] Southern Geophysical Ltd, Geophysical Site Investigations: Downhole Shear-wave Velocity Tests, Macraes Gold Operation, January 2021

4.6.1 Modelling Assumptions

This section presents a summary of assumptions carried forward for the stability analyses of FTSF.

- Geological structures (faults / shears) in this analysis are modelled with a 0.5 m fault core (FF and "Other Faults") plus a 6 m damage zone (using Class C properties), Table 1.
- Within the footwall slope the damage zone above the FF was removed based on the assumption that the upper damage zone was already sheared off due to the 2014 west wall failure.
- Constant far field total head of 510 mRL was assigned in all steady state models.
- A zero-pressure boundary condition is applied at the surface of the wet tailings to represent water table at the top of the tailings as deposition rises.
- Polyline searches for block sliding were applied in zones of structurally controlled sliding, including discrete shears within the hanging wall (i.e. Section 3) and remobilisation of the failed psammite on the footwall slopes (i.e. Section 1 and 2).
- Non-circular slip surfaces were used for stability Factor of Safety (FoS) calculation in pit walls where no major defects were modelled (i.e. Section 4 and several high tailings elevation cases for Section 3 where no block sliding failure occurred).

4.7 Results

This section presents the two-dimensional (2D) Limit Equilibrium (LE) slope stability analyses results that were used to assess the following failure mechanisms:

- Rock mass failure
- Planar sliding along a possible adverse fault in FROP highwall with rock mass toe breakout
- Planar sliding along the FF on the western side of FROP.

Individual FoS outputs are presented for static and pseudo-static analysis in Table 4 and Table 5 with graphical outputs included in Appendix A.

Table 4 - Summary of Static Stability Results during FTSF Construction and Final Closure Pit Lake

Tailings Elevation (mRL)	Factor of Safety			
	West Wall		East Wall	
	Section 1	Section 2	Section 3	Section 4
Current (No tailings)	0.55	0.70	1.58	3.46
345	0.80	1.11	1.68	-
416.5	1.26	2.05	2.33 [2]	3.29
Tailings = 416.5 Pit lake = 489	1.12	2.68	3.12	3.41

1 Highlighted cells indicate scenarios with resultant FoS < 1.

2 No block failure occurred through fault, FoS results shown are based on non-circular failure path searches.

Table 5 - Summary of Seismic Stability Results for FTSF Construction Geometry

Seismic Loading	FTSF Geometry	Factor of Safety			
		West Wall		East Wall	
		Section 1	Section 2	Section 3	Section 4
Operational (0.0385g)	Tailings 345 mRL	0.68	0.97	1.63 [2]	-
	Tailings 416.5 mRL	1.08	1.58	1.42	3.17
Closure (0.34g)	Tailings = 416.5 mRL Pit lake = 489 mRL	0.51	1.08	2.82 [2]	2.04 [2]

1 Highlighted cells indicate scenarios with resultant FoS < 1.

2 FoS results shown are based on non-circular failure path searches.

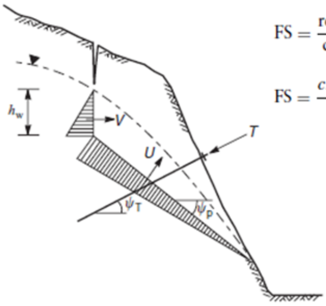
3 Tailings to 416.5 mRL, pit lake to 489 mRL. Analysis completed on updated tailings depth.

Results of the stability analysis undertaken for the existing FROP walls during both construction and closure of the FTSF is discussed below:

- Generally, the most adverse stability condition under static scenarios occurs prior to FTSF backfilling. The FoS gradually increases as tailings' rise where additional buttress support is provided to the pit walls
- The west wall remains in a marginally stable condition (consistent with the observed long-term creep) until tailings backfill reaches approximately 400 mRL and offers sufficient buttressing to support the mass
- Under OBE seismic loading conditions, the assessed west wall stability falls below unity, FoS= 0.7. It is noted that:
  - The west wall planar sliding mechanism is partially buttressed by the FTSF embankment immediately to the north of Section 1 (analysed in this assessment), refer to Figure 1
  - Three-dimensional effects from the backfill are likely to provide additional confinement and buttressing against sliding along the FF. The analyses presented herein are considered to represent a lower bound estimate of west wall stability
- The modelled east wall scenarios indicate that stability within the rock mass has a FoS > 1.5 for both static and OBE seismic loadings
- The SEE seismic loading scenario analysed using closure geometries indicated a FoS < 1 for Section 1.

4.7.1 Effects of In-pit Tailings Backfill

Due to the relatively slow backfill rates, groundwater pressures within the pit walls have the potential to rise slightly in advance of the rising pond level. This increase in pore water pressure effectively reduces the strength of the rock mass while also adding to the weight which drives movement of the slopes, as illustrated in the equations below [17].



$$FS = \frac{\text{resisting forces}}{\text{driving forces}}$$

$$FS = \frac{cA + (W\cos\psi_P - U - V\sin\psi_P + T\sin(\psi_T + \psi_P))\tan\phi}{W\sin\psi_P + V\cos\psi_P - T\cos(\psi_T + \psi_P)}$$

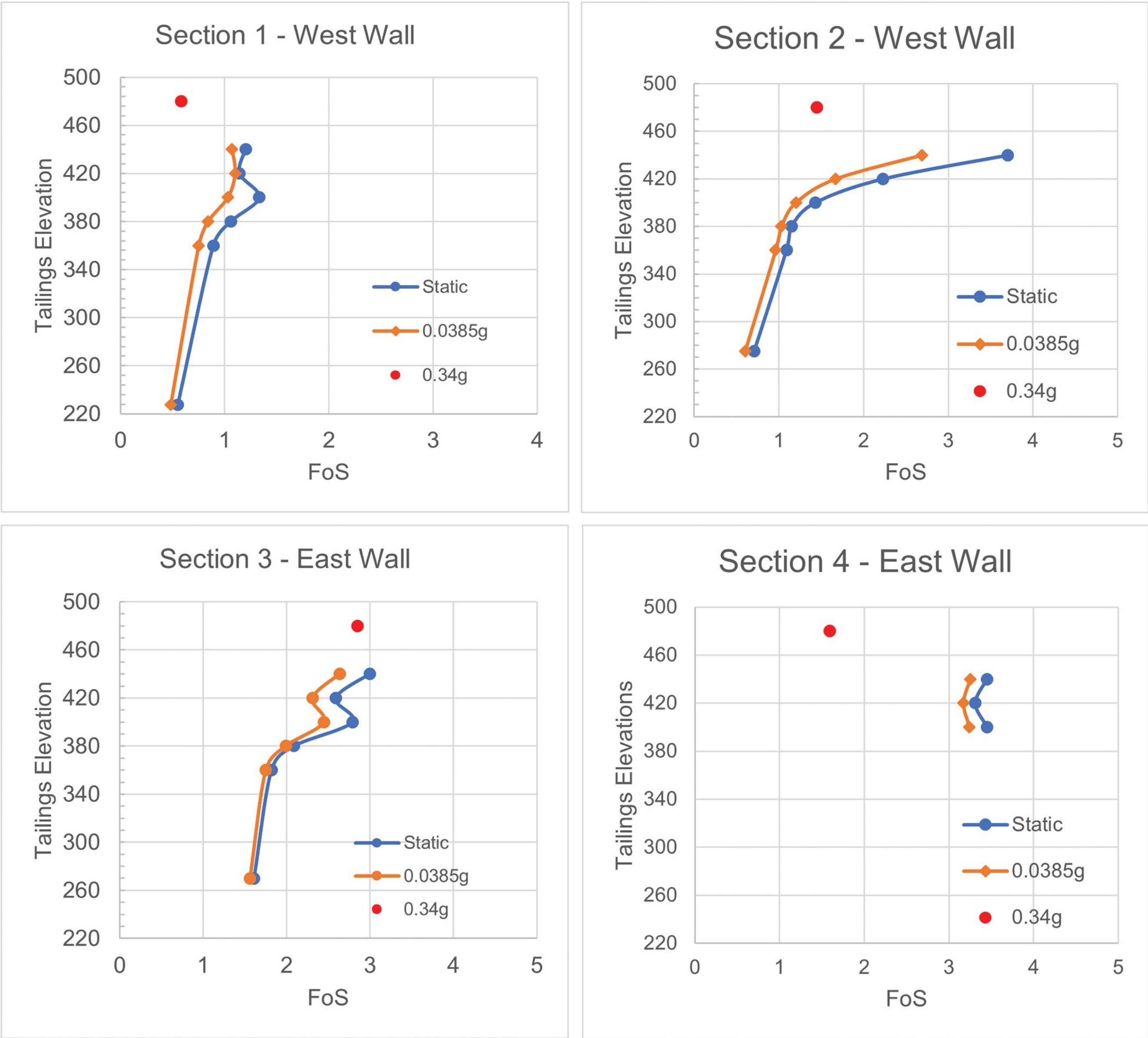
where pore water pressure, U and V, are

$$V = \frac{1}{2}\gamma_w h_w^2 \quad \text{and} \quad U = \frac{1}{2}\gamma_w h_w A$$

In contrast, the tailings act as a tow buttress. Following the initial FoS decrease, the slope equilibrium is reversed ultimately leading to a more stable slope. The following is noted:

- The resultant FoS values account for both the elevated groundwater pressures and an increase in buttressing from tailings is depicted in Inset 9
- The analyses suggest the balance is generally in favour of increasing stability. The lowest FoS of the four sections (Table 4) occurs at the current condition prior to tailings deposition
- The modelled stability of the west wall at the current condition (FoS <1) is consistent with the long-term west wall creep experienced within Frasers.

[17] Modified from Wyllie & Mah *Rock slope engineering*, 4th edition Spon Press



Inset 9: Stability results illustrating the modelled FoS response to changes in tailings level during backfill.

4.8 Discussion

The following section summarises potential failure modes and hazards associated with pit slope instability entering the FTSF during the respective project stages. These are based on documented slope performance and stability analysis completed as part of this assessment.

4.8.1 Operational/ FTSF Construction

- Remobilisation of the west wall failed psammite rock mass is be expected to be a relatively slow, ductile deformation due to increasing pore pressures:
  - Based on the modelled thickness of failed psammite above the FF (and assuming no further mining occurs prior to closure) an estimated volume of approximately 3,500,000 m^3 remains on the slope. This mass could potentially creep downslope until sufficient tailing are in place providing additional buttress support. As modelled this level is expected to be around 380 mRL
  - Any instability would be expected to displace tailings and temporarily increase the rate of rise
  - The greatest potential impact on FTSF levels would occur as the result of a sub aerial slide[18] to occur when backfill levels are below 380 mRL where the ratio of slide material to tailings backfill volume is the greatest, Inset 10 and Inset 11
- While not predicted to occur during FTSF filling, established highwall failure mechanisms are predominantly associated with structurally controlled kinematic block slides. These mechanisms typically progress slowly with increased rockfall around the boundary fringes prior to initiating large-scale displacements
  - Should an unravelling planar/block sliding failure be initiated there is potential to generate impulse (seiche) waves as material enters the FTSF impoundment, Inset 10. The subsequent impact is likely to be insignificant and have no external consequences due to the proposed FTSF geometry.

OceanaGold have demonstrated performance in managing complex open pit slope instabilities. Established management controls that may be applied during the operational mining include:

- Rigorous slope monitoring procedures using both radar and GPS to capture real time slope movements during mining
- A documented history of geotechnical model development, stability analysis and external advice throughout all stages of mining
- Development, review and implementation of TARP's with regular risk assessments.

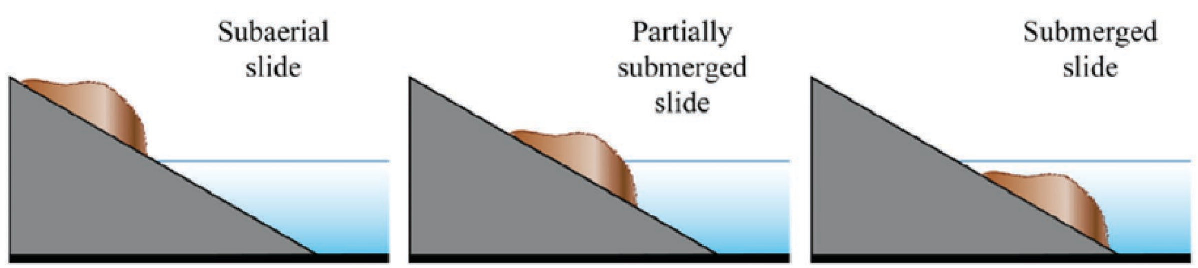


Figure 1-1 Three initial positions of slides before impulse wave generation.

Inset 10: Impulse wave generation relative to slide initiation locations (Source Evers et al, 2019).

4.8.2 Closure

Highwall movement is anticipated under SEE seismic loading, with potential for a global failure scarp to extend approximately 70 m behind the design pit crest. The anticipated consequences of a seismically induced, post closure, slope instability within the FTSF is considered negligible because:

- The volume of material susceptible to subaerial sliding in the final landform is minimum. This is directly applicable to the displacement risk for a mass entering the FTSF impoundment
- Submerged material is buttressed by tailings and is therefore not expected to experience large displacements
- West wall instabilities are constrained by the outcropping FF near the pit crest
- The potential for a rapid failure of the pit walls is considered unlikely
- The FROP crest has a topographic low of approximately 505mRL located along the eastern flank creating an offset (greater than 15 m vertically) between the final impoundment level and the adjacent landform. This negates the risk of potential external loss of FTSF contents.

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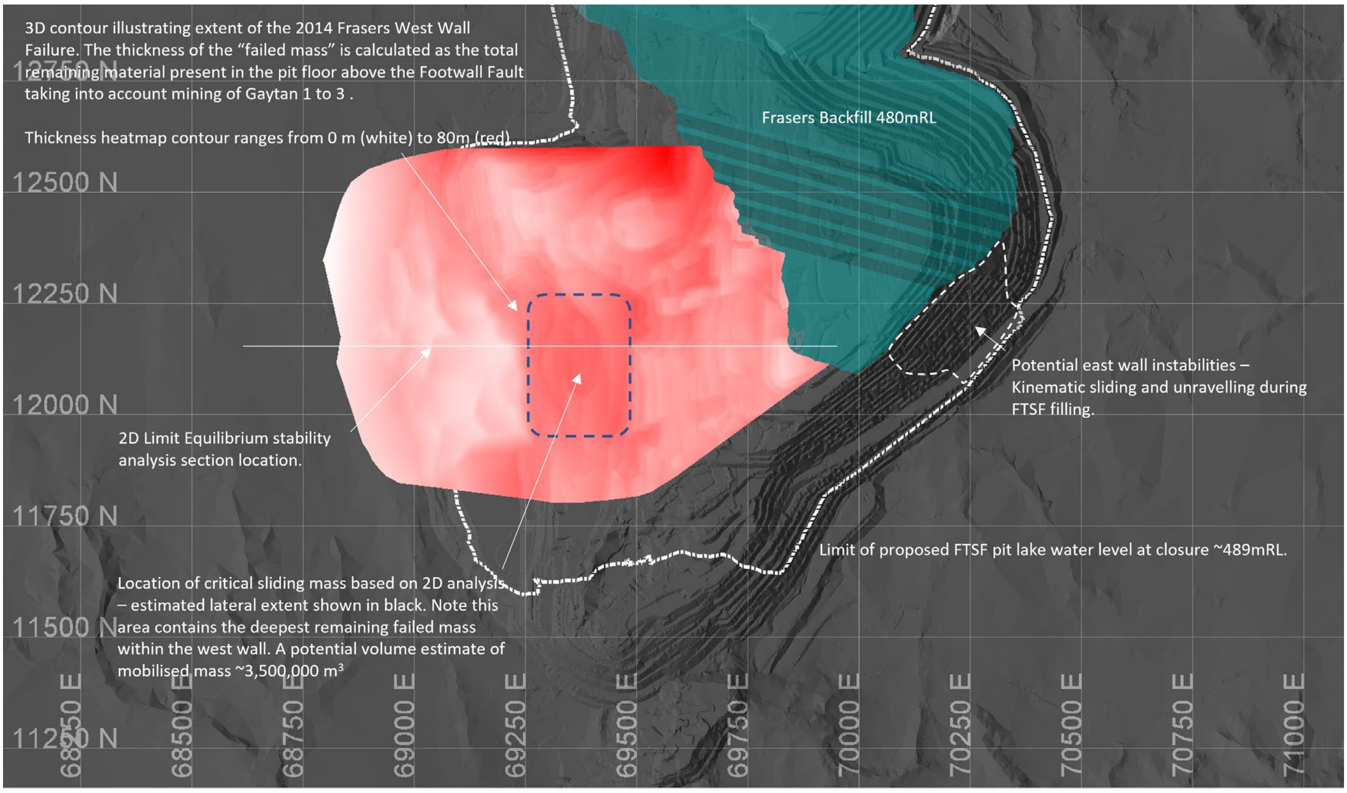
[18] Evers et al (2019) Landslide-generated Impulse Waves in Reservoirs. ETH Zurich



Inset 11: Summary of potential failure mechanisms with increased susceptibility during FTSF filling.

5. Conclusions

The following points list our concluding comments:

- The lowest indicated static FoS = 0.55 occurs on the west wall at the completion of mining. This is consistent with mining-induced creep movements that are actively managed during mining of the Gay Tan pits at the toe of FROP west wall:
  - The stability of the west wall of FROP is likely to be better than indicated in these analyses due to three dimensional effects. Three dimensional effects associated with the FTSF embankment immediately north of the analysed stability section are not incorporated in the two-dimensional limit equilibrium analyses presented here
  - The maximum extent of backbreak on the western side of the pit is well-constrained by the geometry of the footwall fault sliding surface
- Pit slope stability of FROP improves as the TSF backfill approaches final construction height of 416.5 mRL
- Under static conditions the indicated FoS are in excess of 1.5 for typical highwall conditions
- The potential for a rapid failure of the pit walls is considered unlikely
- Slope movements are anticipated under the 1:10,000 annual exceedance probability SEE (very-low probability strong ground shaking) loading condition for closure. There is potential for a failure scarp to extend behind the design pit crest. It should be noted that there are likely to be many natural slopes in the surrounding area that will also deform at this level of shaking
- The FROP crest has a topographic low of approximately 505mRL located along the eastern flank creating a significant offset (greater than 15 m vertically) between the pit lake level and the adjacent landform. This negates the risk of potential external loss of FTSF contents
- Some ongoing deformation (tension cracking, slumping, ground loss) could occur behind the pit crest post-closure. PSM recommends defining a strip of land/zone of influence around the crest of the combined pits to isolate the potentially hazardous ground associated with ground movement and falling from height. PSM understands a ring fence around the pit was included in the consent for MP3. Based on a FoS of 1.5, an exclusion zone at approximately 150 m from the pit crest is recommended. Further geotechnical assessment is recommended to better define the exclusion zone.

Yours sincerely

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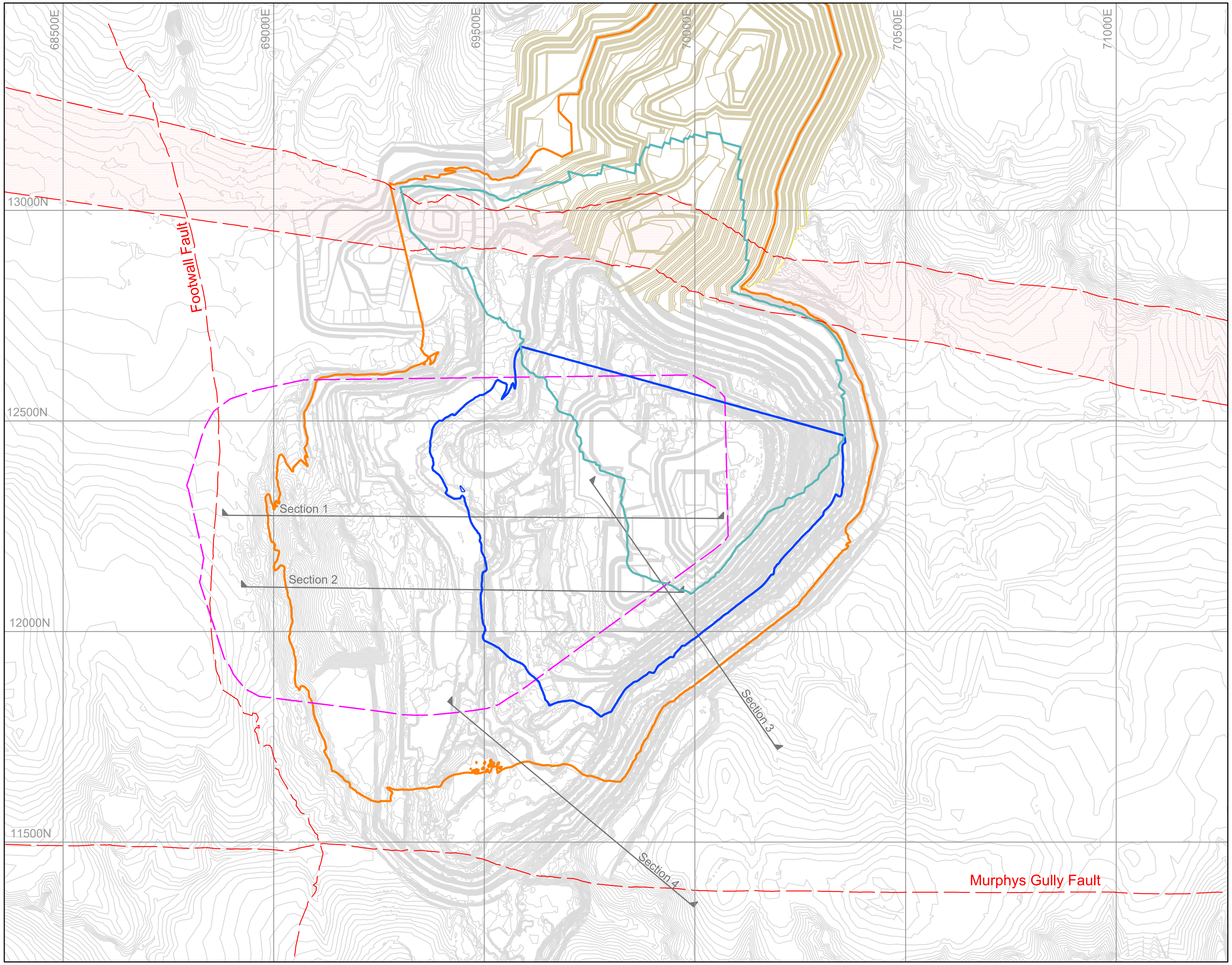
Figures



LEGEND

- Frasers Open Pit - 2m Contours
- Proposed Innes Mills Stage 8 Pit Shell
- Approximate Extents of 2014 Westwall Slope Instability
- Proposed Final Waste Rock Embankment, Crest - 480 mRL
- Proposed Final Tailings Level - 416.5 mRL
- Proposed Final Lake Level - 489 mRL
- Modelled Fault Intersections
- Macraes Fault Zone
- Section Section Locations - Stability Analysis

0 100 200 300 400 500

Scale (m)

OceanaGold
Macraes Phase 4 Consenting Application
Macraes Flat, East Otago

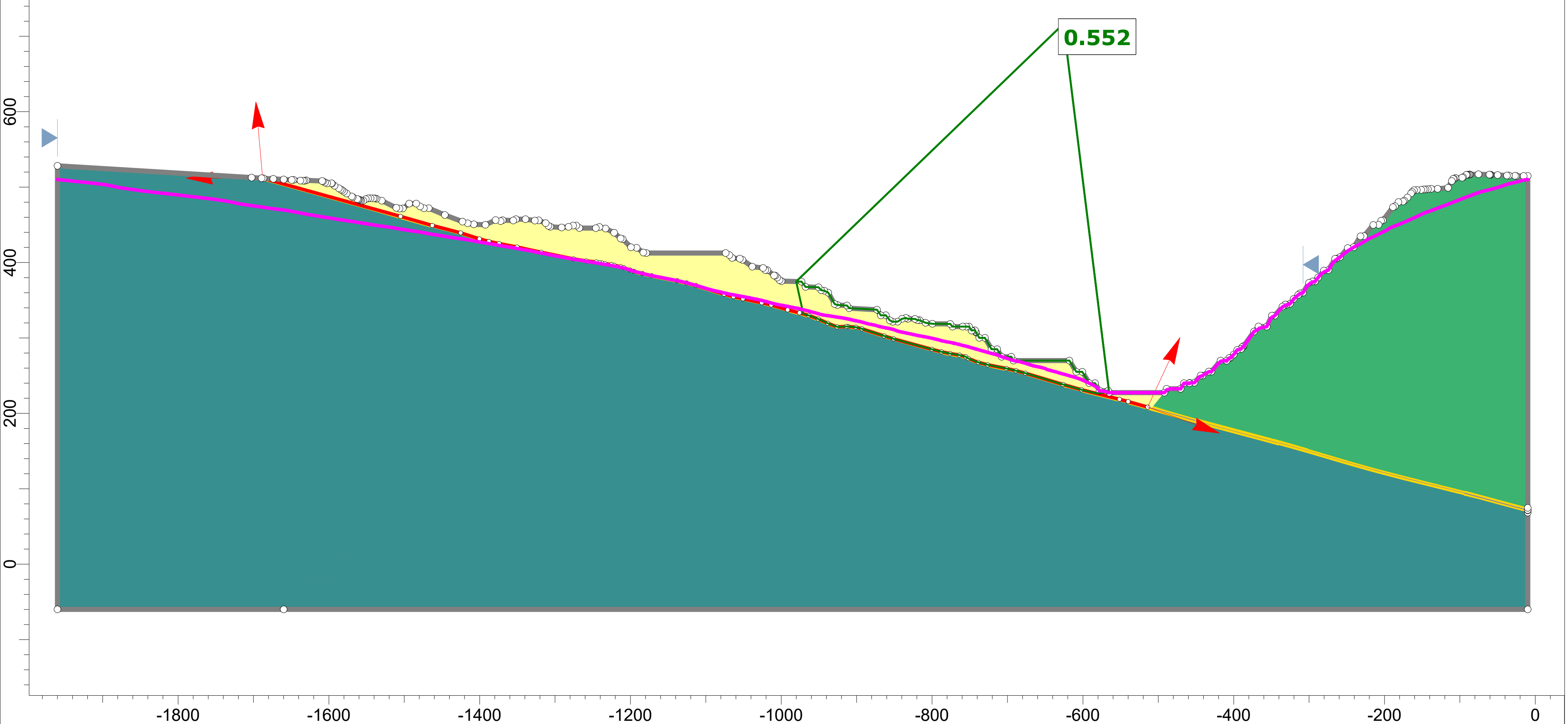
FRASERS TSF - PIT PLAN
FOUNDATION CONDITIONS

PSM071-285R Rev 1 | Figure 1

Appendix A
2D Stability Analysis

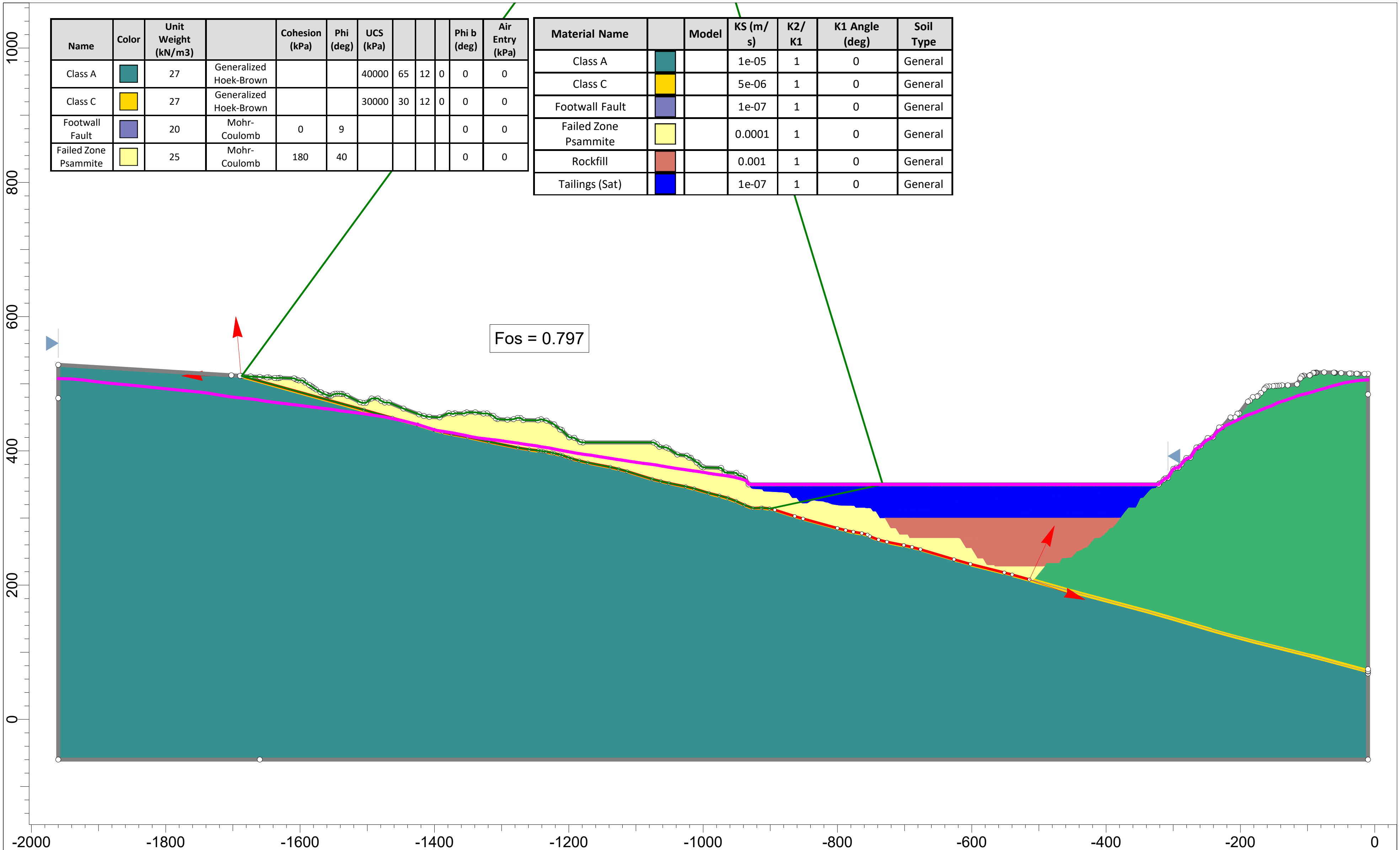
Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



SLIDEINTERPRET 9.027	Client:	OceanaGold
	Project:	PSM71-285R - TSF
	Location:	Frasers Pit - West Wall
	Analysis description:	Section 1 - As-built Static

Job No:	By: KH	Date: 7/11/2023	Scale: 1:8000	Run ID: Static



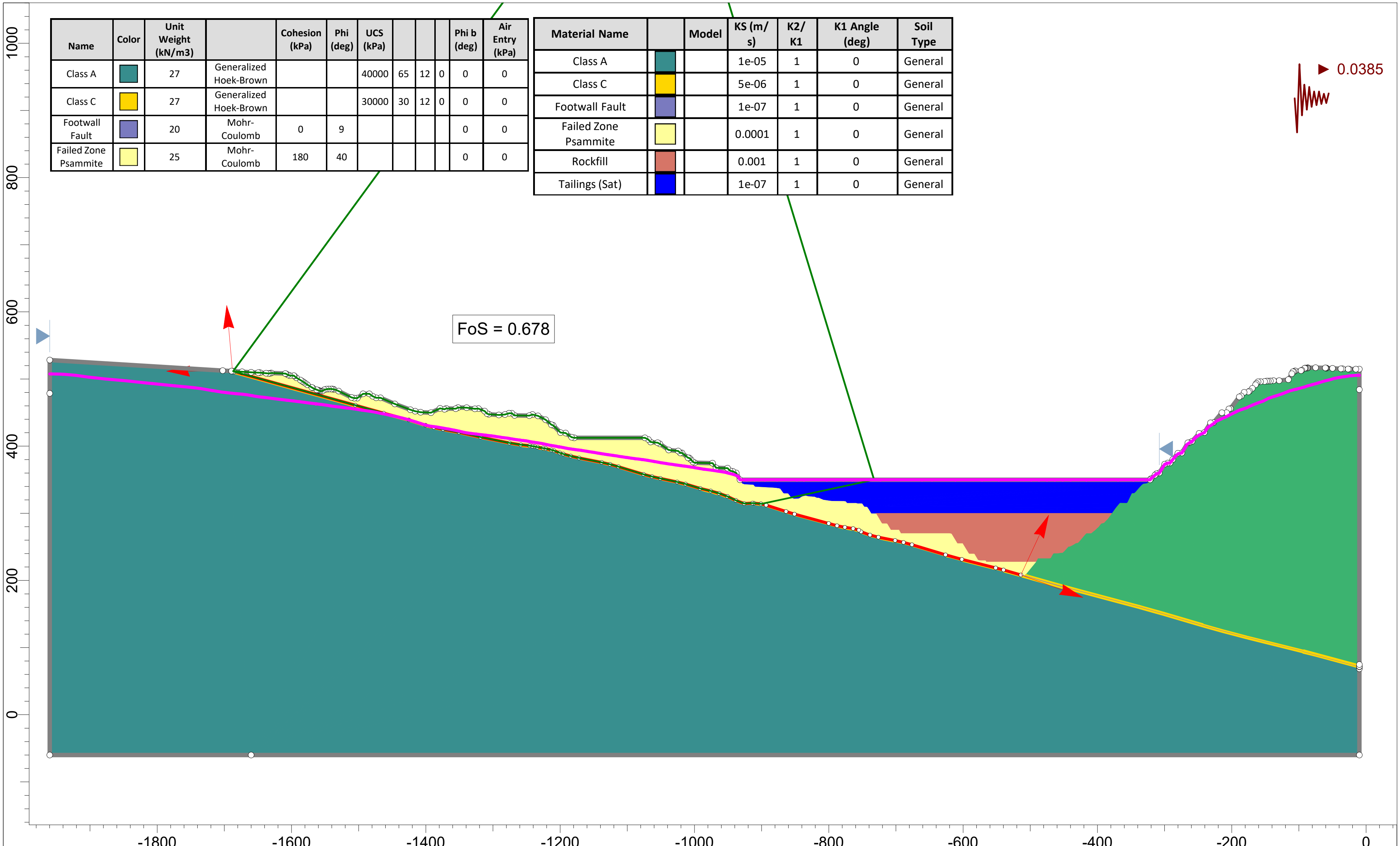
Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - West Wall
Analysis description:	Section 1 - Tailings 345 mRL

Job No:	By: KH	Date: 7/11/2023	Scale: 1:8000	Run ID: Static

SLIDEINTERPRET 9.027



Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

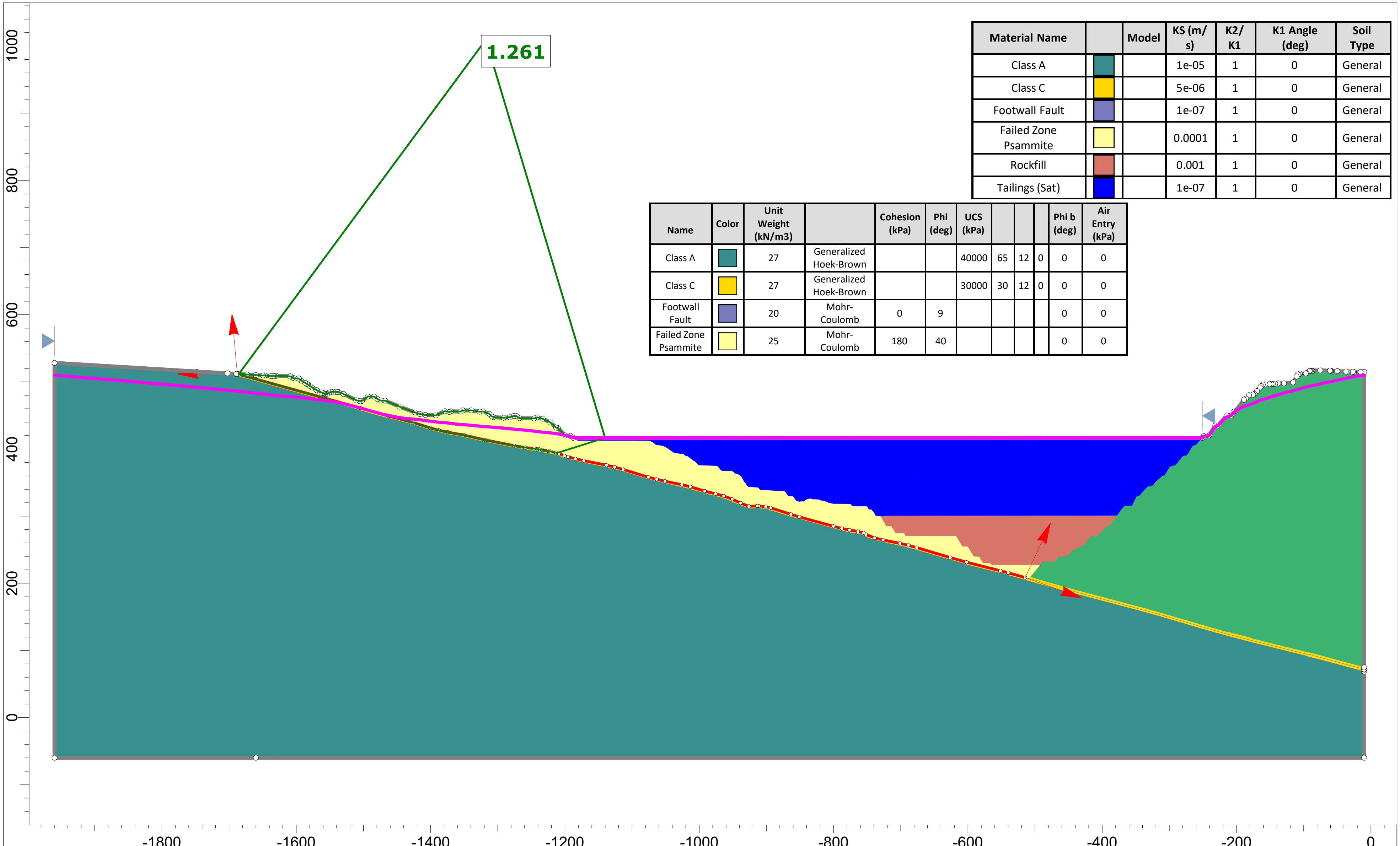
Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

PSM

SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - West Wall
Analysis description:	Section 1 - Tailings 345 mRL

Job No:	By: KH	Date: 7/11/2023	Scale: 1:8000	Run ID: OBE Seismic 0.0385



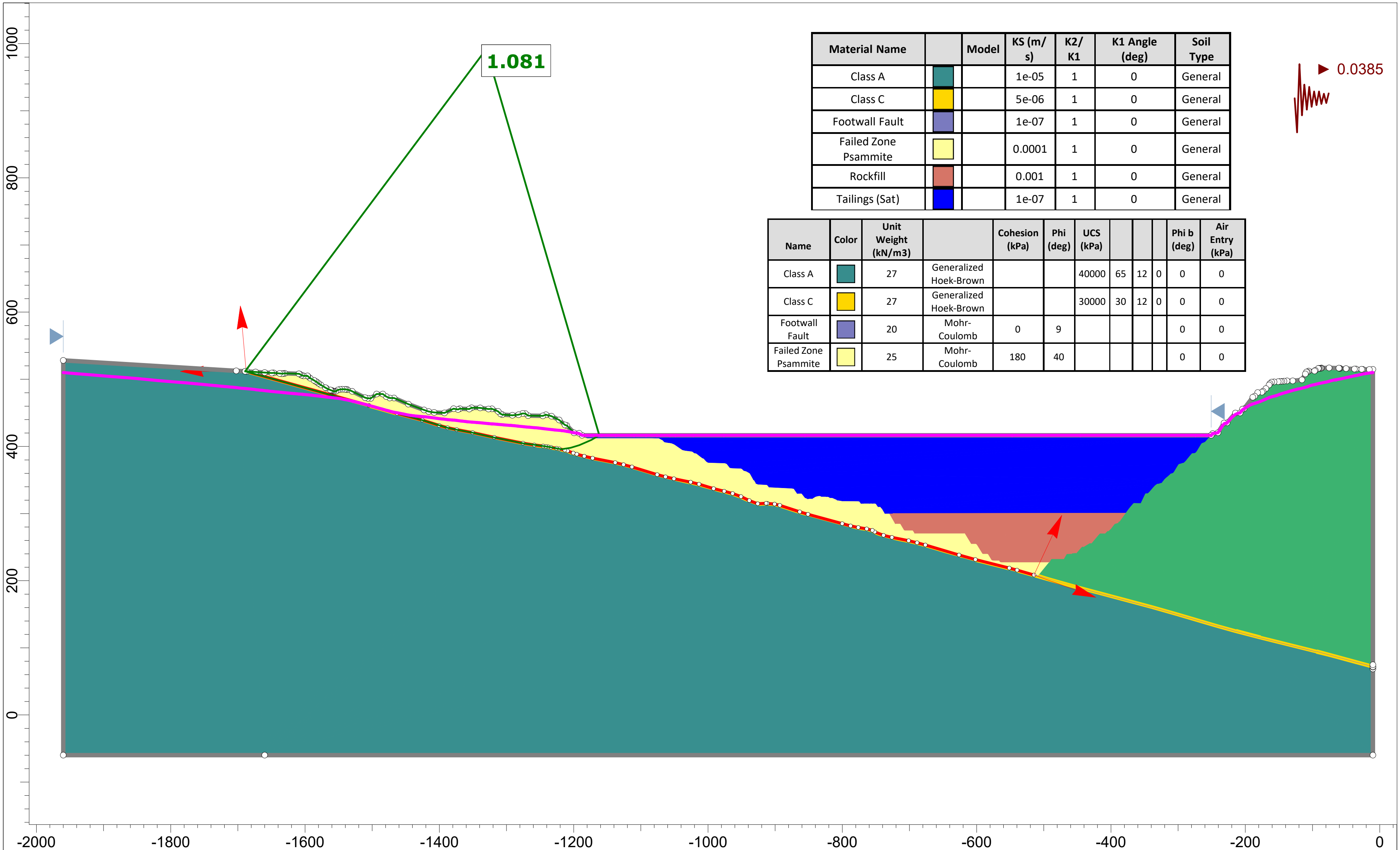
Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Client:	**OceanaGold**
Project:	**PSM71-285R - TSF**
Location:	**Frasers Pit - West Wall**
Analysis description:	**Section 1 - Tailings 416.5mRL**

Job No:	By: **KH**	Date: **7/11/2023**	Scale: **1:8000**	Run ID: **Static**

SLIDEINTERPRET 9.027



Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

PSM

SLIDEINTERPRET 9.027

Client: **OceanaGold**

Project: **PSM71-285R - TSF**

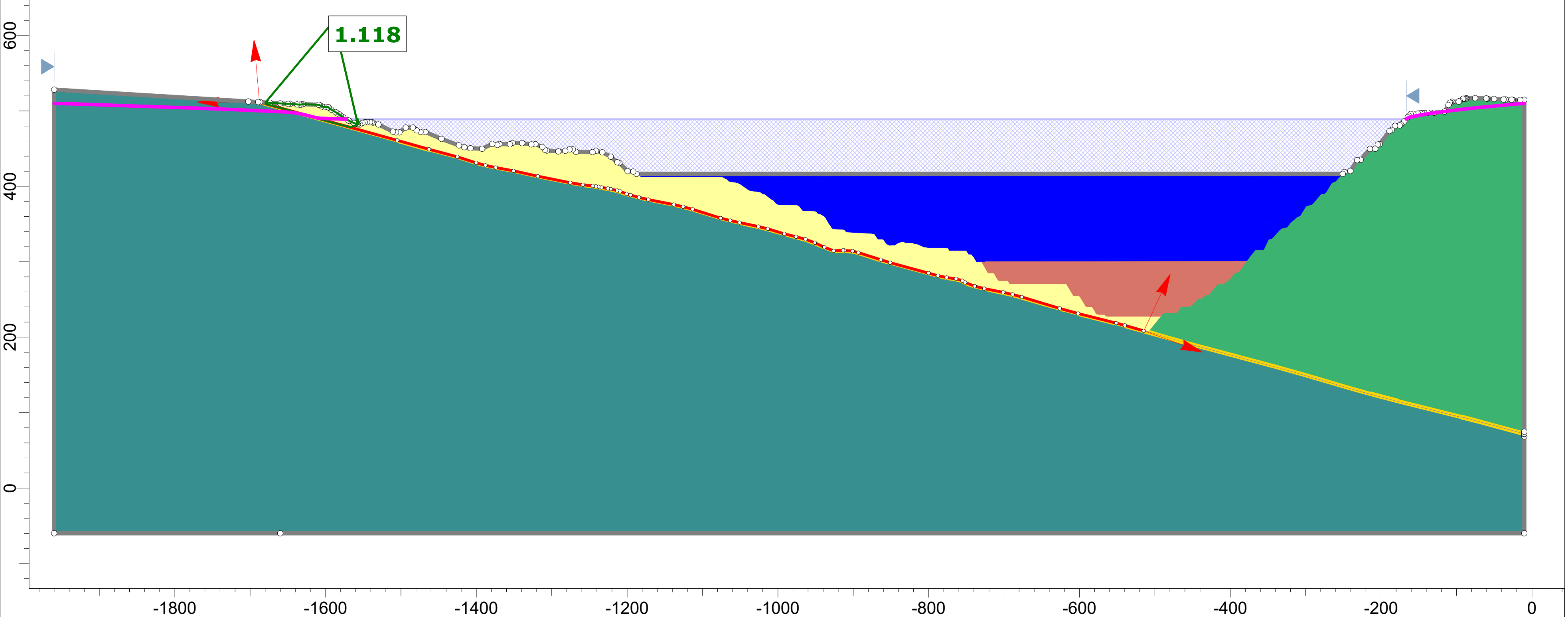
Location: **Frasers Pit - West Wall**

Analysis description: **Section 1 - Tailings 416.5mRL - OBE**

Job No:	By: KH	Date: 7/11/2023	Scale: 1:8000	Run ID: OBE Seismic 0.0385

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



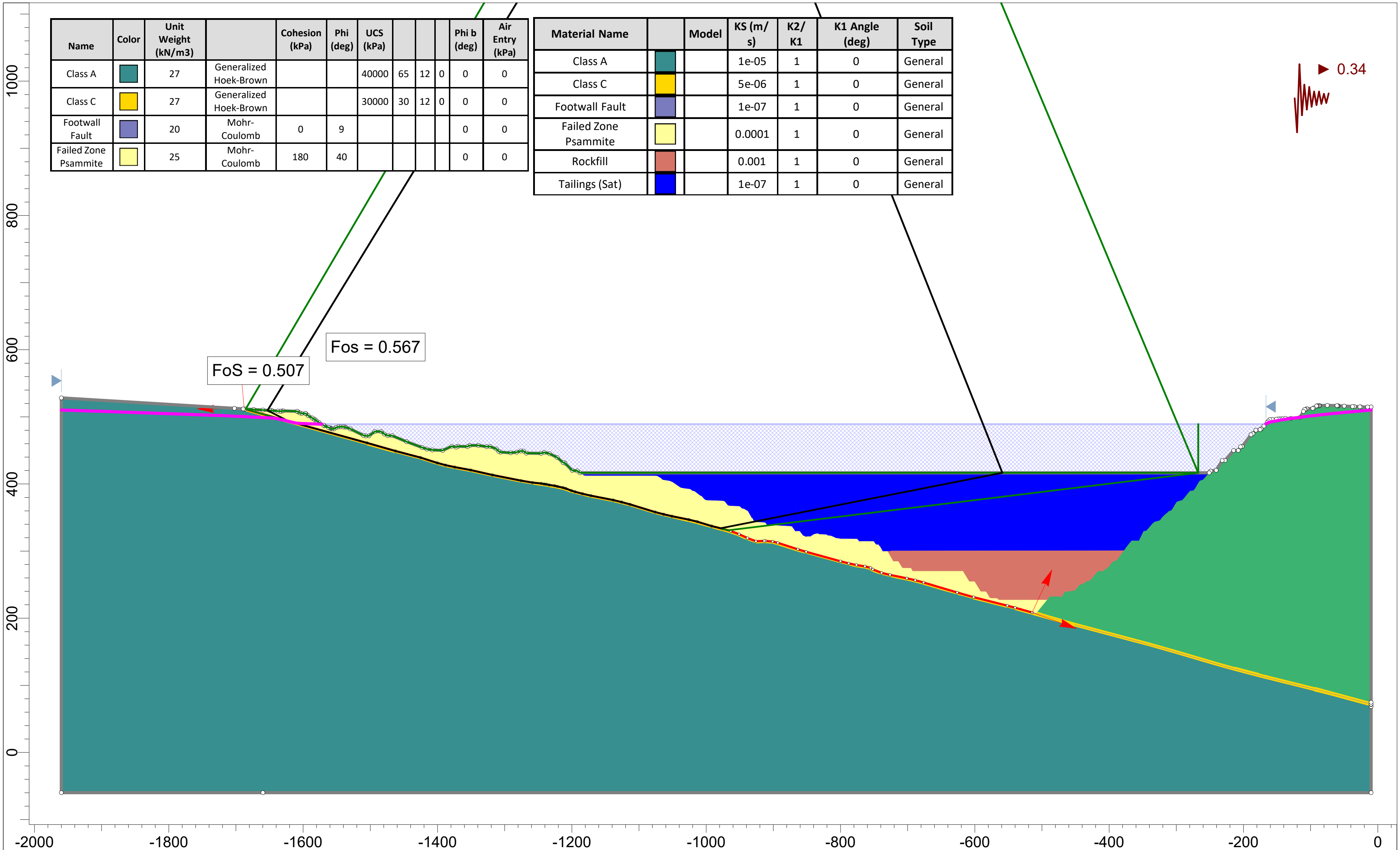
SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - West Wall
Analysis description:	Section 1 - Tailings to 416.5mRL, Pond to 489 mRL

Job No:	By: KH	Date: 7/11/2023	Scale: 1:8000	Run ID: Static

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



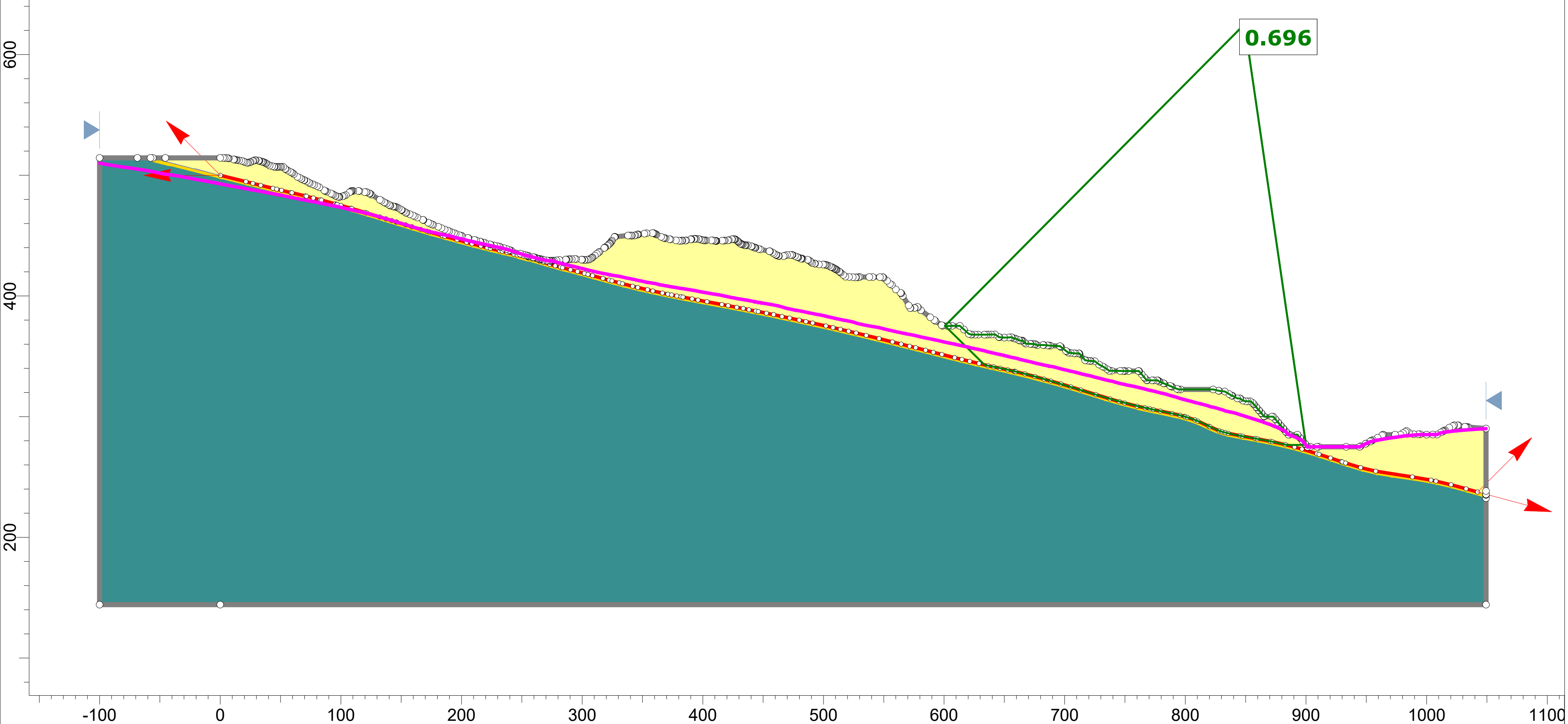
PSM

Client:	OceanaGold						
Project:	PSM71-285R - TSF						
Location:	Frasers Pit - West Wall						
Analysis description:	Section 1 - Tailings to 416.5mRL, Pond to 489 mRL - SEE						
Job No:		By: KH	Date: 7/11/2023	Scale: 1:8000	Run ID: SEE Seismic 0.34		

SLIDEINTERPRET 9.027

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



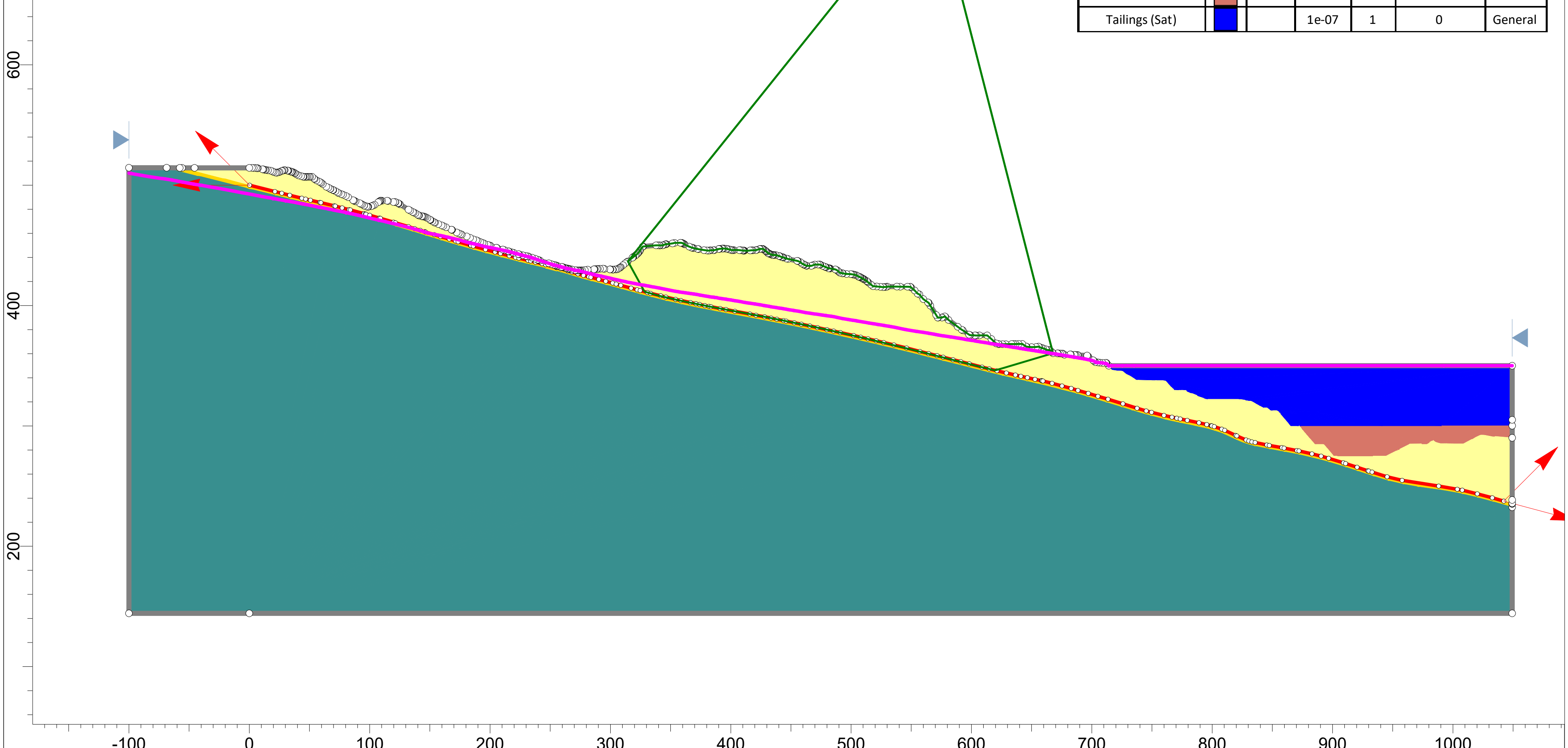
SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - West Wall
Analysis description:	Section 2 - As-built Static

Job No:	By: KH	Date: 8/11/2023	Scale: 1:5000	Run ID: Static

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

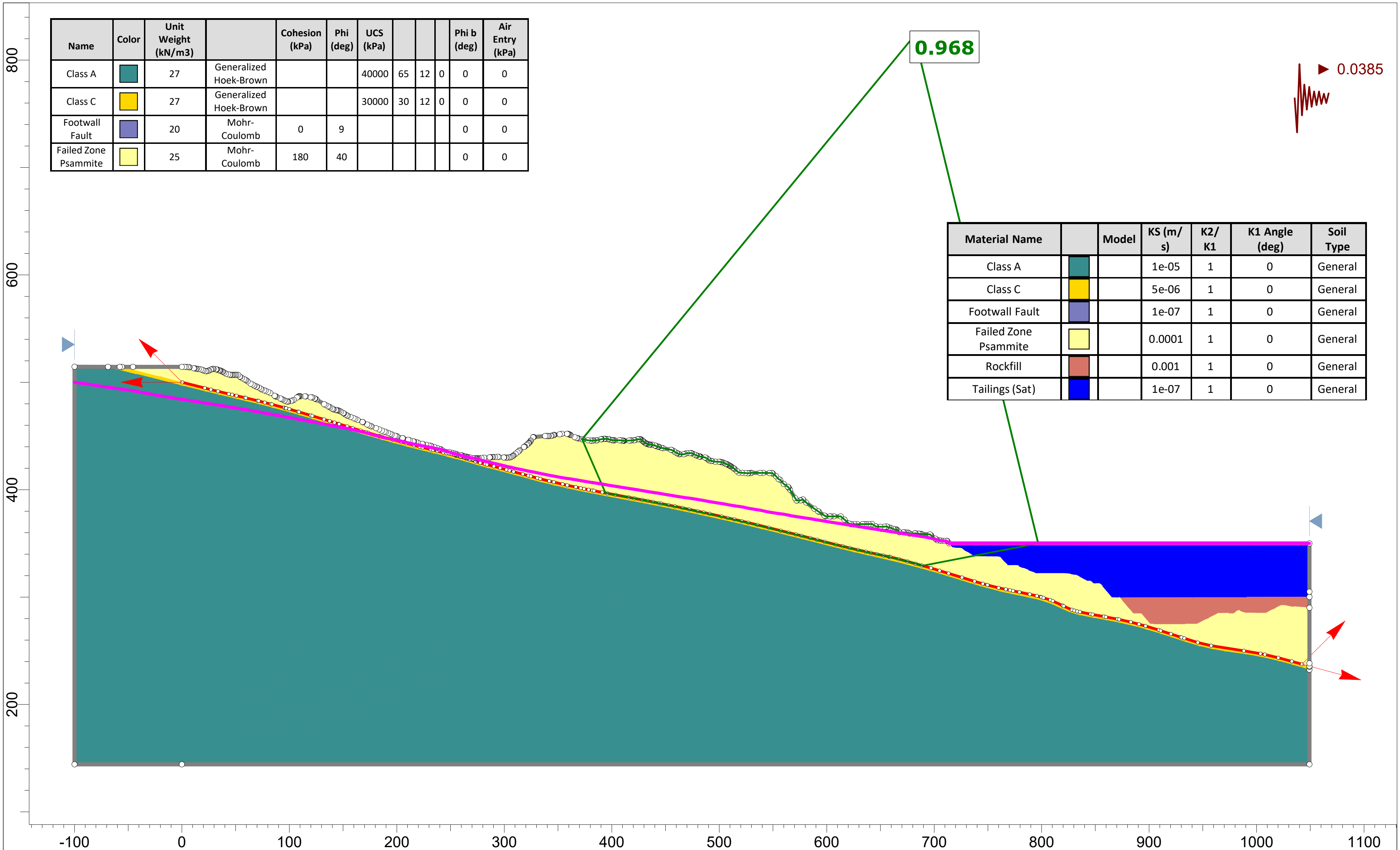
Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - West Wall
Analysis description:	Section 2 - Tailings 345 mRL

Job No:	By: KH	Date: 8/11/2023	Scale: 1:5000	Run ID: Static



Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

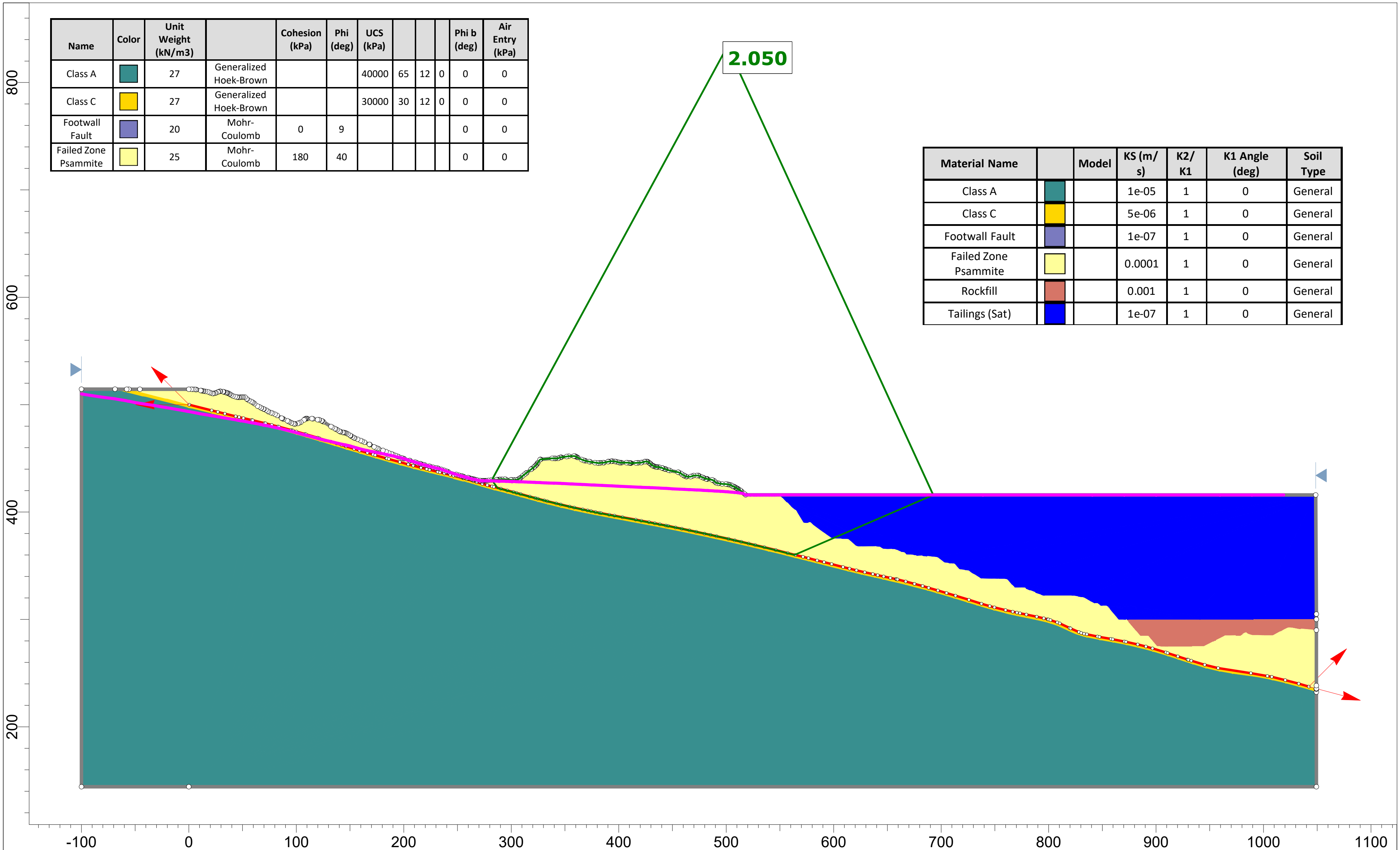
SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - West Wall
Analysis description:	Section 2 - Tailings 345 mRL

Job No:	By: KH	Date: 8/11/2023	Scale: 1:5000	Run ID: Seismic 0.0385

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

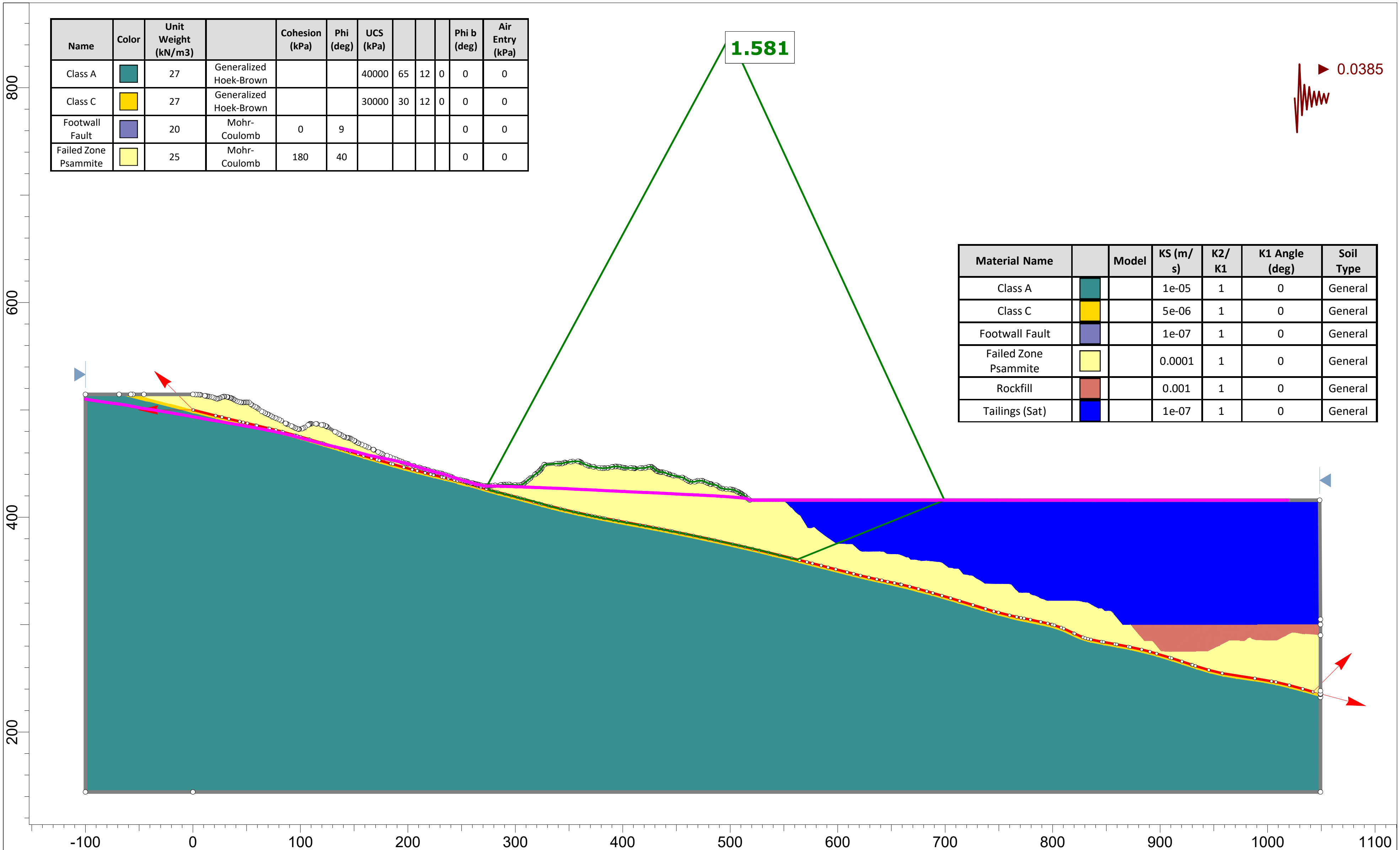
Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - West Wall
Analysis description:	Section 2 - Tailings 416.5mRL

Job No:	By: KH	Date: 8/11/2023	Scale: 1:5000	Run ID: Static



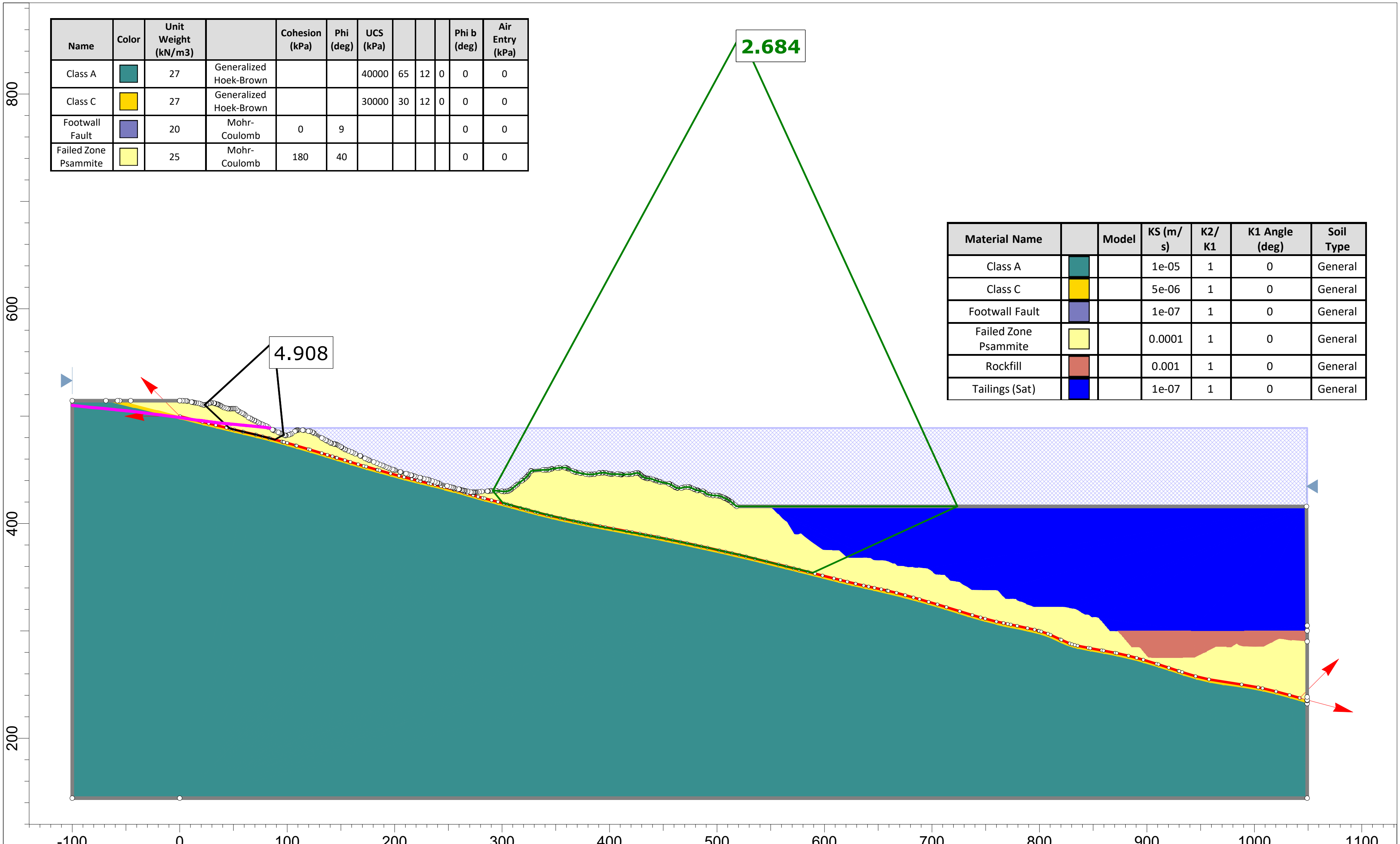
Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - West Wall
Analysis description:	Section 2 - Tailings 416.5mRL

Job No:	By: KH	Date: 8/11/2023	Scale: 1:5000	Run ID: Seismic 0.0385

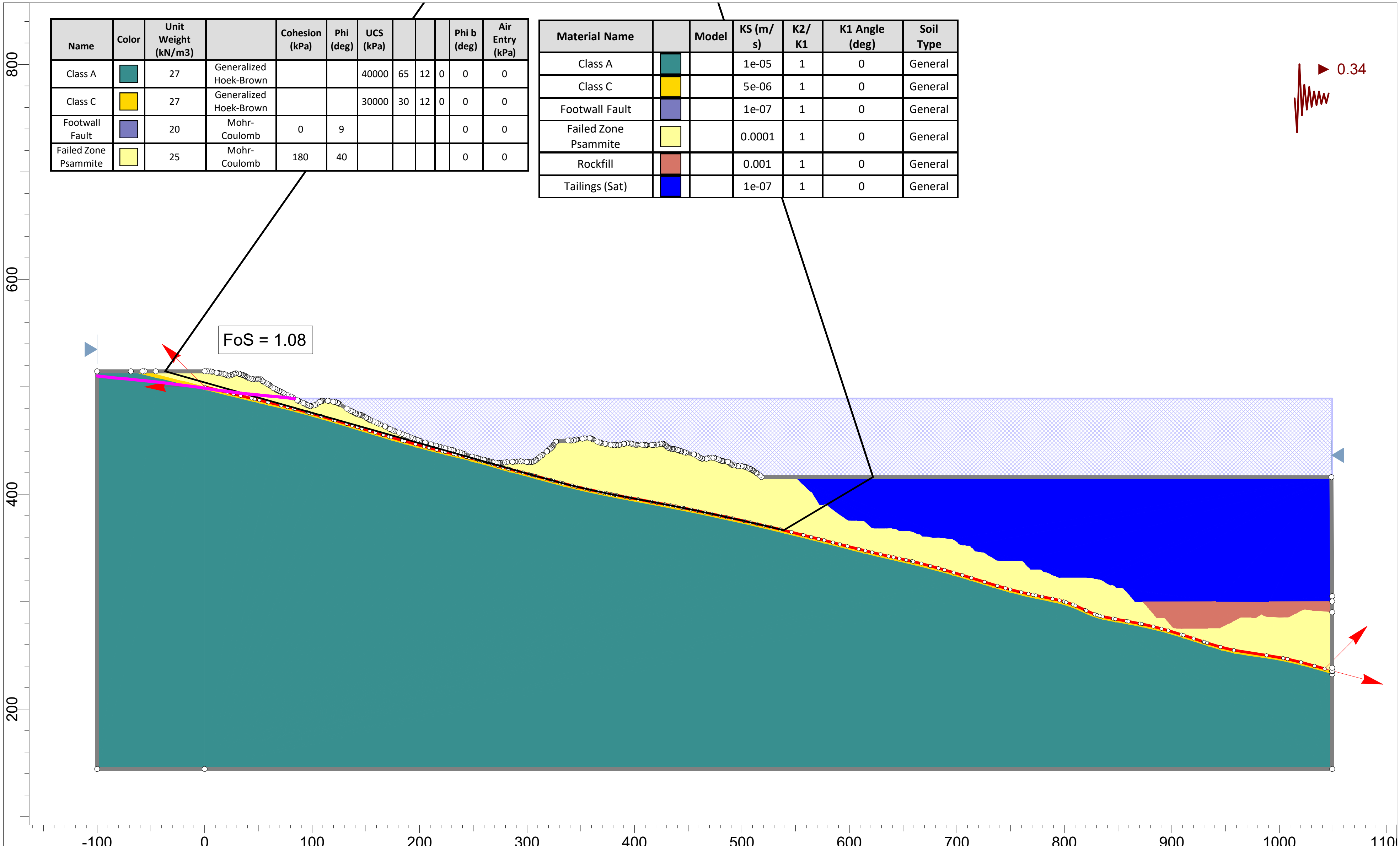


Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

Client:	OceanaGold						
Project:	PSM71-285R - TSF						
Location:	Frasers Pit - West Wall						
Analysis description:	Section 2 - Tailings to 416.5mRL, Pond to 489 mRL						
Job No:		By: KH	Date: 8/11/2023	Scale: 1:5000	Run ID: Static		

SLIDEINTERPRET 9.027



Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

PSM

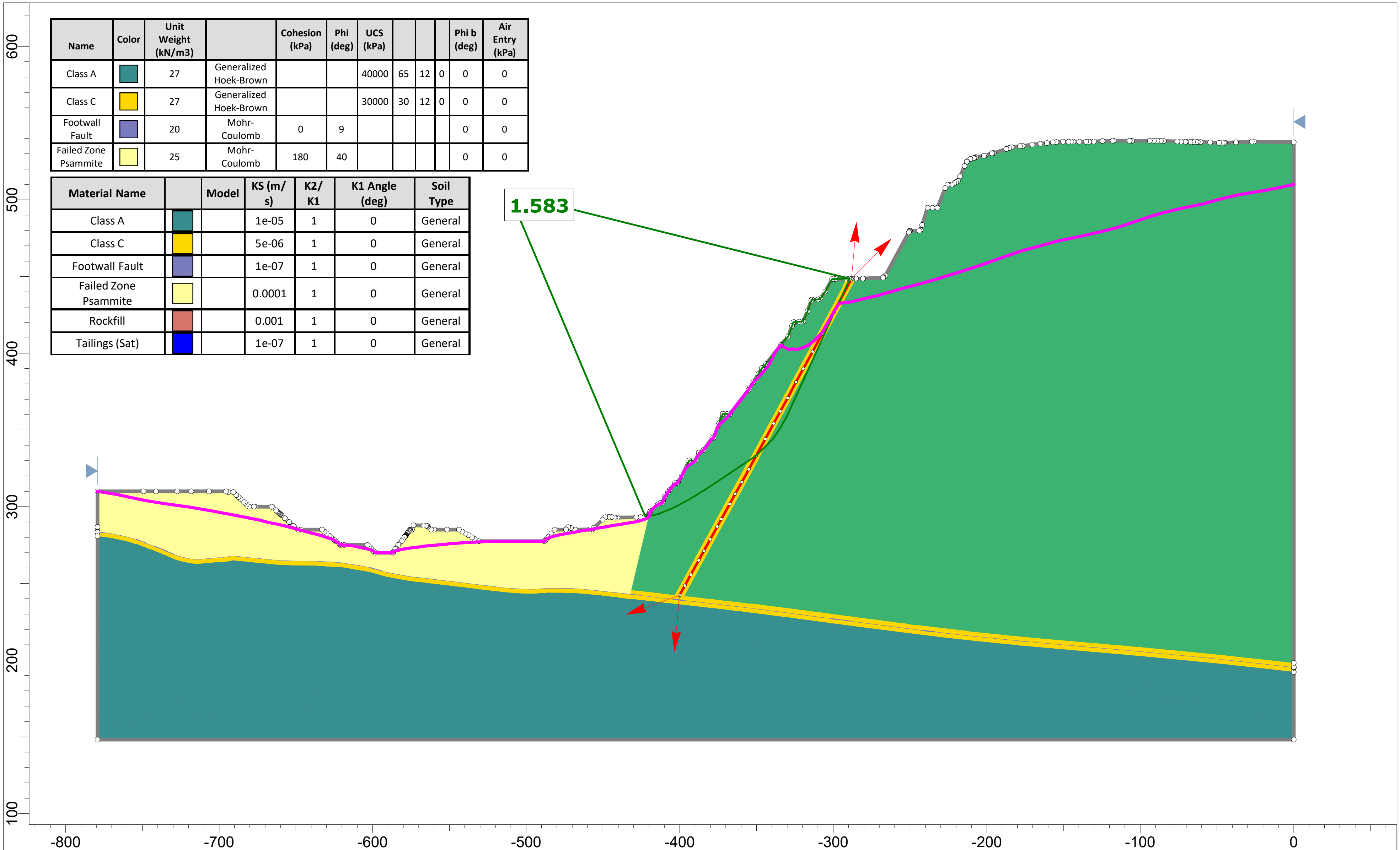
SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - West Wall
Analysis description:	Section 2 - Tailings to 416.5mRL, Pond to 489 mRL

Job No:	By: KH	Date: 8/11/2023	Scale: 1:5000	Run ID: Seismic 0.34

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

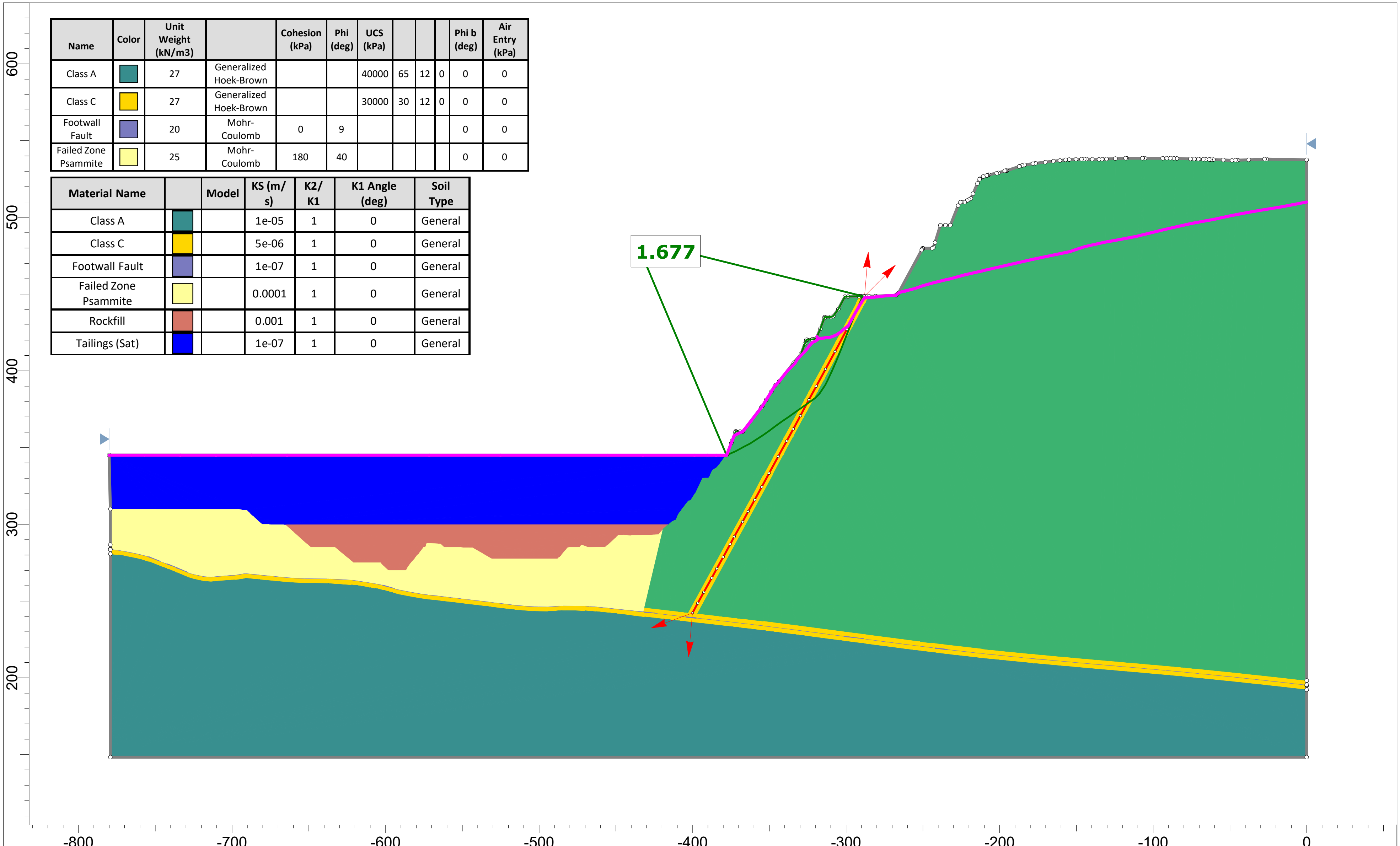


Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - East Wall
Analysis description:	Section 3 - As-built Static

Job No:	By: KH	Date: 8/11/2023	Scale: 1:3500	Run ID: Static

PSM

SLIDEINTERPRET 9.027



Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

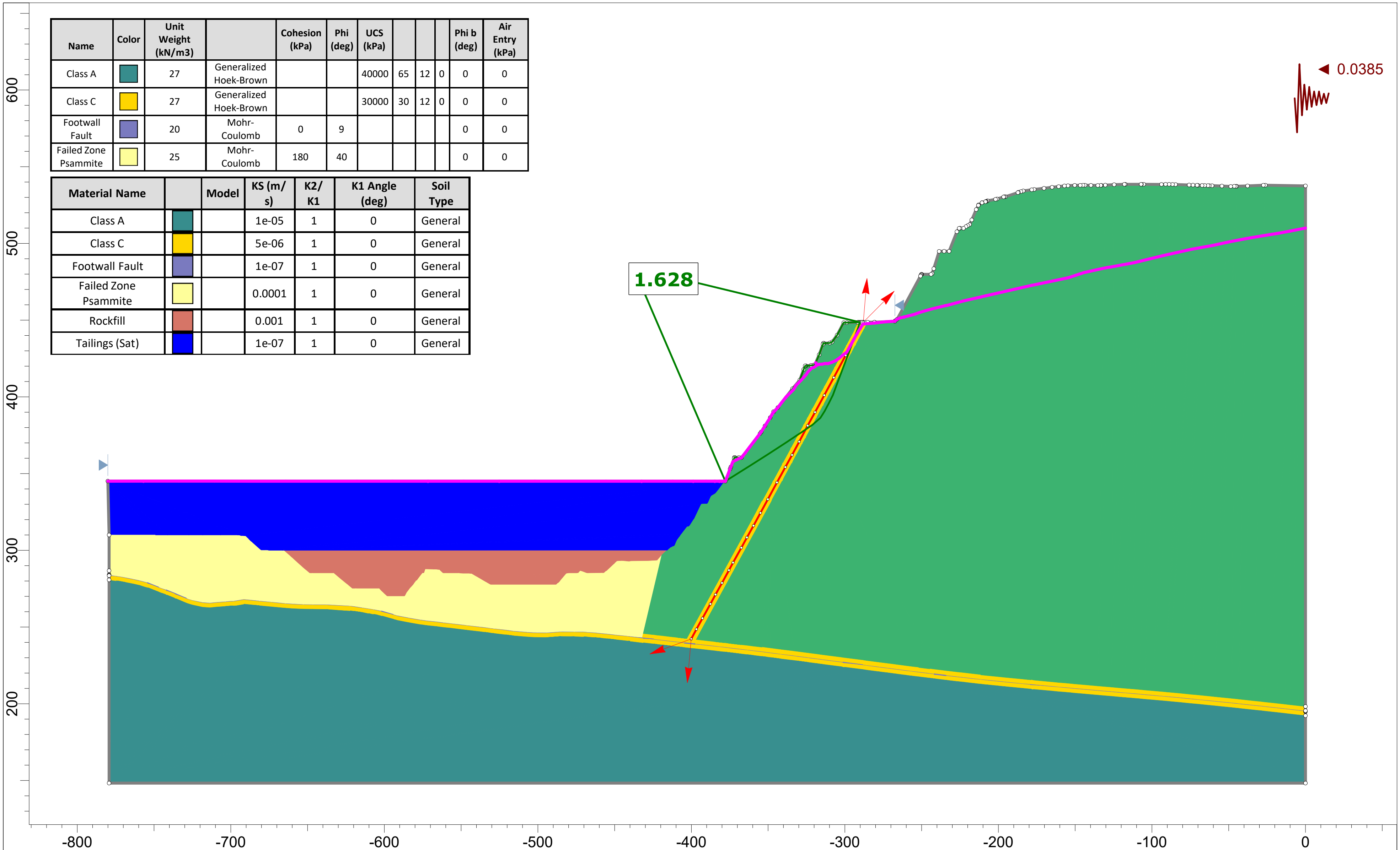
Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

Client:	OceanaGold						
Project:	PSM71-285R - TSF						
Location:	Frasers Pit - Eas Wall						
Analysis description:	Section 3 - Tailings 345 mRL						
Job No:	By: KH	Date:	8/11/2023	Scale:	1:3500	Run ID:	Static

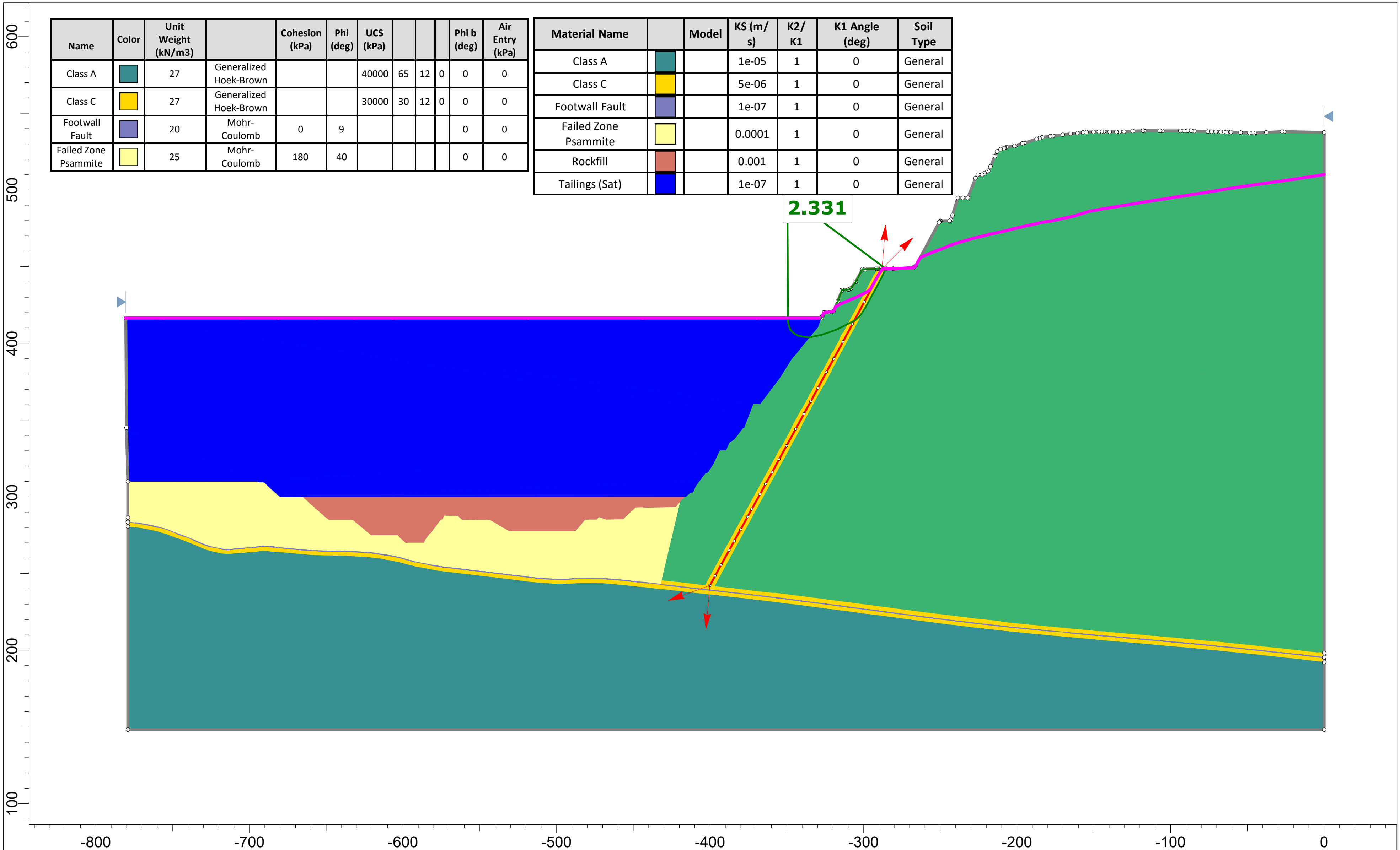
SLIDEINTERPRET 9.027

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



SLIDEINTERPRET 9.027	Client:	OceanaGold					
	Project:	PSM71-285R - TSF					
	Location:	Frasers Pit - Eas Wall					
	Analysis description:	Section 3 - Tailings 345 mRL					
	Job No:	By: KH	Date: 8/11/2023	Scale: 1:3500	Run ID: Seismic 0.0385		



Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

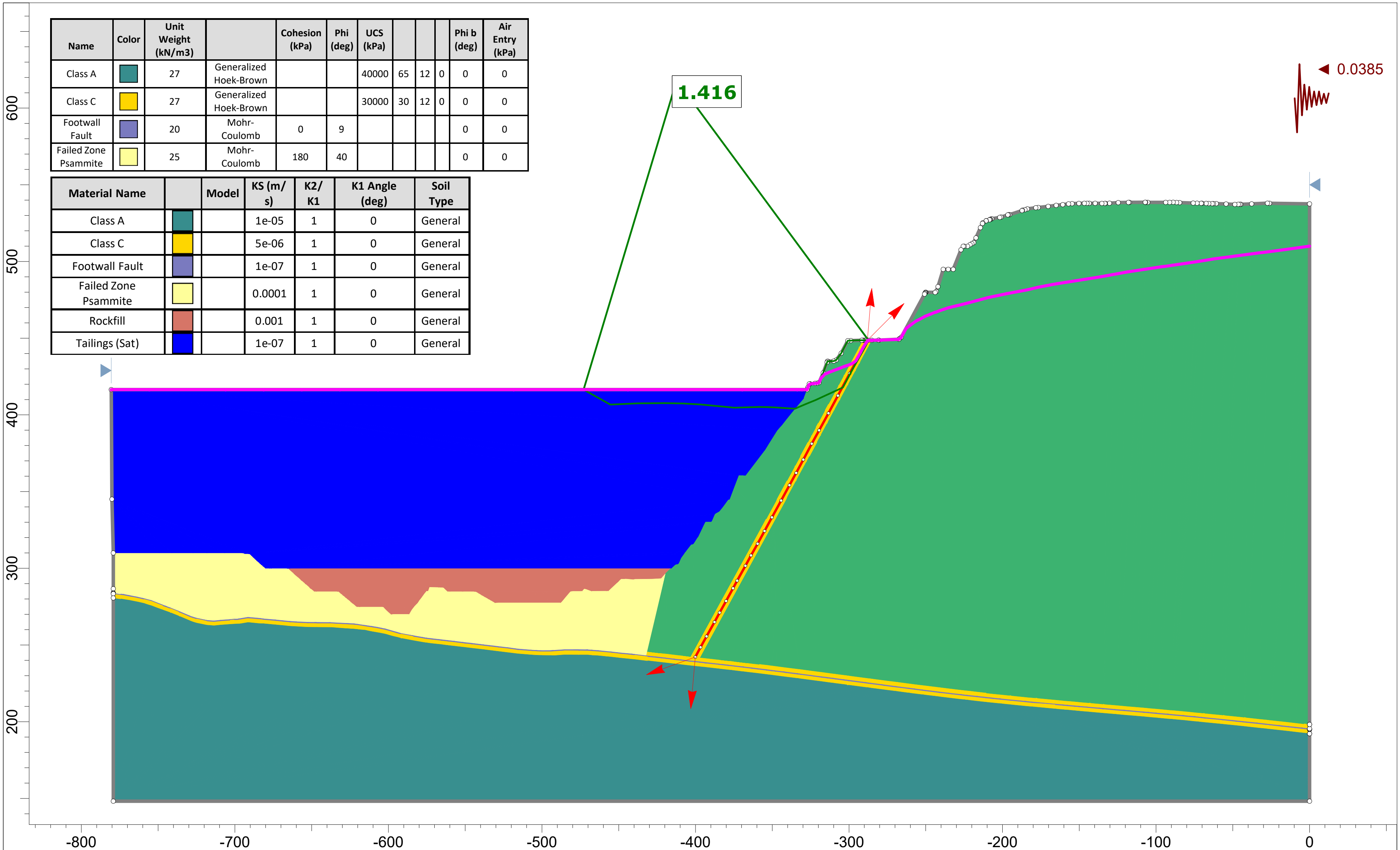
SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - Eas Wall
Analysis description:	Section 3 - Tailings 416.5mRL

Job No:	By: KH	Date: 8/11/2023	Scale: 1:3500	Run ID: Static

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



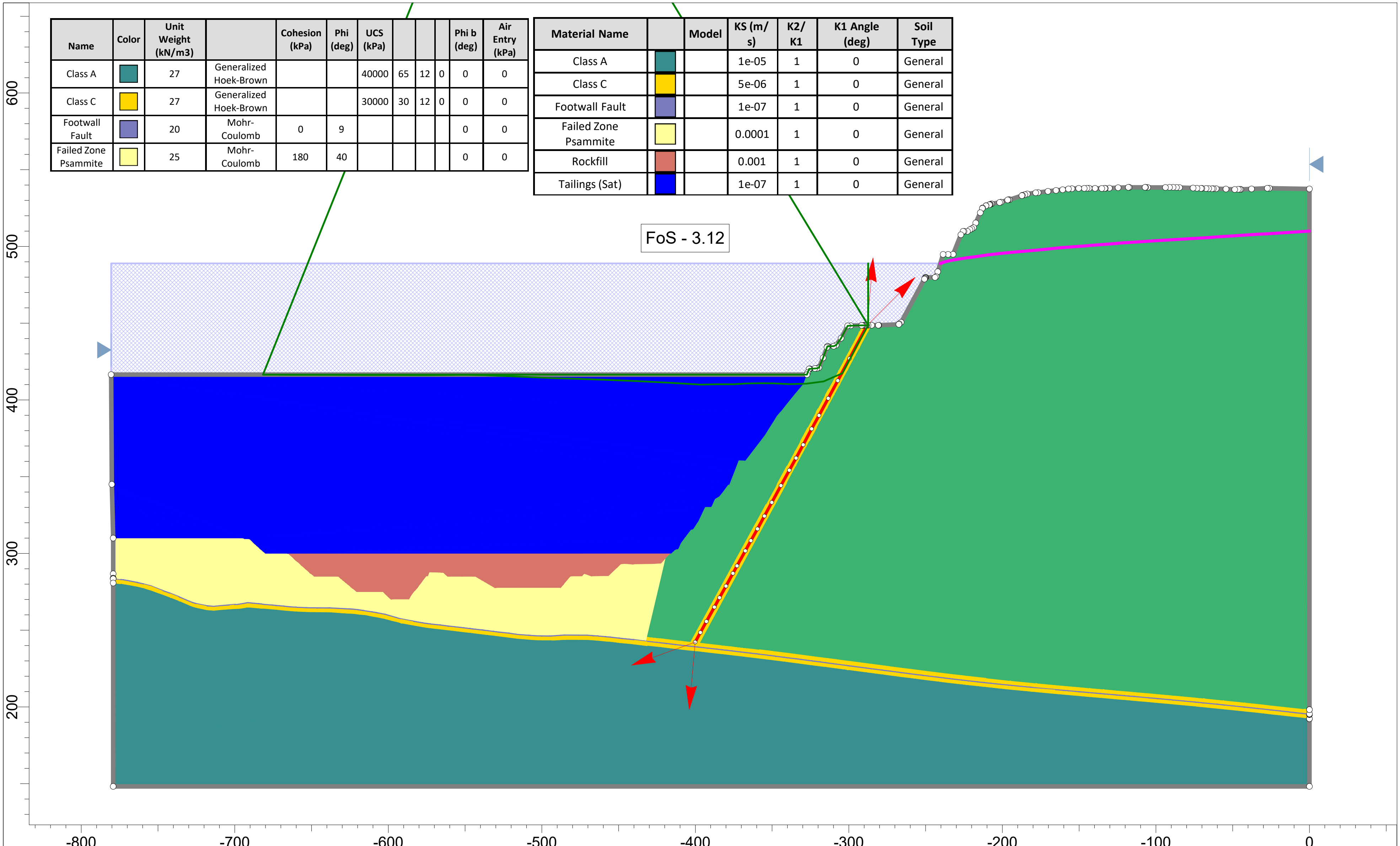
SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - Eas Wall
Analysis description:	Section 3 - Tailings 416.5mRL

Job No:	By: KH	Date: 8/11/2023	Scale: 1:3500	Run ID: Seismic 0.0385

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

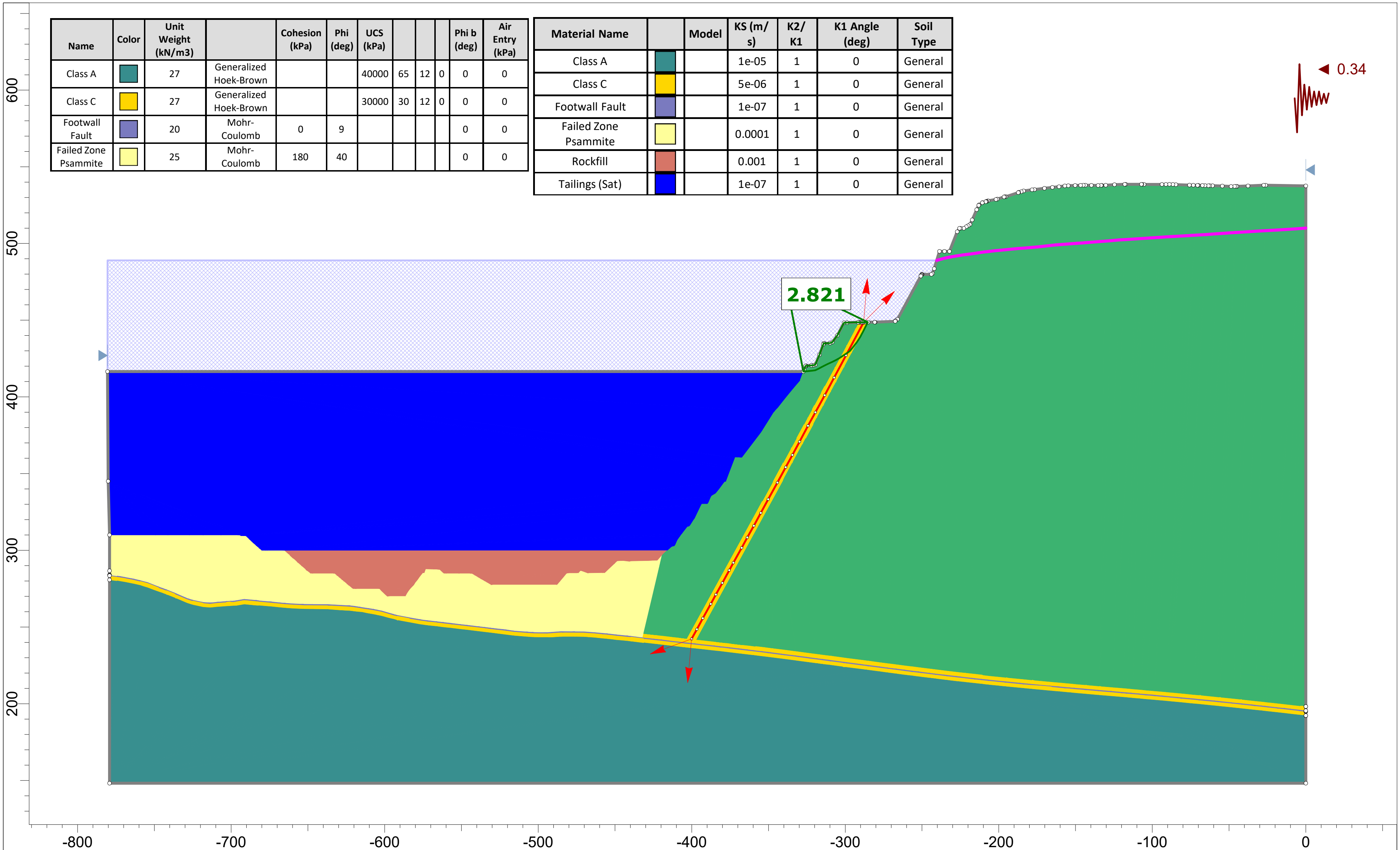
Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



PSM	Client:	OceanaGold					
	Project:	PSM71-285R - TSF					
	Location:	Frasers Pit - Eas Wall					
	Analysis description:	Section 3- Tailings to 416.5mRL, Pond to 489 mRL					
SLIDEINTERPRET 9.027	Job No:	By: KH	Date: 9/11/2023	Scale: 1:3500	Run ID: Static		

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



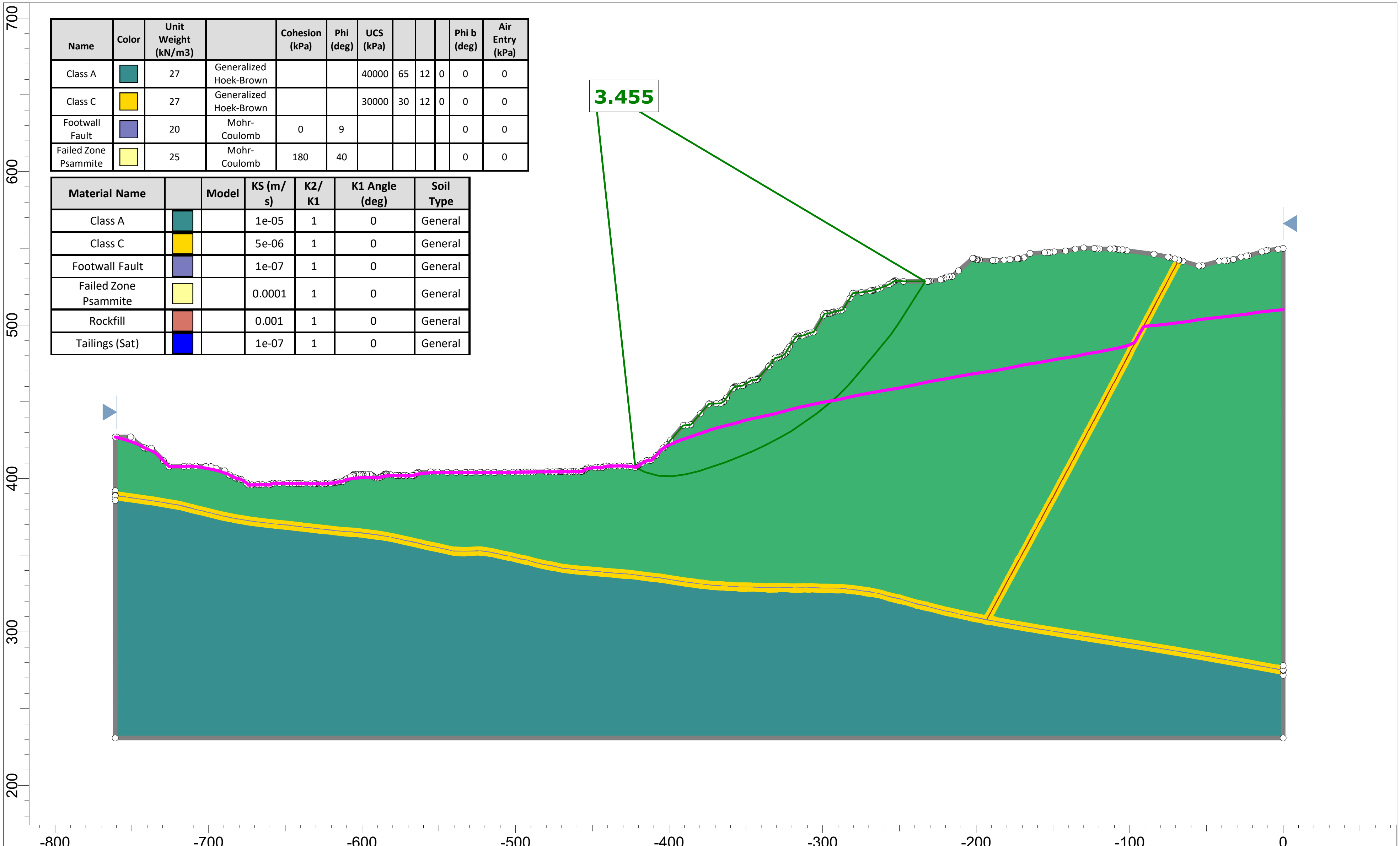
Client:	OceanaGold	
Project:	PSM71-285R - TSF	
Location:	Frasers Pit - Eas Wall	
Analysis description:	Section 3 - Tailings to 416.5mRL, Pond to 489 mRL	

Job No:	By: KH	Date: 9/11/2023	Scale: 1:3500	Run ID: Seismic 0.34

SLIDEINTERPRET 9.027

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



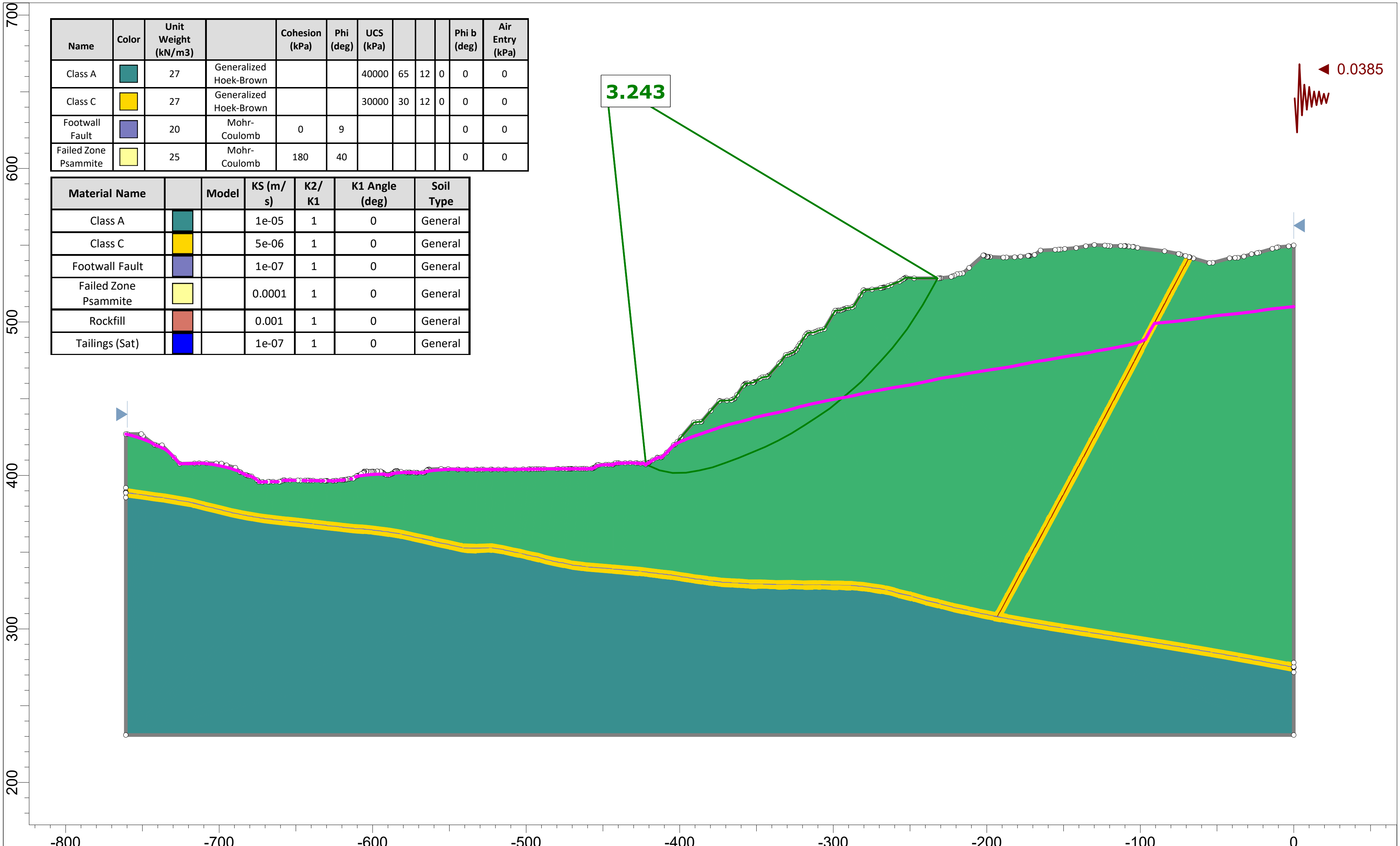
SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - East Wall
Analysis description:	Section 4 - As-built

Job No:	By: KH	Date: 9/11/2023	Scale: 1:3500	Run ID: Static

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

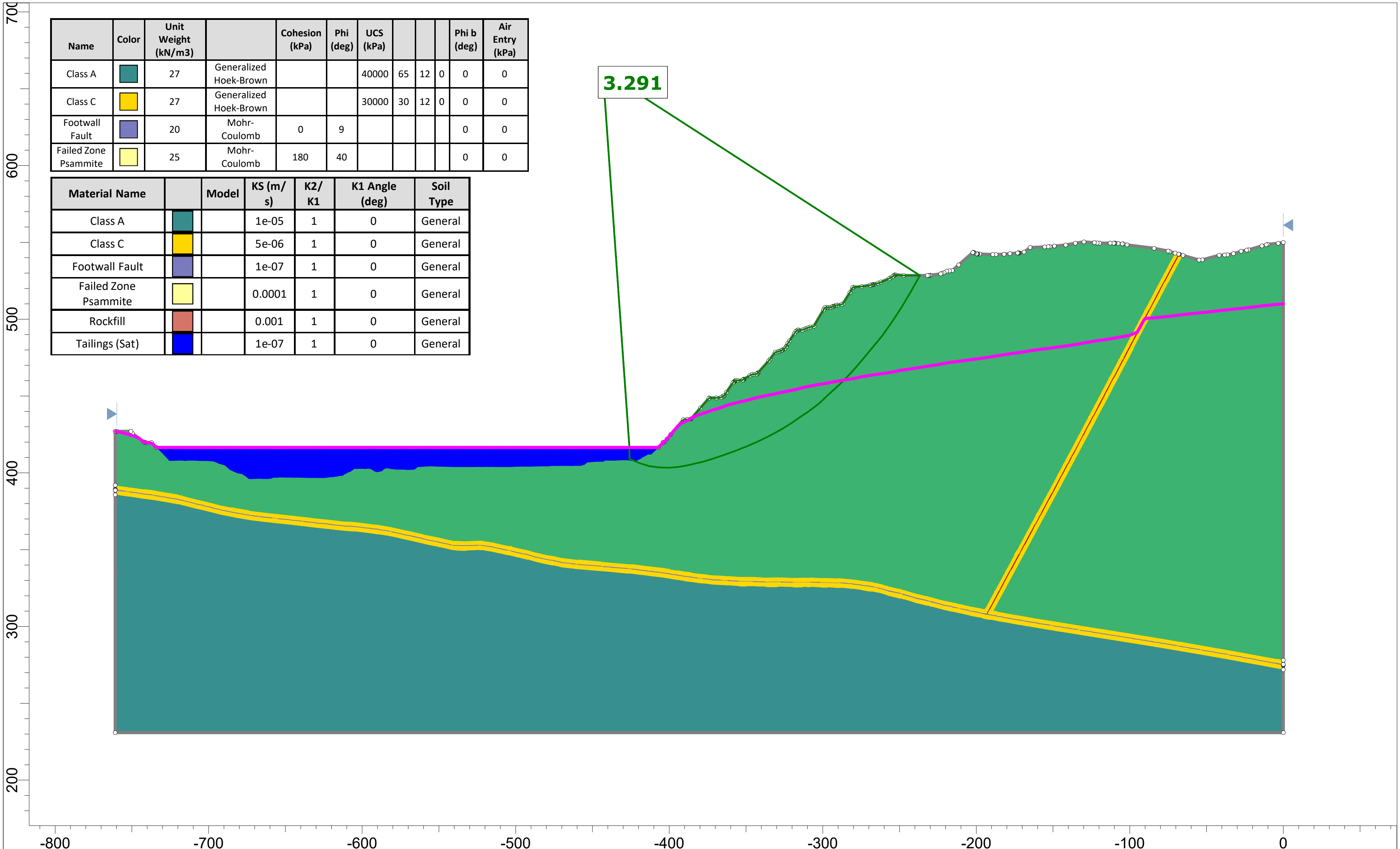


Client:	OceanaGold						
Project:	PSM71-285R - TSF						
Location:	Frasers Pit - East Wall						
Analysis description:	Section 4 - As Built						
Job No:		By: KH		Date: 13/11/2023	Scale: 1:3500	Run ID:	OBE Seismic 0.0385

SLIDEINTERPRET 9.027

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

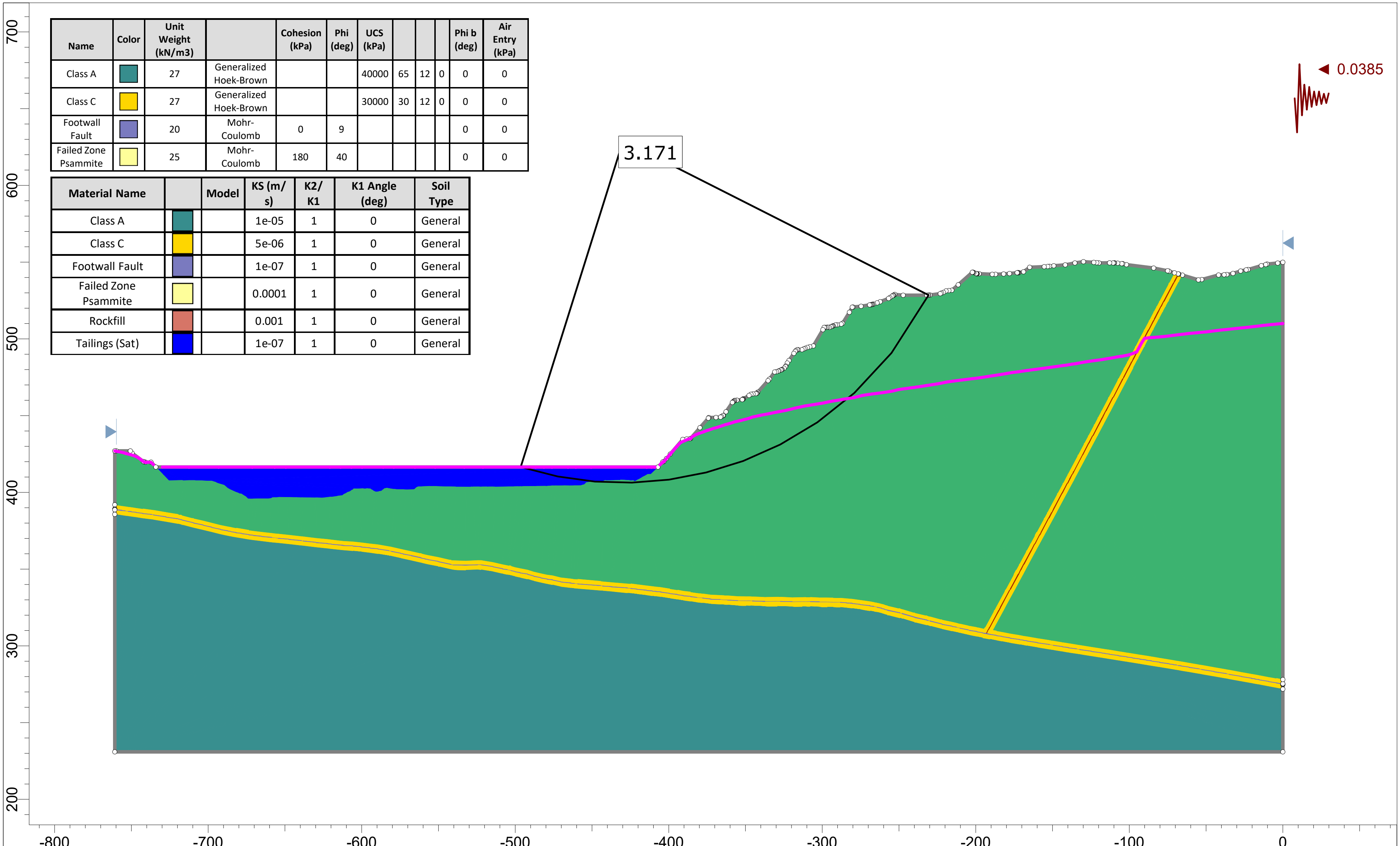
Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - East Wall
Analysis description:	Section 4 - Tailings 416.5 mRL

Job No:	By:	KH	Date:	13/11/2023	Scale:	1:3500	Run ID:	Static



Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General

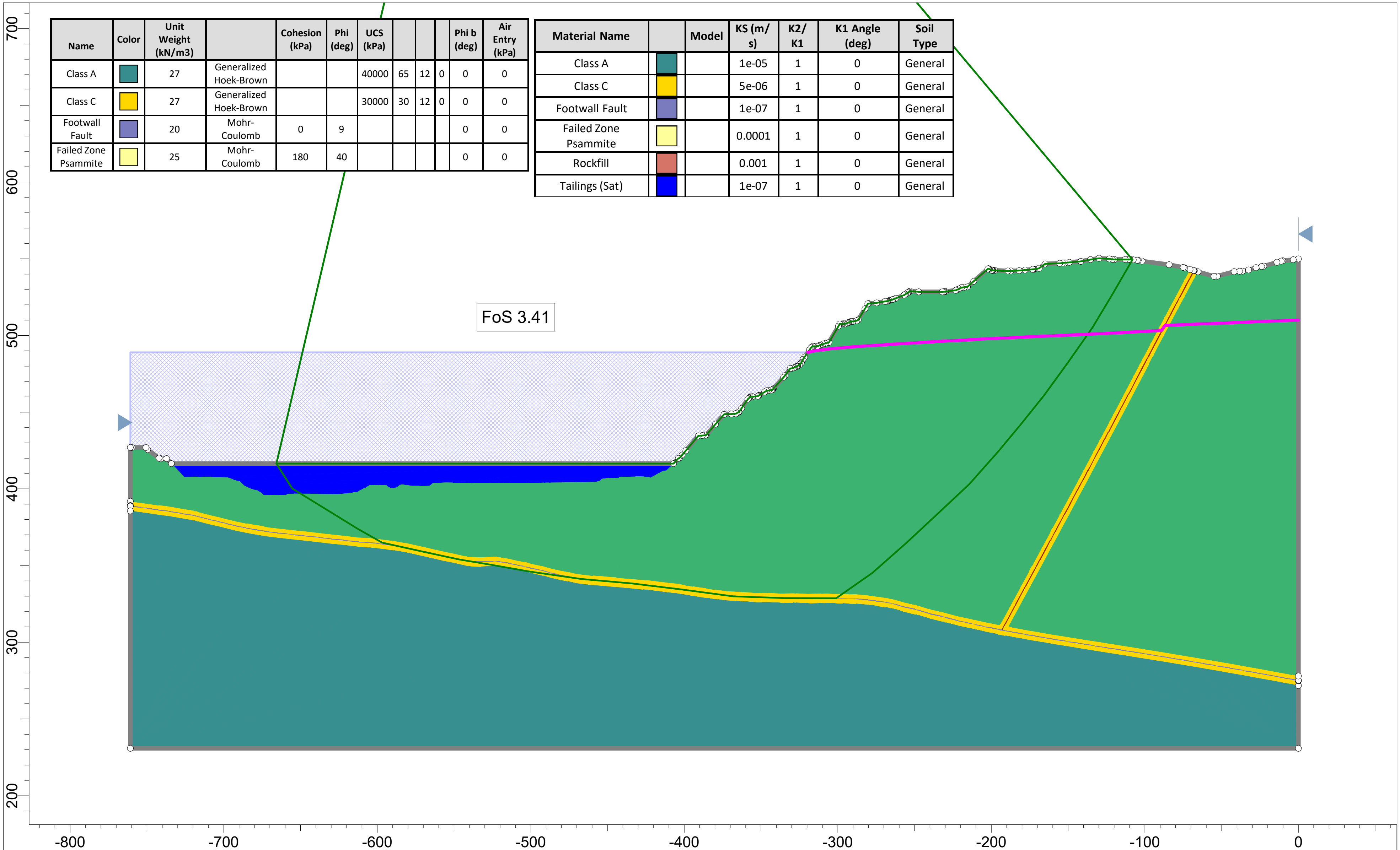
Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - East Wall
Analysis description:	Section 4 - Tailings 416.5mRL

Job No:	By: KH	Date: 9/11/2023	Scale: 1:3500	Run ID: Seismic 0.0385

SLIDEINTERPRET 9.027

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



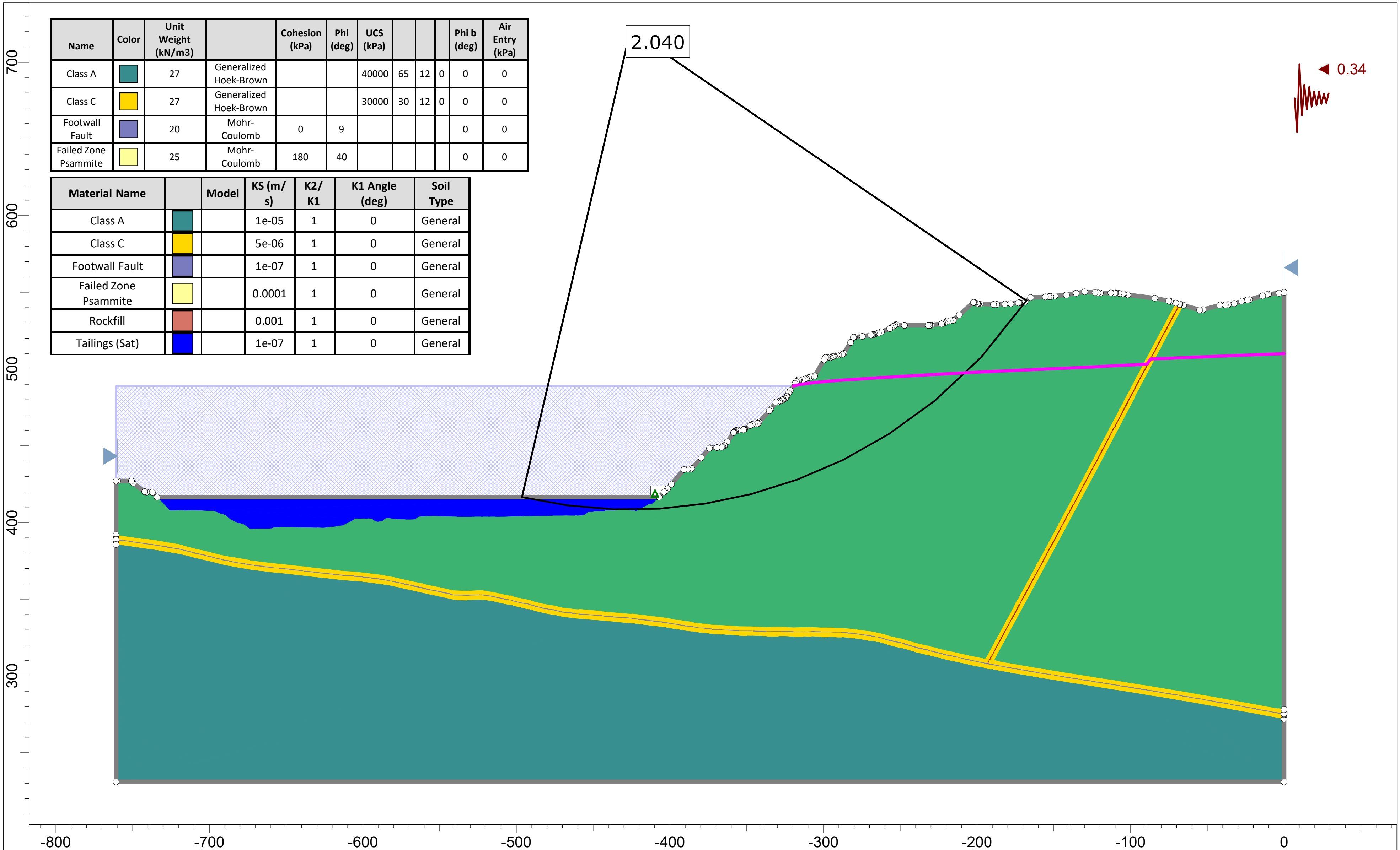
SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - East Wall
Analysis description:	Section 4 - Tailings to 416.5mRL, Pond to 489 mRL

Job No:	By: KH	Date: 9/11/2023	Scale: 1:3500	Run ID: Master Scenario

Name	Color	Unit Weight (kN/m3)		Cohesion (kPa)	Phi (deg)	UCS (kPa)				Phi b (deg)	Air Entry (kPa)
Class A		27	Generalized Hoek-Brown			40000	65	12	0	0	0
Class C		27	Generalized Hoek-Brown			30000	30	12	0	0	0
Footwall Fault		20	Mohr-Coulomb	0	9					0	0
Failed Zone Psammite		25	Mohr-Coulomb	180	40					0	0

Material Name		Model	KS (m/s)	K2/K1	K1 Angle (deg)	Soil Type
Class A			1e-05	1	0	General
Class C			5e-06	1	0	General
Footwall Fault			1e-07	1	0	General
Failed Zone Psammite			0.0001	1	0	General
Rockfill			0.001	1	0	General
Tailings (Sat)			1e-07	1	0	General



SLIDEINTERPRET 9.027

Client:	OceanaGold
Project:	PSM71-285R - TSF
Location:	Frasers Pit - East Wall
Analysis description:	Section 4 - Tailings to 416.5mRL, Pond to 489 mRL

Job No:	By: KH	Date: 9/11/2023	Scale: 1:3500	Run ID: Seismic 0.34